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Yuhang Yang
Maode Ma
*Editors*

# Proceedings of the 2nd International Conference on Green Communications and Networks 2012 (GCN 2012): Volume 3

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# Proceedings of the 2nd International Conference on Green Communications and Networks 2012 (GCN 2012): Volume 3

Springer

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# Preface

Welcome to the *Proceedings of the 2nd International Conference on Green Communications and Networks* (*GCN 2012*), which was held on December 12–14, 2012, in Chongqing, China.

GCN 2012 will be a venue for leading academic and industrial researchers to exchange their views, ideas, and research results on innovative technologies and sustainable solutions leading to green communications and networks. The conference will feature keynote speakers, a panel discussion, and paper presentations.

The objective of GCN 2012 is to facilitate an exchange of information on best practices for the latest research advances in the area of green communications and networks, which mainly includes the intelligent control, or efficient management, or optimal design of access network infrastructures, home networks, terminal equipment, etc. GCN 2012 will provide a forum for engineers and scientists in academia, industry, and government to address the most innovative research and development including technical challenges, social and economic issues, and to present and discuss their ideas, results, work in progress, and experience on all aspects of advanced green communications and networks engineering.

The GCN 2012 conference provided a forum for engineers and scientists in academia, industry, and government to address the most innovative research and development including technical challenges and social, legal, political, and economic issues, and to present and discuss their ideas, results, work in progress, and experience on all aspects of information computing and applications.

There was a very large number of paper submissions (1834). All submissions were reviewed by at least three Program or Technical Committee members or external reviewers. It was extremely difficult to select the presentations for the conference because there were so many excellent and interesting submissions. In order to allocate as many papers as possible and keep the high quality of the conference, we finally decided to accept 486 papers for presentations, reflecting a 26.5 % acceptance rate. We believe that all of these papers and topics not only provided novel ideas, new results, work in progress, and state-of-the-art techniques in this field, but also stimulated the future research activities in the area of information computing and applications.

The exciting program for this conference was the result of the hard and excellent work of many others, such as Program and Technical Committee members, External Reviewers, and Publication Chairs under a very tight schedule. We are also grateful to the members of the Local Organizing Committee for supporting us in handling so many organizational tasks, and to the Keynote Speakers for accepting to come to the conference with enthusiasm. Last but not least, we hope you enjoy the conference program, and the beautiful attractions of Chongqing, China.

December 2012

Maode Ma
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# Organization Committee

GCN 2012 was organized by Chongqing Normal University, BeiHang University, Peking University, and sponsored by the National Science Foundation of China, Shanghai Jiao Tong University, Nanyang Technological University. It was held in cooperation with *Lecture Notes in Electrical Engineering* (LNEE) of Springer.

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# Part I
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# Chapter 1
# Stochastic Insuring Critical Path Problem with Value-at-Risk Criterion

**ZhenHong Li, YanKui Liu and WenJuan Zang**

**Abstract** In this paper, we study a class of two-stage stochastic optimization for insuring critical path problems, in which the first-stage objective is to minimize the Value-at-Risk, and the second-stage objective is to maximize the insured task durations. Subsequently, we turn the proposed problem into its equivalent form. For general task duration distributions, the problem is also very complex, so we cannot solve it by conventional optimization methods. We use stochastic simulation method to estimate Value-at-Risk. Furthermore, we employ a hybrid binary particle swarm optimization algorithm (BPSO) to solve it, where the dynamic programming method (DPM) is used in the second-stage problem. Finally, we conduct some numerical experiments to illustrate the feasibility and effectiveness of the designed algorithm.

**Keywords** Critical path · Stochastic optimization · Value-at-risk criterion

## 1.1 Introduction

In the field of the project management, the minimum time to complete all the activities in the activity network is project's critical path, which equals to the length of the longest path from the source node 0 to the destination node $n$ [1].

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In most business applications, financial penalties of project completion time are often increasing function, so people pay attention carefully on the length of critical path. In this case, most people shorten project completion time by pre hiring additional labor or paying additional money so as to balance the total costs and the completion time, which is referred as insuring critical path problem.

In recent years, researchers have studied critical path problem in certain and uncertain environments. Chen et al. [2] incorporated the time-window and the time-schedule constraints into the traditional activity network. Guerriero and Talarico [3] proposed a general method to find the longest path in a deterministic activity-on-the-arc network. Bowman [4] and Mitchell and Klastorin [5] treated mass uncertain information by heuristic-based and Monte Carlo simulation-based techniques. Shen et al. [6] considered a stochastic optimization for insuring critical path problem and provided decomposition strategies to solve this problem.

The PSO algorithm was first introduced by Kennedy and Eberhart [7]. Compared to other evolutionary algorithms, PSO has a faster convergence rate and much less parameters to adjust, which makes it particularly easy to implement. Recently, the PSO algorithm has attracted much attention and been successfully applied in the variety of fields. For example, Liu [8] solved stochastic portfolio problem by Monte Carlo simulation-based PSO algorithm. Motivated by these mentioned above, in this paper, a hybrid BPSO algorithm, which combines approximation approach, DPM and BPSO, is designed to solve the stochastic insuring critical path problem with value-at-risk criterion. The interested reader may refer to Kageyama et al. [9], where conditional valued-at-risk is employed as a risk aversion criterion.

In the rest of this paper, we propose a class of two-stage stochastic optimization for insuring critical path problems in Sect. 2. Section 3 transforms the proposed problem into its equivalent model, and gives the method to compute Value-at-Risk. The hybrid BPSO algorithm can be used to solve the equivalent problem in Sect. 4. In Sect. 5, we provide some numerical experiments to illustrate the efficiency of the hybrid BPSO algorithm. Finally, we draw our conclusions in Sect. 6.

## 1.2 Two-Stage Insuring Critical Path Problem

In this section, we first recall the definition of Value-at-Risk in random environment. Let $H_Z(z) = \Pr\{Z \leq z\}$ be the cumulative distribution function of a random variable $Z$ and $\alpha \in (0, 1)$. The left-side $a-$quantile of $H_Z$ is defined as $H_Z^{-1}(\alpha) = \inf\{\varphi | H_Z(\varphi) \geq \alpha\}$, and the right-side $\alpha-$quantile as $\sup\{\varphi | H_Z(\varphi) \leq \alpha\}$.

If $Z$ represents losses, the (left-side) quantile $H_Z^{-1}(1-\alpha)$ is also called Value-at-Risk and denoted $VaR_\alpha(Z)$, i.e., $VaR_\alpha(Z) = H_Z^{-1}(1-\alpha) = \inf\{\varphi | \Pr\{Z \leq \varphi\} \geq 1-\alpha\}$..

We now construct a two-stage stochastic insuring critical path model with Value-at-Risk criterion:

$$\begin{cases} \min \quad VaR_\alpha\left\{\sum\limits_{(i,j)\in A} c_{ij}x_{ij} + \Theta(Q(x,\xi(\omega)))\right\} \\ \text{s.t.}: x_{ij} \in \{0,1\}, \forall (i,j) \in A\ , \end{cases} \tag{1.1}$$

where $Q(x,\xi(\omega))$ is the optimal value of the following programming problem:

$$\begin{cases} \max \quad \sum\limits_{(i,j)\in A} (d_{ij}^{\omega} - (d_{ij}^{\omega} - g_{ij}^{\omega})x_{ij})y_{ij}^{\omega} \\ \text{s.t.}: \sum\limits_{j\in FS(0)} y_{0j}^{\omega} = 1 \\ \quad\ \sum\limits_{j\in FS(i)} y_{ij}^{\omega} - \sum\limits_{l\in RS(i)} y_{li}^{\omega} = 0, \forall i \in N\backslash\{0,n\} \\ \quad\ y_{ij}^{\omega} \in \{0,1\}, \forall (i,j) \in A\ . \end{cases} \tag{1.2}$$

In the first-stage, $c_{ij}$ is the cost of insuring arc $(i,j) \in A$, the total costs include the insuring cost $\sum\limits_{(i,j)\in A} c_{ij}x_{ij}$ and the penalizing cost $\Theta(Q(x,\xi(\omega))$ in scenario $\omega$, where $Q$ is the nondecreasing penalty function, $x$ is a decision vector, $\xi$ is the random vector obtained by piecing together all random task durations in the network, $Q(x,\xi(\omega))$ is the critical path length. Given a risk level $\alpha \in (0,1)$, the objective is to minimize the $(1-\alpha)-$efficient cost point of the total random costs. The constraint bounds a binary decision variable $x_{ij}$, where $x_{ij} = 1$ if arc $(i,j)$ is insured, and 0 otherwise.

In the second-stage, $d_{ij}^{\omega}$ is an uninsured task duration, and $g_{ij}^{\omega}$ is an insured task duration for arc $(i,j) \in A$ in scenario $\omega$. The objective is to maximize the sum of the insured task durations. $FS(i) = \{j|(i,j) \in A\}$ is the set of nodes adjacent from node $i$, and $RS(i) = \{j|(j,i) \in A\}$ is the set of nodes adjacent to node $j$, $i,j \in N$. The first and the second constraints enforce flow balance for critical path contiguity, and the third constraint bounds a binary decision variable $y_{ij}^{\omega}$, where $y_{ij}^{\omega} = 1$ if arc $(i,j)$ is part of one identified critical path in scenario $\omega$, and 0 otherwise.

## 1.3 Computing Value-at-Risk Objective

By the definition of Value-at-Risk, we have that $VaR_\alpha(Z+a) = VaR_\alpha(Z) + a$, $\forall a \in R$. Then we obtain

$$VaR_\alpha\left\{\sum_{(i,j)\in A} c_{ij}x_{ij} + \Theta(Q(x,\xi(\omega)))\right\} = VaR_\alpha\{\Theta(Q(x,\xi(\omega)))\} + \sum_{(i,j)\in A} c_{ij}x_{ij}.$$

As a consequence, problem (1.1) (1.2) is turned into the following equivalent model:

$$\begin{cases} \min \quad VaR_\alpha\{\Theta(Q(x,\xi(\omega)))\} + \sum\limits_{(i,j)\in A} c_{ij}x_{ij} \\ \text{s.t.} : x_{ij} \in \{0,1\}, \forall (i,j) \in A \ , \end{cases} \tag{1.3}$$

where $Q(x,\xi(\omega))$ is the optimal value of the programming problem (1.2).

Problem (1.3) is a complete recourse two-stage stochastic integer programming problem (see [10]). The key to solve it is to compute $VaR_\alpha\{\Theta(Q(x,\xi))\}$, i.e., $\inf\{\varphi|\Pr\{\Theta(Q(x,\xi)) \le \varphi\} \ge 1-\alpha\}$.

Suppose that $\xi$ is a continuous random vector for any arc $(i,j) \in A$, then the minimum is attained at $1-\alpha$, i.e., $\Pr\{\Theta(Q(x,\xi(\omega))) \le \varphi\} = 1-\alpha$. Next, we use the stochastic simulation method to estimate the left-side $(1-\alpha)-$quantile of $\Pr\{\Theta(Q(x,\xi(\omega))) \le \varphi\}$. Now we define

$$h(\xi^k) = \begin{cases} 1, \ \Theta(Q(x,\xi^k)) \le \varphi \\ 0, \ \text{otherwise} \end{cases}$$

For $k = 1,2,\ldots,K$, which are random variables such that $E[h(\xi^k)] = 1-\alpha$ for all $k$. By the strong law of large numbers, we obtain $\frac{1}{K}\sum\limits_{k=1}^{K} h(\xi^k) \to (1-\alpha)$

In the sens0065 of almost sure as $K$ towards infinity.

Note that $\sum\limits_{k=1}^{K} h(\xi^k)$ is the number of $\xi^k$ when $\Theta(Q(x,\xi^k)) \le \varphi$ holds. Thus, $\varphi$ should be the $K'th$ smallest element in the set $\{\Theta(Q(x,\xi^1)), \Theta(Q(x,\xi^2)), \ldots, \Theta(Q(x,\xi^K))\}$, where $K'$ is the integer part of $(1-\alpha)K$.

The method to evaluate Value-at-Risk objective is summarized as follows:

**Algorithm 1** (*Approximation to Value-at-Risk*)

Step 1: Generate sample $K$ independent and identically distributed random vectors $\xi^1, \xi^2, \ldots, \xi^K$ according to the probability distribution of $\xi$ for any arc $(i,j) \in A$.

Step 2: Evaluate $\Theta(Q(x,\xi^k))$ by formula (1.4), and denote by $\varphi_k = \Theta(Q(x,\xi^k))$, where $\xi^k$ is the realization of $\xi$ for $k = 1,2,\ldots,K$.

Step 3: Set $K'$ as the integer part of $(1-\alpha)K$.

Step 4: Return the $K'$th smallest element in the set $\{\varphi_1, \varphi_2, \ldots, \varphi_K\}$.

## 1.4 Hybrid BPSO Algorithm

For solving the equivalent insuring critical path model, it is required to compute critical path effectively. According to the characteristics of network structure, we apply optimality principle of dynamic programming [11] to employ the following calculation formula to update the longest path of the network:

$$f(j) = \max_{(i,j)\in A} \{f(i) + (d[i][j] - (d[i][j] - g[i][j])x[i][j])\}\ , \tag{1.4}$$

where $f(j)$ represents the longest path of node $j$ from the project starting point, $f(i)$ represents the longest path of node $i$ from the project starting point, $d[i][j]$ represents an uninsured task duration of arc $(i,j) \in A$, $g[i][j]$ represents an insured task duration of arc $(i,j) \in A$, and $x[i][j]$ represents whether arc $(i,j)$ is insured, i.e., 1 if arc $(i,j)$ is insured, and 0 otherwise.

We now turn our attention to BPSO. BPSO is based on *pop_size* particles, each of which indicates a possible solution of the problem space. Each particle has its own best previous position $P_{\text{best}}$ represents the personal smallest objective value. The global best particle $G_{\text{best}}$ represents the best particle found in the colony.

BPSO uses a vector of binary digits representation for the positions of the particles. The particle's velocity and position updates in BPSO are performed by the following equations:

$$V_{\text{new}} = \omega V_{\text{old}} + c_1 \cdot \text{rand}() \cdot (P_{\text{best}} - P_{\text{old}}) + c_2 \cdot \text{rand}() \cdot (G_{\text{best}} - P_{\text{old}}) \tag{1.5}$$

$$P_{\text{new}} = \begin{cases} 0, & \text{if } r \geq s(V_{\text{new}}) \\ 1 & \text{if } r < s(V_{\text{new}}) \end{cases} \tag{1.6}$$

where $\omega$ is called the inertia coefficient, $c_1$ and $c_2$ are learning rates and usually $c_1 = c_2 = 2$, $s(V_{\text{new}}) = \frac{1}{1+\exp(-V_{\text{new}})}$, and $r \sim U(0,1)$

Now we embed the DPM into a BPSO algorithm to produce a hybrid BPSO algorithm. For the sake of clarity, we only provide the summary about the process of this method.

**Algorithm 2** (*Hybrid BPSO Algorithm*)

Step 1: Initialize *pop_size* particles with random positions and velocities, and evaluate its corresponding objective values by approximation approach.

Step 2: Set $P_{\text{best}}$ and its objective value equal to its current position and objective value of each particle, and set $G_{\text{best}}$ and its objective value equal to the position and objective value of the best initial particle.

Step 3: Update the velocity and position of each particle according to formulas (1.5) and (1.6), respectively, and calculate the objective values for all particles by approximation approach.

Step 4: For each particle, compare the current objective value with that of its $P_{\text{best}}$. If the current objective value is smaller than that of $P_{\text{best}}$, then renew $P_{\text{best}}$ and its objective value with the current position and objective value.

Step 5: Find the best particle of the current swarm with the smallest objective value. If the objective value is smaller than that of $G_{\text{best}}$, then renew $G_{\text{best}}$ and its objective value with the position and objective value of the current best particle.

Step 6: Repeat Step 3 to Step 5 for a given number of generations, and return them $G_{\text{best}}$ and its objective value as the optimal solution and the optimal value.

## 1.5 Numerical Experiments

In this section, we perform some numerical experiments to solve our problem. The hybrid BPSO algorithm is coded in C++ programming language and the numerical experiments are carried out on a personal computer (Lenovo with Intel Pentium(R) Dual-Core E5700 3.00GHZ CPU and RAM 2.00 GB), using the Microsoft Windows 7 operating system.

Consider an insuring critical path problem with 8 nodes and 13 arcs: (0,1) (0,2) (0,3) (1,4) (2,3) (2,4) (3,5) (4,5) (4,6) (4,7) (5,6) (5,7) (6,7), where (0,1) represents the arc from node 0 to node 1, and the rests can be explained similarly.

For each arc $(i,j) \in A$, assume its task duration follows uniform distribution over the interval $[100, 200]$. According to practical situation, task duration is sometimes likely to be delayed or sometimes ahead of task duration. Hence, we generate $d_{ij}^k$ by multiplying the task duration for $(i,j) \in A$ and a random number from a uniform distribution over the interval $[0.85, 1.55]$. For each arc $(i,j) \in A$, we randomly generate $g_{ij}^k$ from the uniformly distributed $[0.6d_{ij}^k, 0.8d_{ij}^k]$, and generate the cost $c_{ij}$ to insure arc $(i,j) \in A\sqrt{a^2 + b^2}$ from a uniform distribution over the interval $[80, 100]$. Finally, we round all the values of $d_{ij}^k$, $g_{ij}^k$, and$c_{ij}$ to the lower integer values. In this insuring critical path problem, we set $M = 10^6$, and assume that the penalty function is given by

$$\Theta(t) = \begin{cases} 0, & 0 < t \leq 800 \\ \sqrt{t - 800}, & 800 < t \leq 900 \\ t - 890, & 900 < t \leq 1000 \\ 110 + (t - 1000)^2, & t > 1000 \ . \end{cases}$$

We now solve the critical path problem by the hybrid BPSO algorithm. For this purpose, we adopt the following parameter values in the solution process: population size $pop\_size = 30$, number of generation $GEN = 300$, the maximum velocity $v_{\max} = 2$, and the weight $\omega$ decreases linearly from 0.9 to 0.4 in consecutive iterations by the formula: $\omega = 0.5 \cdot \frac{GEN - gen}{GEN} + 0.4$, where $GEN$ and $gen$ represent the maximum number of iterations and the current number of iterations, respectively.

Table 1.1 summarizes the computational results by the hybrid BPSO algorithm for the eight nodes and 13 arcs data sets, where column 1 gives the sample sizes; column 2 gives different given risk level $\alpha$; column 3 reports the insured arcs; column 4 shows the objective value, and column 5 gives the average CPU time. In addition, the convergence of the objective value is shown in Fig. 1.1. The performance implies the hybrid BPSO algorithm is effective to solve our problem.

**Table 1.1** The results of the hybrid BPSO algorithm ($GEN = 300$)

| $K$ | $\alpha$ | Insured arcs | Objective value | CPU(s) |
|---|---|---|---|---|
| 1,000 | 0.01 | (0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 446 | 11.063000 |
| | 0.05 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 280 | 10.875000 |
| | 0.10 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 244 | 10.860000 |
| 3,000 | 0.01 | (0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1) | 444 | 41.375000 |
| | 0.05 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 281 | 39.563000 |
| | 0.10 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 247 | 39.515000 |
| 5,000 | 0.01 | (0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1) | 440 | 72.875000 |
| | 0.05 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 278 | 67.906000 |
| | 0.10 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 247 | 67.812000 |
| 7,000 | 0.01 | (0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1) | 444 | 113.594000 |
| | 0.05 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 283 | 103.516000 |
| | 0.10 | (0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1) | 249 | 103.328000 |

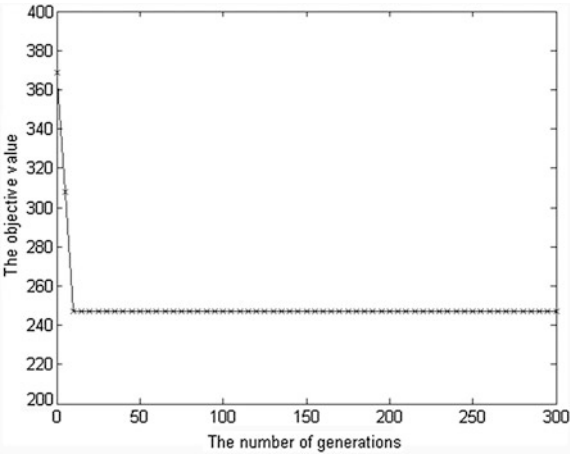


**Fig. 1.1** The convergence of the objective ($K = 5,000, \alpha = 0.10$)

## 1.6 Conclusions

In this paper, we have proposed a two-stage stochastic insuring critical path problem with Value-at-Risk criterion, in which the task finishing times are characterized by uniform variables. The major new results of the current development are as follows:

We have presented a two-stage stochastic insuring critical path problem, in which we adopted the Value-at-Risk criterion and a penalty function in the first-stage, and the task durations in the second-stage problem are characterized by uniform random variables.

For general task duration distributions, the equivalent problem is very complex, so we used the stochastic simulation method to compute Value-at-Risk. To solve our problem, we designed a hybrid BPSO algorithm, where the DPM is used to compute the critical path in the second-stage problem.

To demonstrate the developed modeling idea and the effectiveness of the hybrid BPSO algorithm, a number of numerical experiments has been performed via one numerical example with eight nodes and 13 arcs.

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# Chapter 2
# Research on Classification of Highway Emergency Telephone System

**Xu Jia, Yuxin Liu and Liwei Zhu**

**Abstract** Emergency telephone system is the special symbol facilities of highway. It is the special equipment in highway for providing emergency rescue during the vehicle accidents and sending the information to the relevant manage departments. In this paper, the development history of the highway is first introduced, and a classification framework of the emergency telephone system is given. According to the transmission mode the system is divided into three types: cable type, optical fiber type, and wireless type, and subsequently the advantages and disadvantages of various types in the system are compared, end of this paper, the key issues of the system and the future trend of development is presented.

**Keywords** Emergency telephone system · Electric cable · Optical fiber · Wireless · Highway

## 2.1 Introduction

In the twentieth century European countries first adopt the highway emergency telephone system based on fixed communications technology equipment. Its purpose is to provide emergency rescue and dealing with special events, and the communication tools during the engineering maintenance [1–3]. On the wayside of highway emergency telephone system terminal equipment was set 1–2 km according to a pair of field. Special sections of the highway need to increase the

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equipment density appropriately [4, 5]. When the drivers need help, they can give an alarm through the emergency system. Finally, the staffs of the monitor center adjust the processing. Highway emergency telephone system is one important facilities of the highway; especially the user transfer information in special circumstances and solve the problems in time.

The development of national highway emergency telephone system can be classified in the following five stages [6–8]: (1) 1983–1985 the Tianjin Tanggu port road installed "highway phone box" in Tianjin, mainly provide the maintenance personnel management service, which can be considered as the prototype of the emergency telephone system in our country road; (2) With the Shanghai-Jiading, Shenyang-Dalian, JingJinTang, the capital airport highway and Guangzhou-Foshan highway open and operation in the 1990s, the emergency telephone system was introduced from abroad, such as Alcatel, Siemens and other products from Spain, France, Singapore, and so on. At the same time our country speeds up the research and development process of the emergency telephone system. The typical product is the cable type emergency telephone system; (3) The technical performance and the stability of nation produce emergency telephone system reached and more than imported products widely used in the national highway. This period cable type emergency telephone system is still mainly used; (4) At the beginning of the twenty first century, our country developed the optical fiber type emergency telephone system and wireless emergency telephone system by innovation and replaced the original system gradually; (5) Traditional emergency telephone system only provides the voice business. With the technology developed, the system provides transmitting voice, data business, and image business. Multi-function emergency telephone system has come out. Nowadays the fifth stage system is developed in stable.

The speed and size of national highway construction grow rapidly and enter the ranks of the developed countries. To improve the management level of highway operation, establish and perfect the basic highway facilities, reinforce the traffic management and legal consciousness, improve the highway safety relief rules, improve the service consciousness, and service level become more and more important [9]. Constructing the highway of the good society image is a significant task. In highway operation, reducing traffic accidents, casualties and property losses is priority of the traffic management department and a long-term strategic task. Emergency telephone system as the basic highway facilities and rescue system is necessary.

Nowadays, most national highway set up the emergency telephone. When the drivers need for help in a traffic accident emergency rescue, the emergency system can avoid causing great losses [10]. With the wide application of the emergency telephone, a good performance and lower price highway emergency telephone is in demand of highway development. Emergency telephone system can be divided into three kinds by Transmission mode: the first kind is the full length of the signal transmission cable; the second is the full length of the signal transmission Optical fiber; the third is to use wireless public network of signal transmission. The three transmission ways have different features, and the specific differences in subsequent chapters are expounded.

## 2.2 Cable Type Emergency Telephone System

Highway cable type emergency telephone system sets emergency call console generally placed in monitoring branch or tunnel station, at the same time sets the emergency telephone along both sides of highway or tunnel. The emergency telephone system is composed of telephone console, remote power amplifier equipment, remote control module, transmission cable, the loudspeaker and emergency telephone extension of roadside, and so on.

Cable type emergency call uses local cable as transmission medium [11]. It is widely used in domestic. It has many advantages such as low project cost, easy implementation, mature technology, and so on. The emergency telephones along both sides have high reliability, corrosion resistance, prevent noise performance requirements. Users can contact the monitoring center as soon as pick up the emergency telephone. And the monitoring center warning system is launched automatically; it can show geographical location of the user and deal with the procedure of events. Traditional landline telephone system usually uses the cable transmission pattern.

Cable type emergency telephone system is commonly the independent subsystem of highway private network, and later ally this transmission way has been widely used in domestic highway. But with time elapsing the cable type emergency telephone system also gradually revealed some drawbacks:

(1) Due to the analog circuit design, components influence by the environment set-point drift, causing the fuzzy, large noise, low voice call quality, difficult maintenance, and high repair price;
(2) Extension telephone has high failure rate and later the maintenance cost is high. Due to its own structure, roadside fault of few extension telephone will cause a large section of telephone cannot be used normally;
(3) Initial large investment, large quantity, not easy to maintain, need to lay cable for the system, and take up pipe resources;
(4) The lightning resistant ability of cable type emergency telephone system is weak, the equipment is easily damaged by the thunderstorm and lightning, especially in the serious lightning areas. When the bury cable is short circuit, breaks by hit, the whole emergency telephone system cannot be used;
(5) The cable aging is serious when the environment is damp. The insulation resistance will decrease when the cable is in water for 1–2 years later, at the same time the call quality is affected.

## 2.3 Optical Type Emergence Telephone System

With the rapid development of optical communication technology, in recent years, optical fiber type call system in highway for help and rescue communication emergency fills the blank of highway emergency telephone. At present, the optical

fiber type emergency telephone system is mainly divided into two types: forwarding type self-healing ring structure and passive optical network structure. General use double fiber transmission, through the use of WDM technology, can transmit in the same optical fiber that contains both the receiving and sending light. Some products also increase a core optical fiber in order to transmit triggered or control signals, etc.

Forwarding type self-healing ring structure emergency telephone system is composed of emergency telephone extension of roadside, console of management branch and optical fiber transmission equipment. The whole system can be made of 1–8 two-way self-healing ring structure, every single fiber two-way self-healing ring needs to connect 32 emergency telephone extension, the whole system can accept almost 256 emergency telephone call at the same time. The system is controlled by computer and use the software to realize the man–machine dialog. The console of management branch controls the real-time emergency telephone of various states.. Phone calls of voice to be automatically record, print reports, can set multi-level management mode, and realize the whole province, the centralized management, and can provide many asynchronous data of highway channels for other information transmission.

This kind of optical fiber type emergency telephone system uses optical fiber self-healing ring transmission, improved the redundancy ability of the system, which makes the reliability of the system higher. Even breakpoint appeared in the transmission link, the system can still communicate normally through the reverse transmission instead of system interruption. The extensibility of the system is excellent; each master computer can link eight optical loops, accept 256 pairs of emergency telephone extension at most, and can connect the master computer through network. Each extension of the self-healing ring structure needs double optical transmitter and receiver, system transmission also need double transmission optical fiber.

Emergency telephone system of passive optical network structure is composed of emergency telephone extension of roadside, management center master console, optical fiber transmission equipment, and so on.. The system adopted the optical passive technology, making each extension in standby mode during the no communication state, in order to reduce the power consumption of the extension. Due to the use of optical passive optical technology, the system needs double optical transceiver and optical fiber to ensure the transmission reliability, each machine extension as a branch node of optical transmission link, so the failure of one extension will not lead to communication interrupt of other extensions.

Compared with the conventional emergency telephone system, optical fiber type emergency telephone system has the following features:

(1) Small attenuation, long transmission distance, high system reliability;
(2) Wide frequency band, low wastage, anti-jamming, high quality voice, no noise accumulation;
(3) Strong ability of anti-jamming and lightning. The system uses optical fiber as a transmission medium, not by the electromagnetic interference and has the very

strong lightning protection performance, especially for the mountainous area and the lightning multiple areas;

(4) Simple construction and small investment. The system makes use of optical fiber as the transmission channel, and the channel can be used as communication of optical transmission. The main construction can be finished at one time and need not additional cable, reducing the cable fees and the workload of construction;

(5) Adopting the solar energy and battery to supply power, self-healing ring structure can provide 1 month electrical energy for work during the rainy days;

(6) High integration and can be integrated well with the highway monitor system providing many asynchronous data channels. The system adopts full-duplex transmission, each extension machine of roadside can provide additional 1–2 RS422 interface. Other information such as low rate monitoring data can transmit through this system.

## 2.4 Wireless Type Emergence Telephone System

Wireless type emergency telephone system is developed by wireless mobile network. The reliability and speech quality is excellent compared with the cable type system and the optical fiber type system. As the development of mobile communication network and the improved quality of service, it becomes a development trend of using public wireless communication network to construct the wireless emergency telephone system.

The network mode of wireless type emergency telephone system can be divided into GSM public network mode and custom wireless network mode.

In the wireless type emergence call system based on the GSM public network, each pair of roadside emergency telephones in call pavilion installed a set of the main communication controller and solar battery power supply system. General control device of the call processing center installed a set of communication controller and wireless emergency telephone system host, in order to communicate the call processing center through the wireless telephone extension after the SIM card registration of the roadside emergency telephone extension. All of these formed a complete set of emergency telephone system.

Special wireless type emergency telephone system of ultra short wave radio generally uses full-duplex working way. Its working band is generally divided into 150, 450, 800, 900 MHz. The working band needs to be approved by the committee of national radio before the construction. At present, this type of emergency telephone system barely appeared in the highway application.

The best advantage of wireless emergency telephone system is without laying transmission cable, convenient construction, simple maintenance, and reducing the initial construction period. Due to wireless emergency telephone extension with no long wires, lead the possibility of lightning and thunder damage small and the

maintenance is simple, not affected by the transmission cable faults. At the same time each extension has a unique address, so each extension is independent, not affected by others. The extension density of each host control zone can be increased gradually according to actual situation, suitable for staging investment and gradually improvement.

Compared with cable transmission system, the speech quality of the wireless type emergency telephone system is influenced by the coverage of radio and weather conditions, and vulnerable to interference. Adopting the GSM public network, emergency telephone system is not independent system, which service quality is restricted by the public network, and later need to pay communication fee for the public network. At the same time wireless emergency telephone had a fatal flaw: communication quality of the wireless signals will be discounted greatly in the blind remote mountainous areas.

## 2.5 Critical Issues in Emergence Telephone System

There exist several key questions in the emergency telephone system:

(1) System control software: An advanced emergency telephone system must have the corresponding control software support. The system control software includes the host management program of control center, which controls the automatic recording of multimedia voice signal, information storage and output, management of extension communication. In addition the software requirements contain the solar battery management of the extension, etc. ;
(2) Use the different frequency duplex working way of transmitter and receiver to solve the full-duplex call problems between the host and extension;
(3) The case structure: emergency telephone extensions are set out-field, so they need to adapt different weather conditions. As design and manufacture the case, rainproof, dustproof, high temperature and low temperature prevention, and other factors must be considered. In addition transmitter and receiver are taken security protection in order to prevent man-made destruction.
(4) Component: all key integrated circuits use the foreign temperature standard. The products must meet the −40–+60 °C temperature standard in order to ensure the system work stable.

## 2.6 The Future Development Trend

Emergency telephones will be replaced by mobile phones in good wireless coverage area. Opening the emergency services is a developing trend through wireless expanded network service in the highway.

Cancelling the emergency alarm facilities does not mean reducing the level of social service. However, it means reinforcing the emergency alarm facilities and making more economy, convenient, promptly, and humanized.

Emergency telephones are necessaries in the tunnel and wireless network coverage poor areas, which are still one significant rescue method in highway.

Using the mobile phone instead of the emergency telephone in the new constructed highway, the relevant mileage pile number sign, and direction sign must be set properly. Finally, the managers make relevant department coordinate of the work.

Adopting the mature technology and equipment, in order to develop and expand the rescue service constantly, improving highway multiple service level.

As mobile phones popularizing step by step, the mobile phone brings a lot of convenience when the accident happened in the highway. But mobile phone cannot instead of the emergency telephone; the main reasons are shown as follows:

(1) Both mobile phone and emergency telephone can give an alarm, both can provide rescue services for highway emergency, but each one has its advantage along with the shortage;
(2) An emergency telephone is a special communication rescue tool, which is not restricted by any condition. Finally the emergency telephone is waiting for rescue every moment;
(3) An emergency telephone as a special communication rescue tool has the strict process of emergency alarm rescue.

## 2.7 Conclusion

Emergency telephone system is one important component of the highway traffic engineering. Due to the fully enclosed highway, emergency rescue system becomes particularly important. Nowadays problems of the emergency telephone system should be solved step by step according to the need. Summarizing the experience scientifically and objectively in order to gradually improve the expressway monitoring system and emergency call center system. The application of national highway emergency rescue system is developed and innovated gradually, which becomes an important part of the intelligent transportation system. It will provide a safe, reliable, economic, efficient, harmonious traffic environment for the society.

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# Chapter 3
# Semantic Analysis Model of Chinese MMT Based on Hierarchical Network of Concepts in Chinese–English Machine Translation

**Wen Xiong and Yao Hong Jin**

**Abstract** Machine translation (MT) is a subfield of computational linguistics, which needs the technologies of natural language understanding (NLU), natural language processing (NLP), and the methods of artificial intelligence (AI). Deep understanding of Chinese helps to meet the semantic constraints of Chinese. Since linear and hierarchical structures of language are presented meantime, this paper proposes a semantic analysis model of Chinese multiple-branched and multiple-labeled tree (MMT) based on the hierarchical network of concepts (HNC) in Chinese–English machine translation, which executes the semantic analysis of Chinese sentence and generates HNC-MMT, and performs the conversion of the HNC-MMT to generate the translation. The word knowledge-base and rule-base are used to parse the semantic structure of Chinese sentence. Experiments show one of the most important tasks of semantic analysis of Chinese sentence, the global eigen-chunk recognition, achieves an accuracy above 85 %, which indicates the effectiveness of the model and the parsing method.

**Keywords** Machine translation (MT) · Hierarchical network of concepts (HNC) · Semantic analysis · Syntactic analysis · Multiple-branched and multiple-labeled tree (MMT)

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## 3.1 Introduction

Machine translation (MT) is a research using computer software to translate text or speech from one natural language to another, which is a subfield of computational linguistics. Natural language understanding (NLU) and natural language processing (NLP) are important means and technology used by MT. The researches of MT can be divided into two big categories [1], i.e., rule-based [2, 3] and corpus-based. The latter includes statistics-based [4], example-based [5], and connectionist approaches [6].

The statistics-based MT has gained good effectiveness. However, there are still some cases in the translated texts, which do not meet the semantic constraints. Thus, it is necessary to understand deeply source text using the NLU to improve the quality of the translated texts, which involves the semantic analysis of sentences of the source text. The rule-based method is more conducive to merge the expert's knowledge to analyze the semantic of source sentence. Hierarchical network of concepts (HNC) [7] is an important theory of semantic analysis, which expresses the knowledge of a linguist with word knowledge-base of HNC and rule knowledge-base of HNC. The semantic analysis of HNC is to capture the deep semantic structure and semantic expression of Chinese sentence by the use of the knowledge of HNC in the NLU.

In this paper, we propose a semantic analysis model of Chinese multiple-branched and multiple-labeled tree (MMT) based on HNC in Chinese–English machine translation, which parses the semantic of Chinese sentence and generates HNC-MMT of Chinese sentence by the use of the semantic symbol and means of HNC.

## 3.2 Related Work

The analysis capacity of phrase structure grammar is limited, and the generation capacity is too strong in the analysis of natural language. Feng et al. presented MMT model for Chinese information processing (CIP) [8] in 1983 to overcome the defects of the phrase structure grammar and to meet the requirements of computer processing of natural language of Chinese. Linear and hierarchical structures are shown among linguistic symbols in the same time, which cannot be presented by single feature. Thus, functional unification grammar [9] was proposed to parse the sentence for the multiple characteristics of the linguistic symbols.

The translation of Chinese subsentence is a difficulty in the MT of Chinese–English patent, thus the model of degraded sentence was introduced, and related rules were proposed [10] to form the translation algorithm for the Chinese subsentence. For the solid expressions in MT of Chinese–English patent, especially the expression of the claim sentence of Chinese, the rule-based method [11] can effectively improve the quality of the translated text including these expressions.

The selection of the main verb in the case of multiple verbs used together and the deciding of the boundary of long noun-phrase (NP) are still two difficulties of the syntactic analysis of Chinese. However, the semantic analysis based on HNC theory and the use of the language-logic-dynamic-representation (lv) principle [12] can effectively handle the two situations. When integrated with the system of syntax tree, the research formed a hybrid-strategy method, which can help to improve the performance of the MT of Chinese–English patent. Passive voice is often appeared in patent document. Thus, it is an important step of MT to recognize the corresponding Chinese sentence with passive expression, and then to handle the generation of translated text by the use of rule-based method [13]. Element subsentence is widely existed in Chinese patent documents. Most of the problem of Chinese–English MT about the element subsentence can be perfectly resolved on an online patent MT system in SIPO by the analysis of the semantic structure of element subsentence in three types and the proposal of the rules of Chinese–English MT [14].

## 3.3 MMT Model of CIP

The model construction of the syntactic analysis of Chinese is an important composition of knowledge representation from the viewpoint of artificial intelligence. Thus, the resolving of this problem can serve the follow-up step of knowledge reasoning, and to form the final intelligent decisions.

### *3.3.1 MMT Definition*

The MMT [15] is a knowledge representation defined as follows:

An MMT has and only has one root;

If the root has a child node, then, every child node is an MMT;

Any node in the MMT has child nodes with the number from 0 to n. If a node has 0 child node, the node is a terminal node (a leaf); otherwise it is a non-terminal node;

The mark in each of nodes of MMT is a set of multiple labels.

### *3.3.2 Mark Content of MMT of CIP*

The MMT adopts the combination method by the use of the static mark of word knowledge and the dynamic mark of syntax, semantic, and logic functions for the automatic analysis and automatic generation of Chinese. The mark content of MMT is described as follows.

Static Marks. (1) The part of speech (POS) mark, such as: nouns, premises words, position words, time words, and so on. (2) The phrase type mark, such as: the verb phrase, noun phrase, adjective phrase, and the number and quantity phrases. (3) The inherent semantic mark of words, such as: images, materials, phenomena, time and space, measure, abstract, attributes, and actions. (4) The inherent grammar mark of words, such as a different noun requires a different quantifier, the different valence of verb, and substance properties.

Dynamic Marks. (1) The syntactic function marks, such as: subject, predicate, object, attribute, adverbial, complement, adnex, the center language. (2) The semantic relationship marks, such as: agent, patient, dative, involved, moment, and so on. (3) Logical relationship marks, such as: argument 0 (deep subject of sentence), argument 1 (deep direct object of sentence), and argument 2 (deep indirect object of sentence).

## 3.4 HNC-MMT

HNC-MMT model is different from MMT of CIP on the content of mark, and its value owing to HNC-MMT is semantic analysis oriented.

### *3.4.1 Mark Content of HNC-MMT*

The content of these marks are listed as follows.

Static Marks of HNC. There are about 261 marks distributed in six categories. (1) Class of generalized concept, such as: dynamic concept, concept of abstract noun, concept of specific objects, people, property, and logical concept. (2) Conceptual categories, such as specific concept (associated with persons or things), abstract concept, and ambident concept. (3) Lv attribute, such as: flag of main chunk, flag of auxiliary chunk, the back flag of auxiliary chunk, and so on. (4) Morpheme, such as: adjective prefix, person prefix, verb prefix, noun suffix, verb suffix, people suffix, and substance suffix. (5) Pure dynamic-representation verb. (6) Sentence categories, such as: generalized role sentence, the number of main chunk, chunk-extension sentence, and so on.

Dynamic Marks of HNC. There are about 487 marks distributed in four categories. (1) Features of word form, such as Chinese character, string, starting Chinese characters of string, end Chinese characters of string, English string. (2) Chunk features, such as: concept category of chunk, semantic interpretation of chunk, sentence category of chunk, and so on. (3) Position features used by HNC. (4) Functions used by HNC.

### 3.4.2 Implementation

Directed by HNC theory, the linguist constructed word knowledge-base and rule-base to express the static knowledge and dynamic knowledge.

Rules of Semantic Analysis of HNC-MMT. Rules of semantic analysis of HNC-MMT are divided into two categories. (1) Analysis rules, such as verb-object (vo) and object-verb (ov) processing, auxiliary chunk generation, and so on. (2) Transformation rules, such as conversion of compound constitute of eigen, format conversion, basic format conversion, and so on.

The flow of processing is always to judge whether the word pointed currently is matched with the position 0 in the rule. When matched, the processing matches the left node of the position 0 one by one, if succeed, it matches the right node of the position 0 one by one. An example rule to generate eigen chunk (E chunk) is expressed as follows:

$$\begin{aligned} &(0)\ LC\_CC\ [v] + (1)CHN\ [You,\ Cheng,\ Dao] \\ &= > LC\_TREE\ (E, 0, 0) + LC\_TREE\ (HV, 1, 1)\ \$ \end{aligned} \tag{3.1}$$

where (0) *LC_CC* [*v*] represents the concept category of word 0 pointed by processing currently is a dynamic-representation concept *v*; (1) *CHN* [*You, Cheng, Dao*] expresses the word 1 after the *v* word is a special Chinese character, such as *You, Cheng*, and *Dao*; *LC_TREE* (*E,0,0*) indicates that the processing will add mark of *E chunk* into the position 0, and *LC_TREE(HV,1,1)* indicates that it will add mark of *HV* (a down load) into the position 1. The last character "*$*" is a terminal. For example, this rule will be activated by the following three sentences:

(1) Ling yi duan shezhi you qushui guandao.
(2) Shuju fasong dao jisuanji xitong.
(3) Weiyi bianhuan cheng dian xinhao.

When the pointer of position points the Chinese word "*shezhi*" ("*fasong*" in 2 and "*bianhuan*" in 3) which has a chunk concept-category *v* initialized by word knowledge-base, and there is a Chinese character "*you*" ("*dao*" in 2 and "*cheng*" in 3) after it, the rule (1) is activated by the left of the rule, and the position of Chinese word "*shezhi*" ("*fasong*" in 2 and "*bianhuan*" in 3) will be added an eigen mark and the position of Chinese character "*you*" ("*dao*" in 2 and "*cheng*" in 3) will be added a *HV* mark.

Processing Flow of the HNC-MMT. The total processing flow and preprocessing subflow of HNC-MMT for semantic analysis of Chinese is illustrated as follows.

In the above Fig. 3.1a, after preprocessed, the Chinese sentence is sent to the module of semantic analysis and conversion. Finally, it is postprocessed, and the results of analysis and translation are given, wherein the preprocessing is illustrated as follows.

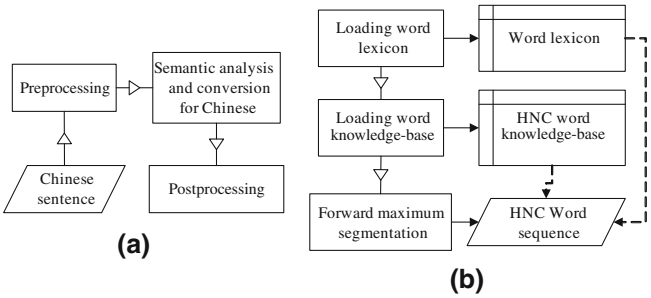


**Fig. 3.1** Processing flow and subprocessing flow: **a** Processing flow of HNC-MMT for semantic analysis of Chinese; **b** Preprocessing of semantic analysis of HNC-MMT

In the above Fig. 3.1b, the module of pre-processing loads the word lexicon and word knowledge-base, and then segments the Chinese sentence by the use of the forward maximum segmentation to acquire the sequence of HNC words, which includes word form and knowledge-feature of words, that is, static mark of HNC. The semantic analysis and conversion for Chinese in the Fig. 3.1a is illustrated as follows.

In the Fig. 3.2a, the module of semantic analysis and conversion loads the semantic rule-base, and executes the rule analysis on the Chinese sentence to generate the HNC-MMT. Finally, a rule conversion for Chinese is performed, which realizes a reorder on the HNC-MMT. In the Fig. 3.2b, the module of post-processing executes the English word selection to generate E chunk of English corresponding to the E chunk of Chinese, and performs the transformation of English verb to generate the final English sentence.

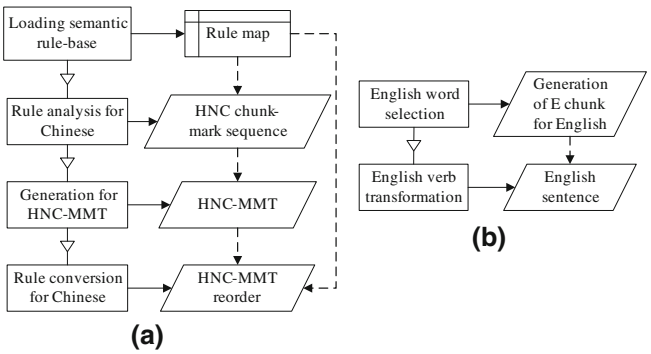


**Fig. 3.2** Sub-processing flow: **a** Semantic Analysis and Conversion of HNC-MMT for Chinese; **b** Semantic analysis of postprocessing of HNC-MMT

## 3.5 Experiments

The experimental corpus is 10 bilingual documents of Chinese–English from China patent information center (CPIC). We extracted 1000 Chinese sentences from these documents sequentially. The main content of the experiment is the recognition of the global E chunk of Chinese sentence since global E chunk plays an important role in the semantic analysis of Chinese, and we took the accuracy as our measure for the evaluation of experiment. The accuracy is defined as follows:

$$\text{Accuracy} = (\text{those recognized correctly})/(\text{all needed to be recognized}) \quad (3.2)$$

The experimental results of open test show the accuracy of global E chunk is 85.1 %, and the throughput of the processing is about 455 Chinese characters per second.

## 3.6 Conclusion

In this paper, we proposed a semantic analysis model of Chinese multiple-branched and multiple-labeled tree based on HNC in Chinese–English machine translation, achieved semantic analysis of HNC-MMT for Chinese by the use of static marks and dynamic marks of HNC, utilized word knowledge-base and rule-base. The experimental result shows the accuracy of E chunk of Chinese sentence is above 85 %. The results generated by HNC-MMT can be used in the generation of translation, and hybrid methods can be used based on the results. For example, we can send the Chinese chunk into the statistical MT engine, and then integrate the output of the engine, and execute a special processing on the predicate verb to generate the translation. Thus, the method of multiple strategies hybrid by the use of HNC-MMT will be our future works.

**Acknowledgments** The paper is supported by "the National High Technology Research and Development Program of China (No. 2012AA011104)" and "the Fundamental Research Funds for the Center Universities."

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# Chapter 4
# Study of University Students' Psychological Warning Prevention and Control Based on Automatic Control

**Jie Liang**

**Abstract** Nowadays, there are all kinds of health problems and crisis in university students' psychology in China. Due to all sorts of reasons, most of the Chinese university systems lacked practical ideologically correct understanding and education practice action. Therefore, this paper took the university students' psychological crisis warning prevention and control system as the research object and established psychological warning prevention and control system according to the university students' mental health problems. The author used the automatic control principle methods to establish physical and mental health warning and prevention system of university students. At the same time, the consultation mechanism of university psychological health education took measures for the early warning intervention and made guidance for the university students' psychological education. And based on this, it researched and explored the construction path of the university students' psychological warning health education system.

**Keywords** Negative feedback · Automatic control principle · Positive feedback · Warning prevention and control system

## 4.1 Introduction

At present, the problem of Chinese university students' physical and mental health crisis was a social concern. University students often could not dealt with the pressure correctly and did all kinds of extreme behaviors like suicide, running

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Lecture Notes in Electrical Engineering 225, DOI: 10.1007/978-3-642-35470-0_4,

away, and other severe crisis. In order to solve the problem of university students' physical and mental crisis, the establishment of the university students' psychological warning prevention and control system was imminent [1].

University students' psychological problems mainly displayed when they met with difficulties or psychological events in themselves or before public thus leading to serious psychological imbalance. Therefore, it was very important and meaningful to research the features and causes which university students' psychological crisis showed, and set up effective university students' psychological crisis warning prevention and control system to improve university students' psychological quality and make it adapted to the change of society [2].

## 4.2 Analysis on the Necessity of the System Construction of University Students' Psychological Crisis Warning Prevention and Control

The university students' psychological crisis was increasing, and this eventually led to severe and extreme behavior of the university students. For students themselves, this might cause pain and regret of their whole life; for schools, it could make the school reputation badly damaged; for students' family, it might be a devastating blow of body and mind. Therefore, the establishment of university students' psychological warning prevention and control system was very necessary [3, 4].

(1) The warning prevention and control system could effectively prevent the university students' psychological crisis.

University students' psychological crisis was urgent, gusty. But it was not helpless and unpredictable when dealing with students' psychological crisis. As long as we established university students' psychological warning prevention and control system and when university students' psychological health condition changed, we did the early detection and timely reporting, timely judge, timely intervention, and timely control, the university students' psychological crisis could be removed in the bud thus avoiding the happening of the psychological crisis.

(2) The warning prevention and control system could improve the effectiveness of the consulting work of university students' psychological health education.

The happening of university students' psychological problem was developmental, potential, and interactive. So this needed great efforts from university mental health education consulting teachers, especially psychological crisis intervention prevention and control ability. Generally speaking, the psychological crisis intervention prevention and control was to give students help in the early psychological problems, help the psychological state go back to balance and set up a type of psychological problems intervention mechanism. At the same time, we

should initiate the students themselves individual to pay positive attention to the advance prevention, professional education, and advice of psychological problems, thus avoiding these problems. We should strengthen university students' individual abilities against psychological problems, and promote the university students' physical and mental health growth.

(3) The warning prevention and control system was beneficial to the potential inherent requirement of the construction harmonious campus and society.

At present, we investigated and analyzed the time of university students' psychological problem and the result of the survey was shown in Table 4.1 (Fig. 4.1).

From the table, we could know that university students' psychological problems appeared in the depression accounted for 15 %, the anxiety symptom occupied 18 %, hostility mental problems occupied 13 %, and the suicide psychological problems occupied 25 % which only second to crimes mental problems of 29 %. Those all urgently needed the establishment of the university students' psychological warning prevention and control system to reduce the abnormal death of university students, maintain the stability of school education and promote the development of higher education enterprise, or the students' physical and psychological health [5, 6].

**Table 4.1** Data statistics of the university students' psychological problems survey

| University students' psychological problems | Ratio (%) |
|---|---|
| Depressive symptoms | 15 |
| Anxiety | 18 |
| Hostile sentiments | 13 |
| Suicide | 25 |
| Crime events | 29 |

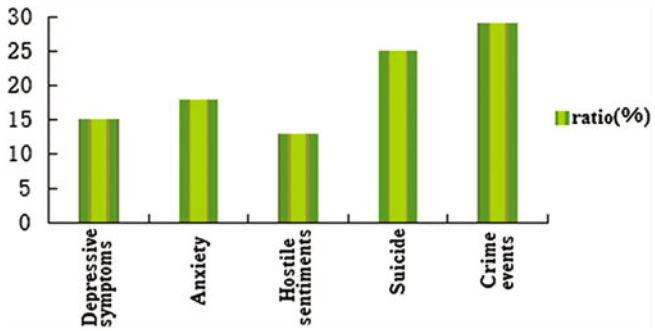


**Fig. 4.1** The occurrence proportion diagram of university students' psychological problems

## 4.3 The System Construction of University Students' Psychological Warning Prevention and Control Based on the Principle of Automatic Control

University students' psychological warning prevention and control system was very complex. The main manifestations were in several aspects:

(1) The university students' psychological monitoring level characteristics, namely the universities, colleges, teaching team, laboratory multi-level structure;
(2) Forced coupling, namely the effect relation in all kinds of activities in which university students linked with each other and depend on each other mutually;
(3) Randomness, due to the great number of university students, we could monitor externally in an important area. The processing method of the students abnormal behavior monitoring was random. The university students' psychological warning prevention and control system was aimed at comprehensively monitoring the university students' physical and mental behaviors. Therefore, establishing the automatic control prevention and control system was very necessary. The main performance control system was shown as follows (Fig. 4.2).

The basic procedures of university students' psychological warning prevention and control system were regularly giving the students' physical and psychological health evaluation as well as making connections with the school counseling program, and finding out students' physical and psychological abnormality and providing information [7, 8]. Teaching management department should study and analyze the students' psychological information, set up the control and decision-making system, and take personal counseling. And students also needed to control themselves according to the opinions provided by the psychological counseling instructors. In the daily life, they should do the self prevention, constantly improve their physical and mental health, and be actively in psychosomatic physical exercise. Students did the information feedback and made control measures

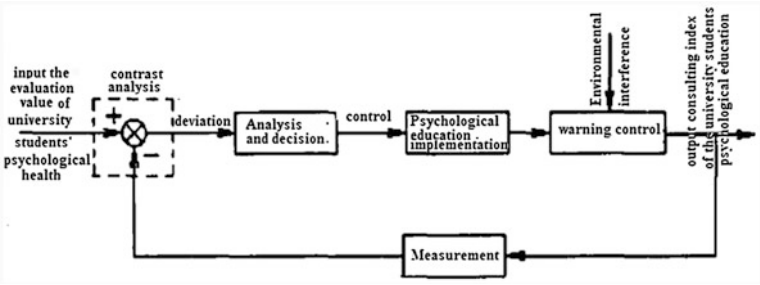


**Fig. 4.2** Automatic control structure diagram of the university students' psychological warning prevention and control system

through their own evaluation as well as the psychological consultants. This circulation system consisting of automatic control, information feedback, and information analysis made the students' body and mind develop healthily. From the above process we could know that the early warning monitoring process on the students' physical and psychological health had all the characteristics of the closed-loop information feedback system and it could adopt the automatic control principle to do the system research [9].

Therefore, we set up the index system graph on the automatic control and prevention of the university students' body and mind: (Fig. 4.3).

From the Figure, we could establish the equation,

Namely, the university students' psychological signal output mode:

$$n(t) = \begin{cases} k_0 X \sin \omega t, \ 0 < \omega t < a \\ k_0 a, \ a < \omega t < (\pi - \alpha) \\ k_0 X \sin \omega t, \ (\pi - \alpha) < \omega t < \pi \end{cases}$$

Thus we got the describing function of university students' psychological status information saturated characteristics:

$$N(X) = \frac{B_1}{X} = K_0 \frac{2}{\pi} \left[ \arcsin \frac{a}{X} + \frac{a}{X} \sqrt{1 - \left(\frac{a}{X}\right)^2} \right] . X > a$$

Among them, $K_0$ stand for the university students' psychological evaluation value of the index system; $X$ stand for early warning mechanism reaction coefficient; $W$ stand for university students' individual crisis factor coefficient; $N$ stand for university students' psychological status information saturation; $A$ stand for the characteristic value of university students' individual [10].

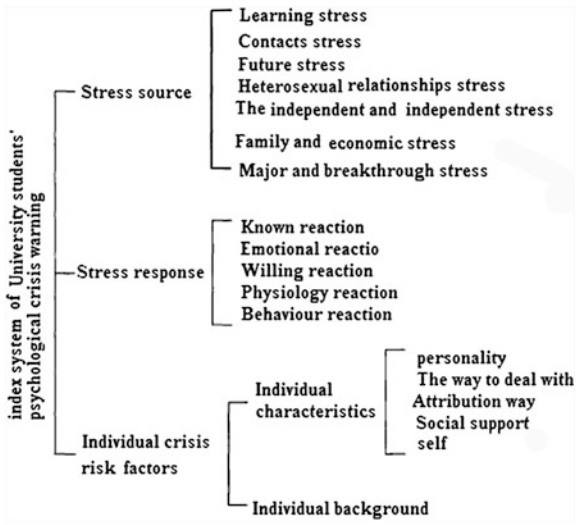


**Fig. 4.3** The index system chart of university students' psychological warning

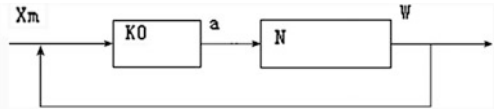


**Fig. 4.4** The Positive feedback relation diagram of university students' psychological crisis warning and behavior

The feedback relation diagram of university students' psychological crisis warning and behavior was as follows: (Fig. 4.4).

## 4.4 The Construction Path of the University Students' Psychological Crisis Warning System

The psychological warning education consulting work which was in allusion to the university students' psychological problems had to do the following [11, 12]:

(1) To strengthen and improve university students' ideological and political education work dynamics, and strengthen innovation of ideological and political education counseling content and form. We should analyze the psychology, behavior, thought, and other characteristics from university students' psychological perspective, help themselves to analyze their own psychological health and the purpose of school education, and research the efficiency of the university psychological consultation work from the perspective of university students' mental health [13].
(2) Use the classroom psychology education teaching method to guide the university students' physical and psychological health advice, help others and strengthen the body and mind opening degree. Based on the physical and mental health education, focused on the early warning prevention and control, did the students' psychological problems intervention control work well? The long-term practice proved that after the university students' psychological health education course was put in university teaching plan, it provided an important basis of the university students' psychological health knowledge and education, ensured university students' psychological health education to be scientific and effective, greatly satisfied the university students' psychological health education desired for the training, and ensured that students could get more comprehensive mental health education system, consulting, and guidance.
(3) Actively carried out the survival education and life education, paid attention to the university students' physical and psychological health growth and usefulness. Through the university students' life values surveys, the paper analyzed the university students' physical and mental underlying reasons, and perfects the university life education system according to the data reason. Meanwhile, colleges and universities should be based on practice to strengthen

the education system. And put forward richer, novel, vivid teaching course to make university students realize the value and significance of life from body and mind education, and try to survive, respect for others, the society and the nature as well as the beauty of man, and establish the correct values.

(4) Positively trained university students to learn to use the social support because the university students' psychological problems were gusty, sometimes the students themselves could not get timely and effective aid. So it was necessary to train students to gain help on their own initiative. Second, strengthened the students understanding of the necessity and significance to be active for help made them regularly participate in the student body and mind health promotion and let university students understand the development status and level of their own physical and mental health, so as to obtain the guidance and support timely [14].

(5) Take more effective university students' psychological health education consulting activities to improve university students' psychological quality training. Through the campus radio, Internet, newspapers, and other different media channels, publicized the university students' psychological health knowledge regularly and vastly and actively created a circle of university student's health atmosphere to and cultivate noble values. At the same time, developed various campuses cultural activities, let students get effective help in the activities, and established university students' psychological crisis warning prevention and control system.

## 4.5 Conclusion

Above all, we could know that it needs social support to establish and improve the students' physical and psychological warning prevention and control system. What is more, we should pay more attention to the diversification of the physical and mental health education. We should make the use of the state, society, families and university education resources to build university students' psychological health warning prevention and control system together and set up the university students' psychological warning system operation mode which regarded school as the center, got support from the student family, and gained the national and social forces for auxiliary. At the same time, university psychological education consultation should actively participate in university students' psychological crisis warning prevention and control mechanism and the intervention mechanism, etc. Especially when serious university students' psychological problems which were beyond the ability range of the school appeared, school teachers should timely ask professional mental institutions for help, and do the interface work well. We should fully arouse all kinds of help and support systems from the national society to participate in the university students' psychological warning, prevention and control, intervention, thus help university students' body and mind to develop healthily.

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# Chapter 5
# Research of Toxic Gas Diffusion Simulation Technology Based on Arc Engine

**Qing-long Zhang, Yi-ru Dai, Jiang Wang and Rong-yong Zhao**

**Abstract** This paper was mainly to solve how to accurately and visually simulate the toxic gas diffusion process. ArcGIS Engine drawing methods and key technologies were used, and gas leak emergencies based on Gaussian plume model was selected as a typical scene of emergency evacuation simulation system, dynamic simulation of gas diffusion based on $t$ was implemented, and three key parameters, leakage source strength $Q$, wind speed $V$, surface roughness $Z0$, that affect results of gas diffusion were briefly analyzed and researched. The results show that simulation system can simulate dynamic diffusion processes after leak of toxic gas, and can quickly and accurately draw and calculate regional distribution of equal concentration about three areas at any time after leakage of toxic gas. The results of simulation can have a good assistant decision function on prediction and assessment of toxic gas leakage accident scene.

**Keywords** Arc engine · Gaussian plume model · Simulation · Key parameters · Equal concentration regions

## 5.1 Introduction

Sudden leakage accidents of toxic and hazardous gases which are widely used in petroleum, chemical, and other industries, frequently occur and are harmful to people's safety. In order to avoid casualties, such problems rely on modeling and simulation technologies for effective evacuation simulation drills has been paid

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increasing attention to [1]. From the perspective of technology and application, GIS has strong skills of spatial analysis, simulation, and visualization [2]. Currently ArcGIS represents GIS industry's highest technical level, ArcGIS Engine is a new product which launched in ArcGIS9 version, and a complete embedded GIS component library and tools library. We can easily realize dynamic and intuitive simulation of gas diffusion process by using the latest ArcGIS drawing methods and key technologies [3].

In this paper we selected a gas diffusion model with continuous leakage characteristic as toxic gas diffusion model, and carried out intuitive and visual simulation of gas diffusion process of continuous point source in the specific space environment and meteorological condition by using drawing methods and key technologies from ArcGIS Engine. Then we analyzed the results [4]. Generally, we have carried out the realistic simulation on the gas diffusion process and achieved reasonable results.

## 5.2 Gas Diffusion Model

In recent years, domestic and foreign researchers have undertaken extensive research and improvements about the toxic gas leak diffusion, there are already many mature toxic gas diffusion models used for the simulation, such as Gaussian model, FEM3 model, BM model, Sutton model, Box model, Slab model [5, 6]. Based on the characteristics of a large-scale evacuation scene and long time evacuation, we select Gaussian plume model as the gas diffusion model. Gaussian plume model [7] is also known as continuous diffusion model of medium density cloud. The expression of bounded continuous point source Gaussian plume model expression as follows:

$$cx, y, z, t, H = \frac{Q}{2\pi\delta_y\delta_z u} e^{-\frac{1}{2}\left(\frac{y^2}{\delta_y^2}\right)} \left[ e^{-\frac{1}{2}\left(\frac{(z-H)^2}{\delta_z^2}\right)} + e^{-\frac{1}{2}\left(\frac{(z+H)^2}{\delta_z^2}\right)} \right] \tag{5.1}$$

In Formula (5.1), $c(x, y, z, t, H)$ is the concentration of diffusion gas which is located in $x$ m of downwind, $y$ m of horizontal direction, $z$ m above the ground; $Q$ Source strength; $\delta_y, \delta_z$ denote diffusion parameters of $y$ direction and $z$ direction, unit is m, the parameters are related to the downwind distance $x$, the ground roughness $z0$, atmospheric stability; $u$ the average wind speed for environment; $t$ time after leakage; $H$ effective height of the source of the leakage. Figure 5.1 graphically illustrates the diffusion shape of Gaussian plume diffusion model in the case of wind.

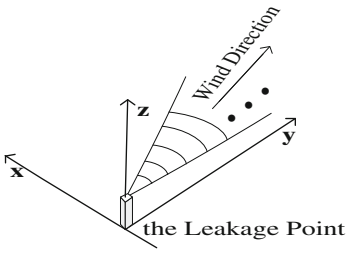


**Fig. 5.1** Gas diffusion mode figure based on gaussian plume model diffusion

## 5.3 Arc Engine Drawing Methods

### *5.3.1 Analysis Based on Arc Engine Perspective of Gaussian Plume Model*

A hazardous gas leak source is treated as the origin of default coordinate system of Gaussian plume model, downwind of the leakage point is the *X*-axis; vertical downwind direction is the *Y*-axis. Because the leakage source height *H* can be neglected when it is compared with the diffusion region, there is two-dimensional Cartesian coordinate system without considering the *Z*-axis. When model is used for simulating and analyzing, the default coordinate system should be converted to projected coordinate system of the Arc Engine map [8].

If the value of *x*, *y*, *z*, and *t* after the leakage are given in Gaussian plume model, we can calculate the gas concentration of *x*, *y*, *z*; If leakage parameter and gas concentration are given, we can calculate the distributed district maps and depth of death area, serious injury area, and minor injury area; In the case of other certain conditions, through changing the value of *t*, we can compute district maps and depth of the equal concentration regions of gas diffusion.

### *5.3.2 Drawing Methods*

#### 5.3.2.1 Geometric Objects

Geometry is the most widely used one of the sets of objects in Arc Engine. Through the geometry, we can draw points, lines (straight or curve), surface features. Then we can draw the toxic gas diffusion region map by using these basic features. The creation methods of the main geometric objects which are used in the simulation system are shown in Fig. 5.2.

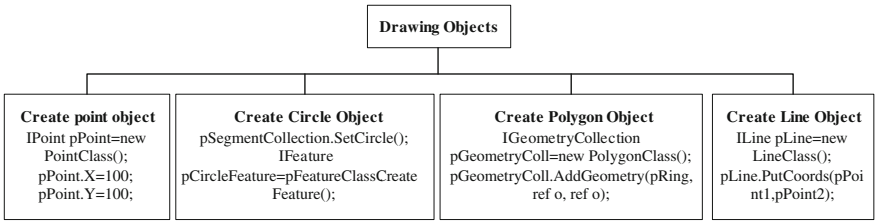


**Fig. 5.2** Geometric objects

#### 5.3.2.2 Rendering and Transparency

In accordance with the intuitive characteristic, we need to render the diffusion region. In accordance with visual characteristic of the region covered by gas diffusion region in the map, we need to set the layers in which the gas diffusion region has the transparent layers. So we choose features as the objects to be drawn. For example, the rendering method of line feature is shown in Fig. 5.3a. And the transparency method about the layer is shown in Fig. 5.3b.

### *5.3.3 Key Technologies*

#### 5.3.3.1 Model Calculation

The implementation of Gaussian plume model is the key problem of the toxic diffusion simulation; in this paper we use cls Diffusion Model class to implement the model. So the implementation of cls Diffusion Model class is the key of the simulation system. In which there are some important methods as TD esity Calculate method, Calculate method, and Judge Method.

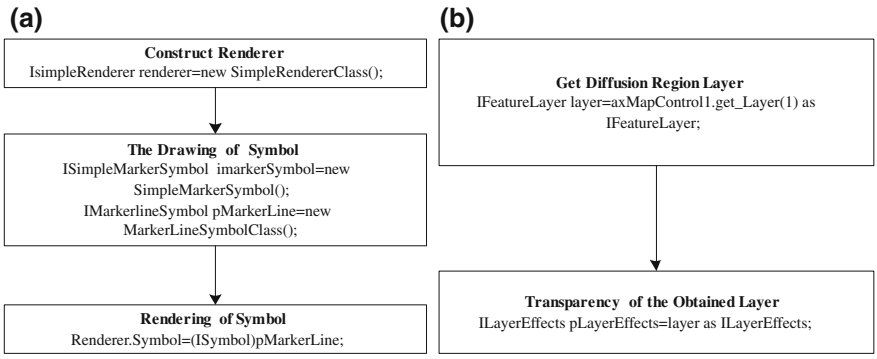


**Fig. 5.3** **a** Rendering method; **b** Transparency method

#### 5.3.3.2 The Design of Dynamic Simulation System

Because dynamic simulation of toxic gas diffusion is drawn by using the drawing methods of ArcGIS Engine, that how to combine ArcGIS Engine and secondary development platform effectively and design the efficient dynamic simulation system is also the key problem. The architecture of entire dynamic simulation system is shown in Fig. 5.4a, and the structure of simulation system is shown in Fig. 5.4b.

Base module save all the information of simulation features in the map, the simulation parameters set by the user and the interaction. Paint module drawing module, which is responsible for functions and methods related to drawing. Interaction module mouse interaction module Arc Engine module provides a reference library for paint module UI module the user interface module.

## 5.4 Implementation and Application Examples

By using the drawing methods of Arc Engine and above key technologies, we developed the dynamic toxic diffusion simulation system successfully. When simulating toxic gas diffusion, the system can automatically calculate the corresponding diffusion depth of death area, serious injury area, and minor injury area in any time; In this paper, we selected Wujing chemical industry area as the map of simulation system, range of map is 2.2 × 3.6 km. We selected the conditions of Tables 5.1 and 5.2 as the initial conditions, and simulated the process of toxic CO diffusion by using the implemented simulation system, and briefly researched the relationships between the depth of toxic gas diffusion region and some key parameters of Gaussian plume model.

The Toxic Gas Diffusion Region Map Based On Initial Parameters of Table 5.1.

The Relationship Diagram Based on the Initial Parameters of Tables 5.1 and 5.2.

Figure 5.6 shows that the toxic gas diffusion regional map in different moments, Fig. 5.5a shows the relationship between the depths of toxic gas diffusion region

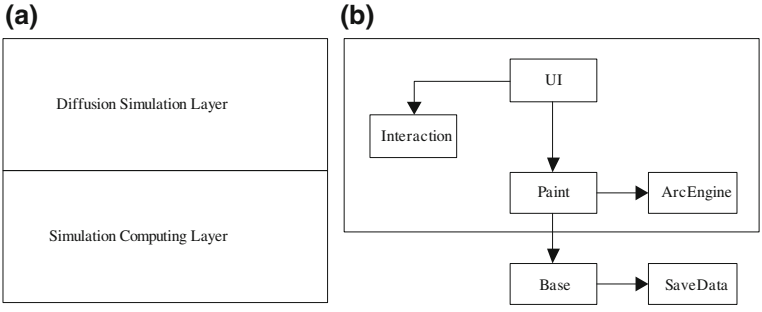


**Fig. 5.4** **a** The architecture of dynamic simulation system; **b** the structure of simulation system

**Table 5.1** Initial condition

| T (min) | Q (mg/s) | U (m/s) | Z0 | EPRGS | Atmospheric stability |
|---|---|---|---|---|---|
| 10 | 2,00,000 | 3 | 0.4 | – | D |
| 15 | 2,00,000 | 3 | 0.4 | – | D |
| Change | 1,20,000 | 3 | 0.4 | – | D |

**Table 5.2** Initial condition

| Parameter | Q | u | Z0 |
|---|---|---|---|
| t | ∞ | ∞ | ∞ |
| Q (mg/s) | Change | 1,20,000 | 1,20,000 |
| u (m/s) | 3 | Change | 3 |
| Z0 | 0.4 | 0.4 | Change |
| EPRGS | – | – | – |
| Atmospheric stability | D | D | D |

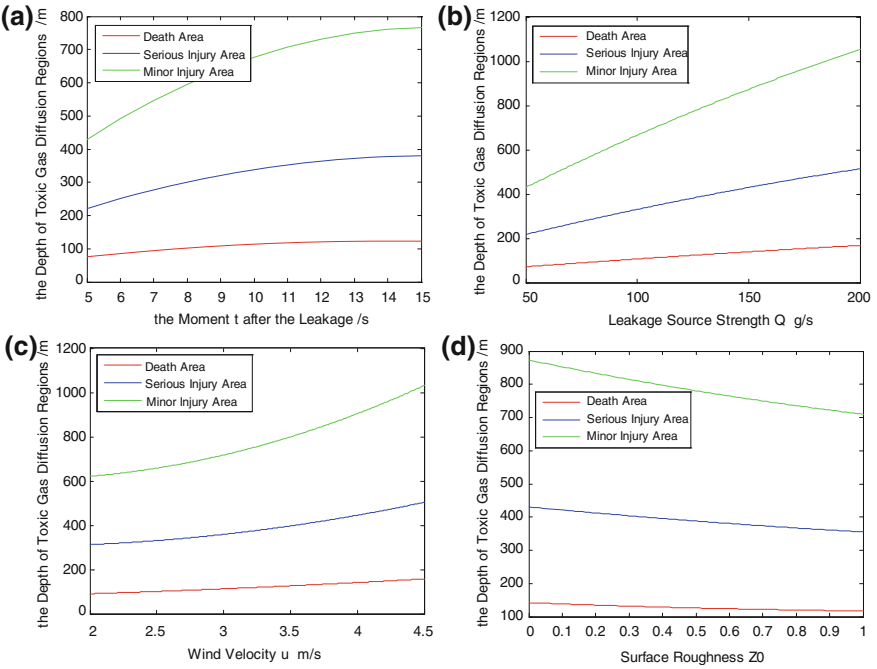


**Fig. 5.5** **a** t and the Depth; **b** Q and the Depth; **c** u and the Depth; **d** Z0 and the Depth

under the initial conditions in detail. Figure 5.5b–d shows that under certain conditions, there is nonlinear proportional relationship between the depth of toxic gas diffusion region and three key parameters $Q$, $u$, $Z0$. As a result, by adjusting the corresponding key parameters, we can get different scenarios of toxic gas diffusion that can increase the plasticity of the simulation system (Fig. 5.6).

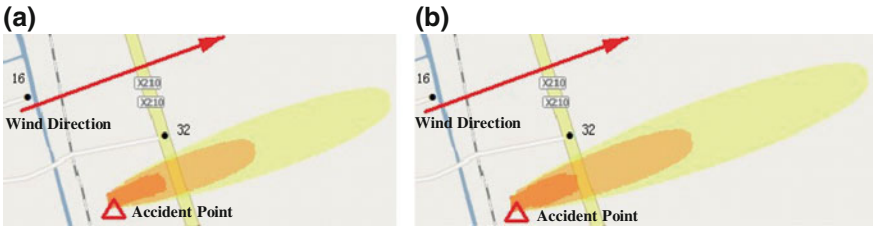


**Fig. 5.6** **a** t = 10 min; **b** t = 15 min

## 5.5 Summary

In this paper, we select the suddenly toxic gas leaking the emergency evacuation simulation system as the research background, and we research the application of the Arc Engine simulation technology in the toxic gas diffusion simulation in detail, and we have developed the toxic gas diffusion simulation system based on Arc Engine simulation technology and Gaussian plume model. In addition, we made a brief research of impact of three key parameters in Gaussian plume model on the depth of toxic gas diffusion region. The toxic gas diffusion simulation system has a good assistant decision function to the prediction and assessment of the toxic gas leakage accident scene and the subsequent evacuation plan.

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# Chapter 6
# Network Security Evaluation Based on Support Vector Machine

**Xiang Chen and Yun Li**

**Abstract** Network safety risk assessment of the solution is a key part of network security. Support vector machine method to overcome the defects of the traditional evaluation method (such as neural network method) of the nonlinear and local minimum value. This paper describes the content and index of network safety risk assessment, and puts forward a network safety risk assessment method based on support vector machine. The experimental results show that the method is feasible and effective.

**Keywords** Risk evaluation · Support vector machine · Network security

## 6.1 Introduction

Along with the development of the computer network technology, network has affected every aspect of our lives, brings to our life great convenience. However, the problem of network security is becoming more and more outstanding [1]. Network security risk evaluation has become the key process to solve in the network security, has become in this field of research hot spot. The task of network safety risk assessment of the risk analysis is loopholes and each network system and information system, and put forward the corresponding measures to control risk to the minimum, to ensure the normal operation of the whole network.

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## 6.2 The Content of Network Security Risk Evaluation

Have a lot of malicious conditions in network system (such as data leak, the system damage, service interruptions. The reason is a loophole in the network. The network safety risk assessment is a calculation and assesses the risk of network system in order to prevent the emerging threats [2]. The network security risk assessment factors as shown in Fig. 6.1 shows, including the threat identification, vulnerability appraisal, assets appraisal.

## 6.3 Indicators of Network Security Risk Evaluation

The value of the network security risk mainly includes three aspects that is, the value of assets, threats, and vulnerabilities. The network security index of risk assessment is based on the three fields [3]. These indicators of network safety risk assessment as shown in Fig. 6.2 shows.

### *6.3.1 Assets*

Assets are to point to have something in the network system of values, such as: operating system, network, network management, id, computer hardware, switch, firewall, and router.

### *6.3.2 Threat*

This threat is a potential damage to the network. There are many factors including the threat of physical environment, the hardware and software fault, malicious code, hacker attacks, operating errors, the information disclosure and falsifying information, threat assessment is through the environment and loss of network system calculation [4].

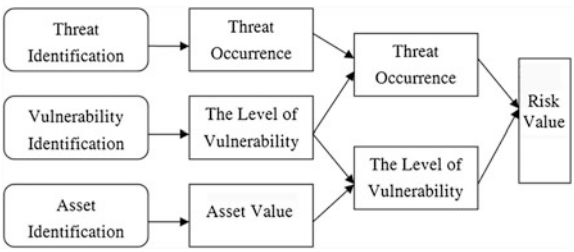


**Fig. 6.1** Content of network security risk evaluation

### 6.3.3 Vulnerability

The vulnerability of the network system is an important part of network safety risk assessment. Led vulnerability including: software security hole and security features, physical access control equipment, data encryption, network structure, the physical environment, and so on. The vulnerability evaluation calculation is through the network of the vulnerability of the equipment, and assessment level of vulnerability [5].

## 6.4 The Classification Method Based on Support Vector Machine

The support vector machine (SVM), as a kind of machine learning method, put forward the bell LABS in 1995, the basic idea is to find a classification surface can distinguish to go correctly. The method based on support vector machine can be divided into two categories [6].

### 6.4.1 Linear Classification

We can obtain the best classification function from the linear separable training samples (Xi, Yj) so as to get the optimal classification surface. The optimal classification functions as follows:

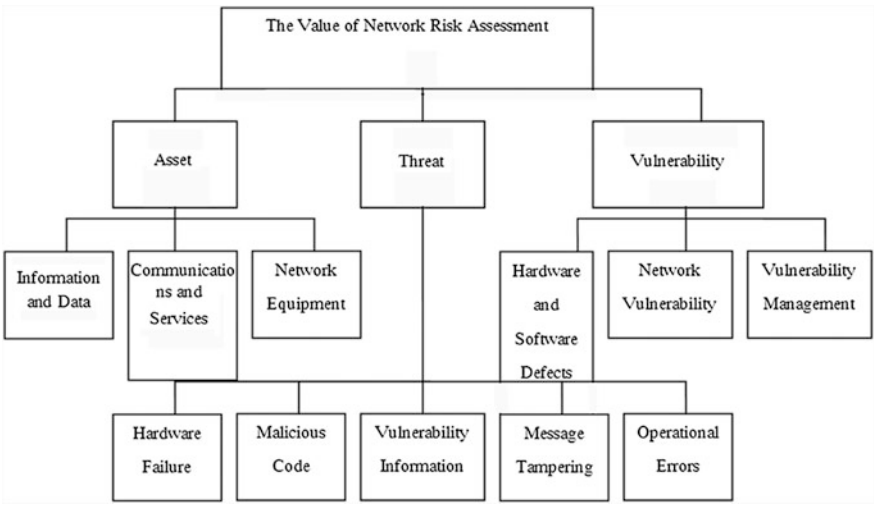


**Fig. 6.2** The indicators of network security risk evaluation system

$$f(x) = \mathrm{sgn}\left\{\sum_{i=1}^{n} a_i^* y_i (x_i x) + b^*\right\} \tag{6.1}$$

Let $a_i^*$ stand for the Lagrange multiplier and $b^*$for classified threshold.

### 6.4.2 Nonlinear Classification

For nonlinear problems, we use the relaxation factor $\{\xi\}_{i=1}^{N}$ to stand for the degree of misclassification and turn the nonlinear kernel function K(xi, yj) into a linear function in the high dimensional space through a series of changes, so we can get the optimal classification surface. The kernel functions as following:

Linear SVM: $K(x, y) = x.y$
Polynomial SVM: $K(x, y) = \{(x.y) + 1\}^d$
Radial basis function SVM: $K(x, y) = e^{-\|x-y\|^2/2\sigma^2}$
Neural network SVM: $K(x, y) = \tanh(K, x.y - d)$

In this paper, the support vector machine of radial basis function is used and the corresponding classification function is as follows:

$$f(x) = \mathrm{sgn}\left\{\sum_{i=1}^{n} a_i y_i K(x_i x) + b\right\} \tag{6.2}$$

## 6.5 Evaluation Model

The steps of the network security risk evaluation model based on support vector machine can be described as follows:

Training the large-scale samples

Obtaining the optimal classification function and decision-making surface by continuously adjusting the decision function and classification of surfaces;

For the data to evaluate, we can obtain the classification results by using the optimal classification function and decision-making surface to classify.

Before obtaining the optimal classification function and decision-making surface of support vector machines, we should define parameters and incentive value of the kernel functions. In this paper, $\sigma^2 = 0.15$ $H = 100$.

The training samples are divided into four risk levels. Each risk corresponds to the support vector machines. All the sample data are the input of the first SVM. We use 1 to stand for the risk value $R >= 0.5$, $-1$ for the risk value $R < 0.5$ and $(1, -1)$ for the output of the first support vector machine. We can get the number and structure through the training of the first support vector machine.

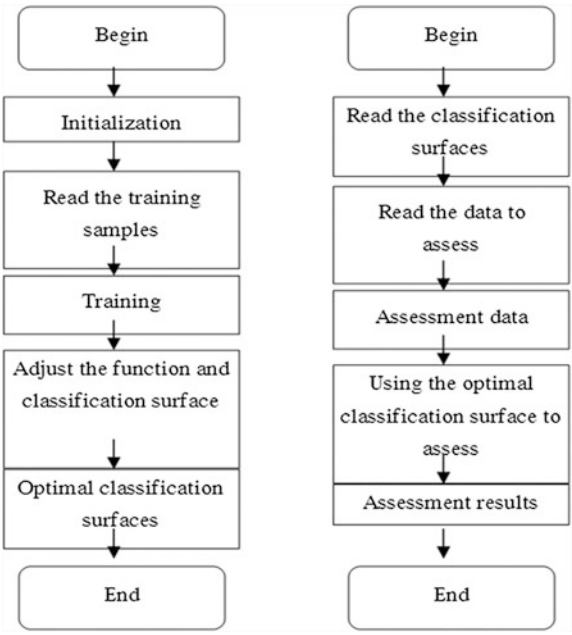


**Fig. 6.3** Network security risk evaluation model

The evaluation model based on support vector machine is shown in Fig. 6.3, which includes sample training and risk evaluation.

The class of support vector machine and the structure of support vector machine parameter are shown in Figs. 6.4 and 6.5.

## 6.6 Experimental Results

We do the experiment to verify the accuracy and generalization ability of the method proposed above. The generalization ability is interpreted as a production of a reasonable decision for data previously unseen in the process of training.

We select 50, 100, 150, 200 samples as training samples separately, 600 samples as test samples to verify the accuracy of the method. And then we select 200 samples as training samples and select 2,400 samples divided into four groups randomly as the test samples to verify the generalization ability of the method. The results are as follows.

The results are summarized in Table 6.1 from which we can see that, with the sample increasing, the accuracy increases gradually. When the sample was 200, the accuracy is 91.08 %. For the same sample, the amplitude of accuracy is 0.0138.

```
Class CvSVM
{
Public:
    CvSVM():
    Virtual ~ CvSVM();
    CvSVM (const CvMat*_train_data, CvMat*_responses,
    Const CvMat*_var_idx=0, const CvMat*_sample_idx=0,
    CvSVMParams_params=CvSVMParams() );
    const CvMat*_var_idx=0, const CvMat*_sample_idx=0,
    CvSVMParams_params=CvSVMParams() );
    virtual float predict (const CvMat*_sample ) const,
    virtual int get_support_vector_count () const;
    virtual const float* get_support_vector (int i) const;
    virtual void save (const char* filename, const char* name =0);
    virtual void load (const char* filename, const char* name =0);
    virtual void write (CvFileStorage*storage, const char*name);
    virtual void read (CvFileStorage*storage, CvFileNode* node);
    int get_var_conun () const {return var_idx ? idx ->cols: var_all;}
};
```

**Fig. 6.4** The class of sum

**Fig. 6.5** The structure of sum parameter

```
Struct CvSVMParams
{
    CvSVMParames():
    CvSVMParames (int_svm_type, int_kernel_type,
    double_degree, double_gamma, double_coef (),
    double_C, double_nu, double_p,
    CvMat*_class)weights );
    int     sve_type;
    int         kernel_type;
    double      degree; //for poly
    double      gamma; // for poly
    double      coef 0; // for poly
    double      C;
```

**Table 6.1** The result of method of network security risk evaluation

| Training samples | Test samples | Accuracy |
|---|---|---|
| 50 | 600 | 0.8728 |
| 100 | 600 | 0.8931 |
| 150 | 600 | 0.9056 |
| 200 | 600 | 0.9108 |
| 200 | 600 first | 0.9087 |
| 200 | 600 second | 0.9132 |
| 200 | 600 third | 0.8994 |
| 200 | 600 forth | 0.9077 |

## 6.7 Conclusion

This paper proposes a network safety risk assessment method based on SVM. Using the method of kernel function is a new combination different classification of function, continuous optimization classification scheme to improve the performance of the assessment of the SVM.

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# Chapter 7
# Study on Nursing Safety and Quality Management

**XiuFen Ma, Qingling Han, Lichun Zhou and Ying Hu**

**Abstract** Objective: Explore the practice and application of safety care management and quality management at work. Methods: Establish and improve the nursing management system, safety assurance, and quality improvement through the development of clinical nursing assessment standards, supervision, inspection, and evaluation of the hospital-based nursing quality management to ensure the compliance of the basic quality indicators; raised the nursing quality, to improve with the basic pattern, we prefer both the long and short-term goals, implement and guide the nursing quality, to improve project implementation, quality management training and assessment. Results: Through the implementation of the management of nursing safety and nursing quality, hospital comprehensive nursing quality and service satisfaction has increased significantly. Conclusion: Implementation of nursing safety management and nursing quality management, which ensure the nursing quality of hospital-wide surveillance, improvement and implementation of nursing quality and service satisfaction improved to play a positive role in promoting. Through increased management, nursing quality management has more standardized and institutionalized procedures, and enhanced the quality of nurses' awareness and sense of competition, play an enhanced role in the promotion of the service concept of "patient-centered", improve the nursing comprehensive quality, and create a safe and comfortable medical and rehabilitation environment.

**Keywords** Nursing safety · Nursing quality · Nursing management

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## 7.1 Materials and Methods

Nursing management is an important part of the hospital management, the matron in the hospital is manager and organizer of nursing team. The matron directly impact on the quality of hospital nursing and management level. Nursing management is a behavior process in order to achieve the management objectives, nursing managers to adopt a certain organizational forms and methods, command, coordination and control managers, and complete the pre-nursing goals. Nursing management is an important part of the hospital management; the matron is the main body of nursing management. This paper analyzes the matron should have the quality and improve the quality of matron, and conducted in-depth discussion on the nursing and safety and care management skills. Improve the matron quality is the basic guarantee for improving the nursing management. Make full use of nursing management skills to ensure that the necessary means to complete high-quality nursing management [1, 2].

### *7.1.1 Professional Quality of the Matron*

(1) Love nursing job, work hard, serious, and responsible.
(2) There is a strong sense of responsibility and dedication.
(3) Have a good nursing ethics, ideology and work style, work style, to set an example, self-discipline, to treat people equally.

### *7.1.2 Matron should have Skills as Follows*

(1) Grasp the nurses configuration principle.
(2) The principles of the nursing staff scheduling, scheduling.
(3) Nursing role and principles of performance evaluation.
(4) Nursing training and education in the form and method.
(5) Characteristics of nursing human resources.
(6) Motivation theory in nursing tube.
(7) Familiar with communication skills, effective communication strategies.
(8) Solve the doctors patients conflict.

## 7.2 Nursing Quality Management

In recent years, the transformation of the medical model and the rapid development of medical, the scope of nursing services continue to expand, increasingly high expectations of the nursing quality. A nice nursing quality management system can effectively improve the nursing quality and nursing services process

control. We must follow the principle of patient-centered service delivery model, and comprehensive nursing quality, so that we deeply appreciate the continuous improvement has more significance. Through practice and standardize nursing behavior on the basis of further implement the nursing quality management process, we think that should do the following aspects of work to improve nursing management [3, 4].

### 7.2.1 To Improve the Quality of Consciousness

Establish the quality and development of consciousness. Quality of nursing should adapt to the needs of social progress and technological development, nursing thoughts of quality first throughout the entire work, nursing quality management is the core of nursing management is an important indicator to measure the level of hospital management. To grasp the nursing quality management must tackle well management system and standardized implementation of the standards and quality objectives [5].

In recent years, with the national health system reform people's awareness of the law have greatly improved, patients and their families have become increasingly demanding in the quality of health care services and nursing techniques, nursing quality control must have a complete set of management system supervise the implementation of standards, to meet the needs of patients and their families.

### 7.2.2 Enhance the Awareness of Health Care Services

The quality management system operation involves every nursing staff, it is full participation in the process. Establish the nurses' collective consciousness. Consciously safeguard the interests of hospitals and departments. Establish a good quality management system. Create a long-term development. Firmly establish a sense of service.

Overall quality of education and training, monthly implementation of the nurse integrated quality evaluation, and receives better results and thus stimulates the enthusiasm of the nurse's work.

Through various forms of professional training, skill training, to meet the needs of patients with multi-faceted, multi-level needs, also provides nurses and patients to communicate and exchange, identification of patients 'request, the implementation of personalized analysis to fully understand the patients' request. Ensure opinions and suggestions of the patient for our nursing work can get immediate feedback, the patient's complaints are handled timely and effective, to the satisfaction of the patient nursing services, fully embodies the purpose of people-centered care [6, 7].

### *7.2.3 Standardize the Nursing Quality Management*

#### 7.2.3.1 The Basic Principles of Nursing Quality Management for Patient-Centered Principles

The principle of a leadership role; the principle of involvement; the principle of process approach; principle of system approach; fact-based decision-making principles; the principle of continuous improvement. Management system is not perfect, the imperfections of the rules and regulations, management and supervision are not effective and other influencing factors affect the nursing and safety management system is the greatest threat to patient safety. Mistakes in management decisions and organizational processes are the potential-induced system failures most fundamental reason [8].

Therefore, establish and improve the quality of nursing safety management system is particularly important to establish the three links of the quality management (PDCA). According to plan (P), the implementation of (D), check (C), cycle (A) scientific procedures for quality control activities. Through timely and quality control, evaluation, feedback, good to continuously carry forward the inadequacies identify the causes, suggest improvements, and transfer it to the next PDCA cycle in order to achieve continuous improvement purposes.

#### 7.2.3.2 Improve the Quality of Nursing Monitoring of Nursing and Improve Quality Management System

Each department to nursing work this week to carry out quality checks; monthly organization of administrative and operational rounds of the nursing department, a combination of regular quality inspection and occasional spot checks; nursing director weekly to follow the president of the competent business subjects cycle rounds to check the nurses' responsibilities, real-time grasp sections. Establish self-control and control of mutual coordination and restraint nursing and quality control of nursing implemented by the Ministry of focus on the quality of management control, sections of the focus on process quality control, and nurses on the basis of quality control, the focus on quality assurance at the same time each month discussion and analysis, timely summary of the feedback.

#### 7.2.3.3 Establishment of the Quality Management Standard

Nursing quality management begins with the standard, and finally standard setting quality objectives, based on hospital quality and the objectives and requirements, the department of Nursing, developed to achieve the target of the management system of the nursing work, nursing responsibilities, nursing management practices, code of conduct for nurses, technical operation, and disease care routine.

#### 7.2.3.4 The Development of Nursing Work Job Specification

For the basic nursing, nursing classification, nursing documentation writing, ward management, disinfection and isolation, staff and assessment, aid items, sterile goods, do our best to the efficient management and improve operational results. Require the control of the process of inpatient nursing services, to ensure timely safe and effective nursing care to patients during hospitalization, to ensure the quality of medical. To avoid the error occurred, etc., to ensure that the total quality control management.

#### 7.2.3.5 Focus on Training to Improve the Ability of the Matron in the Nursing Management

There are plans to arrange the matron to take turns to attend training to learn, to improve the matron overall quality and management capabilities.

#### 7.2.3.6 Rational Allocation of Nursing Human Resources

Nurse managers should be the rational allocation of nursing human resources. Nurses the number of clinical practice should be to match the workload. Positive and reasonable working hours, the implementation of the nursing staff workload and working hours would like to combine. The heavy workload, work longer hours, small amount of work, shorter working hours. Hierarchical management system, new and old nurse with the system to work. In order to reduce the overload of work status. Reduce burnout and improve the quality of care, to ensure the patients get better nursing.

## 7.3 Nursing Safety Management

Health care quality is the life of the hospital, is the core of the hospital management, hospital survival and development of fundamental medical safety is an important guarantee of the hospital normal operation, is an important part of the quality of medical care. Nursing safety management is the guarantee of quality care to ensure that the patient's physical and mental health and effective control of various factors of insecurity. With the development of society, people's health awareness and self-protection awareness is growing, more stringent security requirements of the nursing work. "Patient-centered" management philosophy, nursing safety issues more and more attention. The nursing safety has become an important indicator to measure hospital care.

To strengthen the safety management of nursing, avoid medical safety accidents, so that patients receive appropriate, timely and safe nursing, and important responsibilities for the maintenance and reconstruction of health nursing workers

nursing safety management can improve nurses' awareness of security to minimize the error of nursing, the incidence of accident disputes is an important part in the nursing quality management.

Our national health management system, the current lack of sound quality management system and nursing emergency plan, the nursing process is not perfect. Nursing safety management is the core of the nursing quality management, nursing quality directly affects the quality of medical care, patient safety, the hospital's reputation. Management system is imperfect, the lack of monitoring efforts, insecurity, lack of foresight, do not attach importance to education and training of nursing staff, human resources vacancies, nurses low salaries are to lead to insecurity. Nursing and security presence: the nursing safety culture is not perfect, patient safety management model is not established, the low level of nursing human resources, it should do the following points.

### *7.3.1 Strengthen the Learning of Medical Laws and Regulations, Strengthen the Care and Safety Awareness Entries*

With the rapid development of medical science and technology, modern medical care activities become increasingly complex, more and more a variety of factors that affect safety, such as individual young nurses a sense of responsibility is not strong, professional conduct is indifferent, weak legal awareness, lack of self-protection awareness.

Response to this situation, it is necessary to organize a learning knowledge of laws and regulations, adhere to in their daily work, and actively guide the nursing staff to raise awareness, strengthen safety awareness, and strive to improve the quality of professional ethics of the whole department nurses, the first concept of a strong healthcare safety, well-known own professional authority, rules and norms, should not only be legally bound by words and deeds of self-perfection, and good service to patients, the maximum to prevent the occurrence and put an end to the issue of medical safety.

### *7.3.2 Focusing, Attention to Detail, and Adhere to Improve Service, Improving the Nursing Quality*

Nursing services is trivial, complex services, both in the management should pay attention to focus, but also attention to detail. On the one hand, we should grasp the key patient care, such as critically ill, surgery, and patients with mental disorders and old age combined cardiovascular and some significant disease, these patients should be the focus of a good care. On the other hand, we will focus on nurses

training new nurses, practice nurses; working careless easy problems nurses as a key nurse treat new nurses during the pre-based on the training of nurses. For all sections of the case, hospital should provide opportunities for nurses in the training of specialist knowledge.

While at the same time, we should focus on the implementation of the nursing work system, do strict supervision and inspection, try our best to understand and to master each group completion of the work, ensure all the nurse is on duty, such as basic nursing, observe the patient's condition if had been improved, found the problem and correct the problem in time, warmly to all the patients, specification and attentive nursing services in order to win the trust and cooperation of the patient's and their family. Effectively ensure the quality of service.

### *7.3.3 To Encourage Nurses and Continuously Improve the Quality of Nurses' Professional*

The nurse has the glorious duty of the life-saving. Qualities of Nurses not only have a close relationship with the quality of medical care, but also the decisive factor for the development of nursing science. Therefore, to continuously improve our own quality, is an important task of qualified nurses.

The wealth of expertise and excellent professional skills is the most basic quality of the nurses. Only when we have a wealth of expertise and excellent operational skills we can do great deal with the daily work, can be successfully resolved the technical problems in their daily work, in this way, we can deal with emergencies and unforeseen circumstances in their daily work.

To have such a capability, the nurse must be practice in the daily work, and continue to accumulate experience, get a certain amount of expertise reserves, have the ability to update the knowledge structure, and constantly learn new theories, new skills, and master these skills.

According to nurses who less experienced and lack of clinical experience, the department should do the monthly assessment of first aid techniques and conventional operation, practice how to identify problems, and promptly pointed out, did not miss a detail, at the same time, to encourage young nurses in the nursing process meet new problems, difficulties, doubts, should learn to the ability of observe, think, analyze, and judge, to continuously improve the ability of observation and critical thinking, and take advantage of the morning meeting, try to practice and study skills, difficult cases discussion by using the relevant knowledge, training, and guide nurses to use the knowledge to the nursing, of clinical. Once meet the specific problems, nurses need foresee, identify, and assess the risk as soon as possible. In critically ill patients, nurses should focus on patients with assessment of predictable nursing to remind the nurses how to take the initiative in the work, and carefully avoid the risk of various treatments. Nursing staff's safety training and nursing skill training were highlighted. The consciousness of law, responsibility, safety management, and risk prevention were strengthened.

Nursing skill and professional quality were greatly improved. Nursing fault was effectively controlled and patients' satisfaction. Nursing dispute decreased. Nursing safety management is an effective way to ensure sustainable development of safety nursing, it improved nursing quality.

### 7.3.4 Improve the Nursing System to Protect the Safety of Clinical Nursing

Nursing management system is to reduce health care risk factor, but also a basic guarantee for the protection, it is to protect the personal safety of patients and medical staff. Hospital nursing risk management should do, first must conscientiously implement the system, followed by non-omission of details, the nurses take turns to work in the implementation of the system, check system, the rescue system and the technical procedure and attention to every detail, and timely detection of potential nursing security risks, aspects of the work likely to cause nursing risk, and strengthen the nursing safety management system.

Strengthening nursing risk prevention and plans for the emergency response. According to different sections of the working characteristics, do strengthen emergency rescue work, training, drills and basic nursing care, stringent requirements for all the staffs. Monthly assessment.

To all kinds of department nurses, include of first aid knowledge and operation of appraisal skills, to supervise the nurses to seriously study a variety of first aid knowledge.

### 7.3.5 Construction Nursing Safety Culture

First update the nursing managers perspective, actively promote a safety culture, mobilize the enthusiasm of the nursing staff, and take the initiative to report unsafe events. Take the initiative to report on the potential risk, early detection of insecurity, to mobilize nurses to actively participate in the nursing safety management to prevent the occurrence of nursing errors from the source, thus ensuring the nursing safety. Ultimately create a positive safety culture. To find the factors of insecurity as soon as possible, to mobilize the enthusiasm of the nurses, so as to effectively prevent the occurrence of nursing safety hazards.

### 7.3.6 Standardize Nursing Documents Written Work to Ensure that the Law is Valid Strengthen Self-Protection

We found that in the daily care of instruments, nursing records are not standardized, altered records are not timely phenomenon, in order to ensure that the legal effect of the nursing records, the nurse should always emphasize the importance of writing in the nursing documents. Strengthen the nurse's self-protection awareness. General project records complete, in addition to the requirements of nursing records. Should pay more attention and concern in nursing records inconsistent with the law. Special attention to the quality of medical records written in the usual check. Discover the details and seek to improve the medical continuously improve the quality.

## 7.4 Discussions

In these years, with the development of society and medical advances, people's health care needs to further improve the patients to further improve health nursing safety requirements. In the increasingly fierce competition in the medical services market, the quality of nursing management as an important indicator of one of the measure of nursing services, and the most direct patient medical nursing choices, nursing is also one of the most important indicators for one hospital.

Quality is the lifeline of survival, security is the protection of the quality. Nursing safety is the focus unremittingly in the nursing management. We must strictly control the quality, the timely detection of potential safety problems, to eliminate unsafe factors for the patient, try to provide efficient, high quality, safe services.

The nurses on the importance of nursing safety is necessary to protect the good nursing safety work. On the basis of the quality control group of hospital care, the establishment of the department quality of care control group, primary care personnel directly involved in the nursing safety management, and checked by passive acceptance to active participation, strengthen the safety awareness of the nursing staff, and enhance a good job of quality of care the consciousness of the work, the formation of a favorable environment for everyone to pay attention to quality control to ensure the quality of nursing work. The lack of nurse practitioners and professional identity crisis more and more serious, excessive workload and fatigue can also cause decreased attention and vigilance, resulting in increased error. Therefore, the increase in nursing human resources, can improve the quality of care and safety. And through results of the evaluation of the nursing safety quality evaluation, give nurse staff some encouragement.

Nursing management is a process of continuous improvement, nursing managers absorbing foreign experience, while actively improve our country nursing safety and quality management standards, combine with nursing the actual work of

analysis and reengineering of the existing nursing processes to develop appropriate management strategies, development a suitable security incidents reported to the analysis system for our nation, and do the systematic management of the nursing work to improve the standard of nursing safety and quality management. Nursing quality management is the core of nursing management is an important indicator to measure the level of hospital management. Grasp the quality of planning, quality control and quality improvement of the three processes is the focus of our work. Improve the quality of the nursing skills of nurses is an important factor to improve the quality of care is to ensure that the core of the nursing management.

The management concept of innovation is a source of innovation, it is the precursor of all management system, it is every manager should possess. Follow eight basic principles of quality management: customer-centric, the implementation of the system management; strengthen the leadership role to achieve continuous improvement; to encourage full participation in decision-making based on facts; to take the process approach, the nursing of the supply-side relationship. Establish the quality of hospital safety culture. Central idea is People-centered, quality control, safety to the highest priority, such a thought process to infiltrate the organization of each unit into each operating norms.

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# Chapter 8
# Study on Monitoring Mechanism of Micro-Blog

**Yu Chen and Ming Xu**

**Abstract** With the fleeting progress of network technology, micro-blog has become the major way of informative communication. So far, many new characteristics and challenges emerge with its development in China. To ensure the national political security, healthy and harmonious development of society, it is necessary to monitor the information spread through the micro-blog. Based on using for reference on foreign advanced micro-blog monitoring mechanism and understanding of domestic objective existing situations, this paper discussed and analyzed the new micro-blog monitoring mechanism, which will play guiding role and have practical significance on improving network social harmony and progress.

**Keywords** Micro-blog · Monitor · New tendency · New mechanism

## 8.1 Current Situation and New Tendency of Micro-Blog

### *8.1.1 Definition and Characteristics of Micro-Blog*

Micro-blog (micro blogging or micro blog) is a new blogging form, in which users are allowed to make an update to short texts and also publically release information in time [1]. In general, the characteristics of the micro-blog can be concluded as follows. First, it is easy and fast to use. In a micro-blog, the number of

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the input words has been limited within 140, and also the way of releasing information is very simple. Second, great freedom and space are available for users to publish speeches. In a micro-blog, there is only a limitation on the number of the input words, but not on the themes. This allows the ordinary people to own the same right to speak as intellectual elite. Third, the information in a micro-blog is public completely. Different from network spaces and blogs, no passwords can be set the information in a micro-blog and only making public and keeping secret can be set, and thus most of the information is fully open. Fourth, the "users-fans-concerns" form is used for the communication of information. The concerns about the users are called as "fans", and the users that people are interested in can be set as "concerns", promoting a hug user base to be formed ultimately. Therefore, in micro-blog, the reorganization of the mass information is realized through the concerning, forwarding, or replaying functions for users [2]. Fifth, the information in micro-blog spreads highly quickly. Information can be spread with fast speed as long as the users have a few of clicks, and also fission spreading can be proven to be real. Sixth, the users of micro-blog are extensive. Now, stars, business owners, deputy to the NPC, students and common people have owned their micro-blog. Like QQ, mobile phone number and E-mail address, micro-blog has proven to be a way of communication printed in personal card.

### *8.1.2 Current Situation and New Tendency of Micro-Blog*

The Annual Report 2011 about Micro-blog in China released by Public relations research center and public opinion research laboratory of Shanghai Jiaotong University shows that micro-blog continued to keep a high-speed development in 2011, and the number of the micro-blog accounts had risen to 320 million by the end of November and the pieces of the information released and forwarded in micro-blog had been higher than 150 million. The user groups of micro-blog trends to be diversified in China, and also user coverage has been further expanded. First, in 2011, the number of users of micro-blog had been increased further, and also the user groups of micro-blog trended to be diversified. Now, in China, the micro-blog market competition has been segmented, and also the pattern in which Sina micro-blog and Tencent micro-blog are two major forces has been preliminarily formed at the micro-blog market. Second, micro-blogs oriented governmental affairs have changed into a new place for governmental officials and national people to communicate with each other. Therefore, micro-blog has become very popular in governmental departments. By the end of October 2011, the number of the authenticated sina micro-blogs of governmental agencies and officials at all levels had been close to 20,000 in total. Among these micro-blogs, the number of the micro-blogs of governmental agencies had exceeded 10,000; the number of the micro-blogs of governmental officials had reached nearly 9,000; the number of the micro-blogs of provincial and ministerial governmental departments was 37; the number of the micro-blogs of provincial and ministerial

governmental officials was 14; the number of the micro-blogs of governmental offices and bureaus was 429; the number of the micro-blogs of the officials in governmental offices and bureaus was 268. A few days ago, micro-blogs oriented at governmental affairs have covered 34 provincial administrative regions of China; micro-blog of governmental affair has been unavailable in no provinces of China. According to statistics, the fast increasing of the number of the micro-blogs oriented at governmental affairs happens in Beijing, Guangdong, Jiangsu, Zhejiang, Fujian, and Sichuan in the year, reaching more than 1,000 [3]. Third, the rumors constantly emerged in micro-blog, and had given rise to an effect on the social development and stability to some extent. After an analysis on the rumors released in the rumor-prohibition area of Sina micro-blog, it was found that the rumors in micro-blog in the year were mainly concentrated in March and the period from June to September. The most frequently-released rumors were natural and man-made disasters, celebrities, and people's livelihood in society, etc.; most frequently used words used in the rumors of micro-blog were pornography, violence, celebrities, governmental officials, young children, students, policemen, etc. [4].

## 8.2 Micro-Blog Monitoring and the Ways of Monitoring in Foreign Countries

### *8.2.1 Definition of Micro-Blog Monitoring*

There has been not an authorized and accurate definition on micro-blog monitoring yet. The authors think that micro-blog monitoring can be understood as a dynamic behavior of relevant organizations and agencies to monitor the information and users of micro-blog for the purpose of ensuring the political and social stabilities and harmonious development of a country. At present, the micro-blog monitoring is mainly targeted at some sensitive information, users and designated information, manual dynamic monitoring on users. Therefore, the workload is huge, and also it needs to take a long time.

### *8.2.2 Current Situation and Problems of Micro-Blog Monitoring*

Monitoring network micro-blog is mainly relying on the manual searching and reviewing at present. First, the monitoring on the sensitive information in micro-blog is objectively not in time, because it is mainly relying on manpower, but the Internet is always available for 24 h. Second, the personal privacies are objectively violated by the monitoring, because of the extensive users of micro-blog and the

fast information spreading. For this reason, in the implementation of micro-blog monitoring, it is necessary for relevant departments and personnel to pay attention to the coverage, and simultaneously make use of related laws and regulations with efficiency, for the ultimate purpose of ensuring the harmonious and healthy development of the country. Third, in the implementation of network micro-blog monitoring, the effective laws and regulations for ensuring the legitimacy and rationality of micro-blog monitoring are still in short in China. Fourth, no specific departments have been designated for ensuring the smooth completion of micro-blog monitoring. At present, micro-blog monitoring is implemented cooperatively by many large websites and governmental departments. However, because there are no insufficient principal manpower and material resources of relevant departments and no guarantees from relevant institutions, effective micro-blog monitoring is still absent in China.

### *8.2.3 The Ways of Monitoring in Foreign Countries*

In India, the Law of Information Technology has been improved by its government. Therefore, the micro-blog monitoring is ensured from the perspective of law, and simultaneously the state sovereignty unity and social harmonious and stable development can be guaranteed [5]. From the perspective of technology, instant messaging software such as blackberry and the websites such as FaceBook and Twitter are monitored in India.

In the United States of America, freedom of speech is always pursued by people. However, in the network micro-blog, a real-name management system has been implemented in micro-blog of the United States.

South Korea was the first country in implementing a real-name management system for network micro-blog compulsory.

In Japan, there has been not a decision made relying on administrative power for implementing a real-name management system for network micro-blog so far. However, a real-name management system in Internet has been actually quietly popularized in Japan through the ways such as IP address and mobile phone real-name registration [6].

In the United Kingdom, there has been not a real-name management system in Internet till now. However, Cameron, prime minister, said that the rights of a person would be deprived if he carries out violence activities with network micro-blog.

Therefore, in micro-blog monitoring, real-name management is used by some countries, but strict monitoring and management methods are adopted by other countries from the perspective of laws, for putting an end to the information spreading threatening the security of a state and ensuring the harmonious and healthy development of society [7].

## 8.3 New Micro-Blog Monitoring Mechanism

### *8.3.1 Learning and Introducing the International Micro-Blog Monitoring Mechanism*

At present, seeing the micro-blog monitoring all over the world, the real-name management system and the method of strengthening the laws and regulations have applied in most countries. Therefore, a real-name management system can also be applied in the micro-blog monitoring of China. As long as a real-name management system is implemented and the real information of each micro-blog owners is authenticated, the speech environment in micro-blog will be kept relatively harmonious. Therefore, it is necessary for China to learn and introduce the international methods of making laws and regulations, so as to speed up the improvement of laws and regulations and optimizing network communication environment. The key to suppress the emergence and harms of the rumors in Internet is a good network public opinion communication environment, but not providing soil and opportunity for rumors to emerge, spread, and ferment. By introducing the micro-blog monitoring mechanism in the international society, the purpose of micro-blog monitoring should be preventing the negative effect spreading, but not turning it to be a deformation mean for monitoring and limiting the freedom of speech of citizens.

### *8.3.2 Introducing Effective High-Tech Means in Micro-Blog Monitoring*

The objective fact that human resource and time for the micro-blog monitoring are limited and the effect is poor in existence. Therefore, it is necessary to make an enhancement to micro-blog monitoring in terms of technology; a dynamic, automatic, and intelligent monitoring can be applied in combination with relevant software. At present, the micro-blog public opinion monitoring and warning system can be applied in China, which is a tool for comprehensively controlling the public opinion dynamics in micro-blog, knowing about polls, and providing early warning prompts. With the application of the micro-blog public opinion monitoring and warning system, related micro-blog contents can be known within the shortest time, and thus an early warning about emergencies and sensitive information can be sent in time and also public opinion dynamics and tendencies can be grasped at any time. Therefore, to promote micro-blog contents healthily and orderly develop and ensure the healthy and harmonious development of the state and society, it is necessary to apply a micro-blog public opinion monitoring and warning system in China.

### 8.3.3 Network Environment Guiding Mechanism Influenced by Positive Micro-Blog

The authors think that positive micro-blog can be classified into two types: one is governmental micro-blog, and the other is the folk micro-blog used for spreading a positive force. The government micro-blog can positively and actively receive, learn and make good use of micro-blog platforms for promoting them to play a "speaker" effect and changing to effective and favorable tools of communication between government and citizens. Also, if the characteristics of (the incomparable information spreading speed and greatly involving the public) micro-blog can be utilized for fully combining the positive micro-blog with policy making and emergency management and the orientation of expressing attitude and views, clearing the truth, guiding the public opinion in network, directing cyber citizen's emotion and leading image communication can be established, the governmental ruling ability and service quality will be greatly enhanced [8]. Folk positive micro-blog is used for conveying some good people and good deeds on a micro-blog platform. For example, the first case of confessing crime by using micro-blog appeared in Zhongshan; the activity of "rescuing egging children by taking photographs" was launched in micro-blog, promoting "attacking begging behaviors by micro-blog" to receive a very good result. Ultimately, through the strength of positive micro-blog, a harmonious and healthy network environment will be produced.

### 8.3.4 Monitoring Mechanism for the Classification of Micro-Blog Information

The classification of the information involved in micro-blog can be taken into account; monitoring indexes can be quantitative for each category according to the appearing frequency, and relevant measures can be taken when the amount of information reaches a certain level. It is necessary to apply a monitoring mechanism for the classification of micro-blog information. Also, it is necessary to pay attention to the capturing of the keywords in groups of micro-blog, so as to find out the universally concerned elements in it and put on records. In addition, with the implementation of the monitoring on the classification of micro-blog information, the micro-blog information retrieval rate and monitoring efficiency can be improved.

### 8.3.5 *Uniformly Establishing an Accountability System Centered at Micro-Blog Platform Responsibility Platform*

A platform responsibility system, which is under the principle (i.e., the company that establishes the micro-blog platform should manage it and undertake the due obligations if there are problems), can be uniformly established. Also, centered at this platform responsibility system, a strict accountability system can be established. Any micro-blog website, which has a problem, will receive serious monitoring and punishment. Therefore, it is necessary for a micro-blog platform to undertake corresponding responsibilities and even pay the price of closing business, so as to ensure micro-blog management platforms to perform social responsibilities and improve the efficiency of monitoring micro-blog platforms [9].

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# Part II
# Intelligent Evolutionary Algorithm

# Chapter 9
# Knowledge Extension for Agent Learning in MAS

**Zhiling Hong and Meihong Wu**

**Abstract** Multi-agent system (MAS) requires coordination mechanisms to facilitate dynamic collaboration of the intelligent components, with the goal of meeting local and global objectives. This paper deals with the issue of using dynamic epistemic default logic to offer a natural way of communication policies for the management of inter-agent exchanges in MAS. We first explore the communication protocols in MAS that operate in dynamic and highly uncertain environments, and then we add the constrained default sets to realize the extension of dynamic epistemic logic theory and restrict the agent's inference behavior via constrained epistemic default reasoning. We also specify and reason the characteristic of the dynamic updating when agent meets incompatible knowledge in the logical framework that show the usefulness of logical tools carried out in the dynamic process of information acquisition.

**Keywords** Dynamic epistemic logic · Epistemic extension · Agent learning · MAS

## 9.1 Introduction

Multi-agent system (MAS) is an area of distributed artificial intelligence that emphasizes the joint behaviors of agents with some degree of autonomy and the complexities arising from their interactions [1, 2]. MAS range in their description

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from cooperative to being competitive in nature [3]. In MAS a number of autonomous pieces of software (the agents) interact in order to execute complex tasks, and then MAS require coordination mechanisms to facilitate dynamic collaboration of the intelligent components, with the goal of meeting local and/or global objectives. In the case of MAS, the coordination structure should provide communication protocols to link agents having inter-related objectives and it should facilitate mediation and integration of exchanged knowledge [4, 5].

The growing interest in MAS and their specifications has brought forward the concept of logic theory as useful formal tool to model key characteristics of the agents, such as the evolution of their knowledge, communication, etc. One of the characteristics of communication in MAS is that it does not change the bare facts of the world, but only information that agents may have [6–8]. As in default reasoning, the default rules simplify knowledge representation instead of describing all possibilities one can construct rules and exceptions, and default reasoning allows construction of different knowledge bases from the same set of rules by agents operating in different environments and with different sets of facts.

Epistemic logic is one of the promising approaches to deal with what agents consider possible given their current information [9]. This includes knowledge about facts, but also higher order information about information that other agents have. The ability to reason about higher order information distinguishes epistemic logic from many other approaches to information. Dynamic epistemic logic is an umbrella term for a number of extensions of epistemic logic with dynamic operators that enable us to formalize reasoning about information change. Therefore we apply the default reasoning methodology for describing agent's knowledge and use an extension of default logic to construct beliefs for a single agent [10].

In this paper, we first propose a new frame of multi-agent system based on the dynamic epistemic logic, which works as an inference tool describing the distributional multi-agent system, and then we describe the communication rules for agents in the new frame of multi-agent system based on the dynamic epistemic logic. Furthermore, we provide a logical approach to information exchange and we present the epistemic extension of knowledge updating in this logic framework, finally we provide a method to reason about the information renew in this dynamic process and show how the default reasoning can be organized on the condition that information sharing among various agents.

## 9.2 Extension in an Implemented Framework for Agent Learning

A formal system for the specification of learning for MAS requires the ability to reason about agent beliefs as well as the communication rules of the system. The design of a knowledge-based agent is a central issue in agent theory, in this section we design a logical framework including a group of $n$ agents, where

$K_i\varphi(i \in 1, \ldots, n)$ represents "agent $i$ knows $\varphi$" and for each $i = 1, \ldots, n$ represents a single agent. The agent operates within a chain of command subject to security restrictions and there is linear order in agents' private knowledge.

**Definition 1** The MAS frame $\langle \sum, \Delta_1, \ldots, \Delta_n \rangle$ consists of a set of agents who can collaborate with each other through communication, where $\sum$ represents $n$ Agents, namely $\sum = \{1, \ldots, n\}$; According to the inference rule and axiom in logical language $L_{K[]}(\Sigma, P)$ [1], where $\sum$ is a finite set of agents and $P$ denotes a countable set of atoms in the language $L_{K[]}(\Sigma, P)$, the following axioms hold: (1) $K_i\varphi \rightarrow \varphi$; (2) $K_iK_j\varphi \rightarrow K_i\varphi(i \neq j)$; and (3) $\neg K_i\neg\varphi \Rightarrow K_i\neg K_i\neg\varphi$, where $\varphi$ refer to any formula in language $L_{K[]}(\Sigma, P)$.

A Kripke interpretation is a model of pair $\langle M_c, w \rangle$, where $w \in W$, $W$ denotes the possible worlds and $M_c$ is a Kripke structure. That is, we give a possible worlds interpretation of belief, it is appropriate, to give a semantic treatment of belief revision in terms of possible worlds. Given a formula $\varphi$ in $L_{K[]}(\Sigma, P)$, a truth definition of belief denotes as $(M_C, w)| = \varphi$.

A default theory $\Gamma = \langle D, W \rangle$ consists of $W$, which is a set of consistent formulas of first-order logic (the facts) and a set of default rules to make $W$ complete. And in this multi-agent system frame, $\Delta_i = \langle D_i, W_i \rangle$ represent the $i$th $(1 \leq i \leq n)$ Agent epistemic default theory, where the default inference rule authorizes an inference to a conclusion that is compatible with all the premises, even when one of the premises may have exceptions. The extension $E_i$ of $\Delta_i = \langle D_i, W_i \rangle$ may be regarded as the belief set about the world of $i$th $(1 \leq i \leq n)$ Agent. The knowledge of the world is characterized by the extension.

**Definition 2** Let $K_i\varphi\big(\varphi \in L_{K[]}(\Sigma, P), i \in N\big)$ be the veridical knowledge of extension $E$ of epistemic default theory $\Delta = \langle D, W \rangle$ on $F$, where $F$ is the supporting set of $E$, if and only if $K_i\varphi \notin E$ , $\neg K_i\varphi \notin E$ and $F \cup \{K_i\varphi\} \not\vdash \perp$.

**Definition 3** let $\Delta = \langle D, W \rangle$ be a default theory and $E$ be the extension of $\Delta$ on $F$, and then the definition of default set $D_\Delta(E, F, \Delta)$of $E$ in $\Delta$ is given as follows:

$$D_\Delta(E, F, \Delta) = \big\{K\alpha : \tilde{K}\beta_1, \cdots, \tilde{K}\beta_n / B\gamma \in D | K\alpha \in E, \neg\big(\tilde{K}\beta \wedge B\gamma\big) \notin (E \cup F)\big\} \tag{9.1}$$

where $W$ is a set of consistent formulas of first-order logic (the possible worlds) which has the form $K\alpha$, $D$ is a set of default rules to make $W$ complete. A default is a rule of the form $K\alpha : \tilde{K}\beta_1, \cdots, \tilde{K}\beta_n / B\omega\,(n \geq 1)$, where $K$, $B$ are modality word means "know" and "believe" respectively, $\tilde{K} = \neg K\neg$, and $\alpha, \beta, \omega$ are formulas of multi-agent epistemic logic language, $\alpha$is the prerequisite of the default $D$, $\beta$ is the justification of the default $D$ and $\omega$ is the consequent of the default $D$.

**Corollary 1** If $K_i\varphi$ is the veridical knowledge of extension $E$ on $F$ of default theory $\Delta = \langle D, W \rangle$, and then $K_i\varphi$ is the veridical knowledge of $W$.

Proof supposing $K_i\varphi$ is not the veridical knowledge of $W$, then we have $(M_c, w)| = K_i\varphi$ or $(M_c, w)| = \neg K_i\varphi$. According to the definition of extension, either $K_i\varphi \in E$ or $\neg K_i\varphi \in E$, which contradicts the fact that $K_i\varphi$ is veridical knowledge of extension $E$. Therefore $K_i\varphi$ is veridical knowledge of $W$. Let $K_h\varphi$ be the knowledge that the agent $h$ transfers to agent $i$. According to axiom, we have $K_iK_h\varphi \rightarrow K_i\varphi$, that is, the agent $i$obtains knowledge $K_i\varphi$. In the Kripke model $M$, the formula $E_{M(K\varphi)}$ which is consistent to $K\varphi$ in the extension corresponding to agent is computed as: $E_{M(K\varphi)} = \{H_i | H_i \in W, M| = H_i, M| = K\varphi\}$ where $\bar{M}$ is ideal if and only if there does not exist another Kripke model $M'$, such that $E_{\bar{M}(K\varphi)} \subset E_{M'(K\varphi)}$, that is $E_{\bar{M}(K\varphi)}$ is maximal.

**Lemma 1** Let $E_i$ be the extension of $\Delta_i = \langle D_i, W_i\rangle$ and $K_i\varphi$ be the veridical knowledge that agent $i$ receives from other agents, then there exist the extension $E_i'$ on $F_i'$ of $\Delta_i' = \langle D_\Delta(E_i, F_i, \Delta_i), W_i \cup \{K_i\varphi\}\rangle$, such that $E_i \subseteq E_i', F = F'$ and $D_\Delta\big(E_i', F_i'\Delta_i'\big) = D_\Delta\big(E_i, F_i', \Delta_i\big)$ holds.

Since the formula of $W$ is the Agent's fact sets, which reflect the facts in the model world, then there continually appears contradiction between the new facts, that is $W \not\vdash \neg K\varphi$ „, therefore $W \cup \{K\varphi\}$ is consistent.

According to Lemma 1, the applicable default set of $\Delta_i = \langle D_i, W_i\rangle$ is still applicable in $\Delta_i' = \langle D_\Delta(E_i, F_i, \Delta_i), W_i \cup \{K_i\varphi\}\rangle$, and $E_i$ is the subset of extension of $\Delta_i'$.

**Corollary 2** Let $E_i$ be extension of $\Delta_i = \langle D_i, W_i\rangle$ on $F_i$ and $K_i\varphi$ be the veridical knowledge that the Agent $i$ receives from any other Agents, then the extension $E_i'$ of $\Delta_i' = \langle D_i, W_i \cup \{K\varphi\}\rangle$ exists such that the following holds: $E_i \subseteq E_i', F_i \subseteq F_i'$; and $D_\Delta(E_i, F_i, \Delta_i) \subseteq D_\Delta\big(E_i', F_i', \Delta_i'\big)$.

**Definition 4** let $E$ be the extension of $\Delta = \langle D, W\rangle$ on $F$, the definition of previous fact set of Agent $i$ is given as: $E_{K_i} = \{K\alpha | K\alpha \in E\}$

**Corollary 3** Let $E_i$ be the extension of $\Delta_i = \langle D_i, W_i\rangle$, $K_i\varphi$ be the new knowledge that the Agent $i$ receives from other Agents, and let $E_i'$ be extension of $\Delta_i' = \langle D_i, E_{K_i} \cup \{K\varphi\}\rangle$ on $F_i$, then we get $D_\Delta(E_i, F_i, \Delta_i) \subseteq D_\Delta\big(E_i', F_i', \Delta_i'\big)$.

According to Corollary 2, the extension of both $\langle D_i, W_i \cup \{K_i\varphi\}\rangle$ and $\langle D_i, E_{k_i} \cup \{K_i\varphi\}\rangle$ all are the superset when the Agent $i$ receives veridical knowledge from other Agents, we therefore get that the extension of the constrained default theory $\langle D_h, W_h \cup \{K_i\varphi\}\rangle$ can be obtained by $\langle D_h, E_{k_h} \cup \{K_h\varphi\}\rangle$ when the agent $h$ obtains actual knowledge. Therefore the agent $i$ can get the only intuitive result by communicating with other agents and constantly receiving veridical knowledge to construct a cognitive process, which accelerates the acquisition of extension.

## 9.3 Agent-Oriented Method on Epistemic Extension of Information

The role of agent-oriented methodologies is to assist in all the phases of the cycle of an agent-based application. Information is communicated in the dynamic process, so knowledge and belief are by no means static, and communication, the process of sharing information, is an obvious source for changing one's information state. In MAS an agent $i$ is the central processing unit of a distributed system of agents whose non-specialized entities transmit their knowledge to a central unit $i$, and agents update their knowledge to meet a given set of constraints. However, the information of an agent acquired from another agent constrains the possibility of the worlds according to the acquired information and an agent may lose its trust or gain new trust at any moment in time due to some reasons such as recommendations from other agents. If the set of possible worlds according to acquired information from some particular agent may be different from that associated with his belief state, the agent may not believe the incompatible information entirely.

When Agent's own belief sets are unable to make an accurate subjective or objective judgment on $\varphi$, namely $\neg K\varphi \in E$, if Agent obtains knowledge $K\varphi$, that is $K\varphi$ regarding to the Agent is incompatible, then Agent will obtain the knowledge $\neg K\varphi$, and will update its own belief sets, such that $\neg K\varphi \in E$.

This section will discuss the variation law of applicable default sets $GD(E_i, F_i, \Delta)$ and extension $E_i$ when $\Delta_i = \langle D_i, W_i \rangle$ obtain the incompatible knowledge.

Because the formula of $W$ is the Agent's fact sets, which reflect the facts in the model world, then there continually appears contradiction between the new facts, then $W \not\vdash \neg K\varphi$ „ therefore $W \cup \{K\varphi\}$ is consistent. In the Kripke model $M$, the formula $E_{M(K\varphi)}$ which is consistent to $K\varphi$ in the extension corresponding to Agent is computed as $E_{M(K\varphi)} = \{H_i | H_i \in W, M| = H_i, M| = K\varphi\}$, $\bar{M}$ is ideal if and only if there does not exist another Kripke model $M'$, such that $E_{\bar{M}(K\varphi)} \subset E_{M'(K\varphi)}$, that is $E_{\bar{M}(K\varphi)}$ is maximal.

The process of acquiring the applicable default set $P_i = \bigcup_{j=0}^{\infty} D_j$ concerning to $W_i \cup \{K\varphi\}$ is given as follows: First, (1) calculate the formula set $\mathrm{Del}_{\bar{M}(K\varphi)}(E_i, K\varphi)$, $\mathrm{Del}_{\bar{M}(K\varphi)}(E_i, K\varphi) = E_i - E_{\bar{M}(K\varphi)}$; then (2) calculate the set CONTRA which is inapplicable for default rules due to the appearance of the negative of consequent set in $GD(E_i, F_i, \Delta_i)$ : $\mathrm{CONTRA} = \{d | d \in GD(E_i, F_i, \Delta_i), J_i(d) \cap \mathrm{Del}_{\bar{M}_i(\neg\varphi)}(E_i, K\varphi) \neq \emptyset\}$; and (3) delete the set $\mathrm{Del}_{\bar{M}(\neg A)}(E_i, K\varphi)$ and then get the set BLOCK which is inapplicable for default rules in $GD(E_i, F_i, \Delta_i)$:

$$\mathrm{BLOCK} = \left\{ d \,\middle|\, \begin{array}{l} d \in GD(E, F, \Delta) - \mathrm{CONTRA}, \\ P(d) \cap \mathrm{Del}_{\bar{M}(K\varphi)}(E, K\varphi) \neq \emptyset \end{array} \right\} \tag{9.2}$$

Since the applicable default set on $W_i^{\text{new}}$ is defined as $P_i = \bigcup_{j=0}^{\infty} D_j$. Finally, we have

$$D_{j+1} = \{d | d \in GD(E_i, F_i, \Delta_i) - \text{CONTRA - BLOCK}, \\ P_i(d) \in \text{Th}\big(W_i \cup \{K\varphi\} \cup C_i\big(D_0 \cup \ldots \cup D_j\big)\big)\}$$

where $D_0 = \emptyset$, $j \geq 0$.

**Theorem 1** Let $E_i$ be the epistemic extension of $\Delta_i = \langle D_i, W_i \rangle$ on $F_i$and $\neg K\varphi$ be the incompatible knowledge the Agent meet in $W_i$. Let $S_i$ be the epistemic extension of $\langle GD(E_i, F_i, \Delta_i), W_i \cup \{\neg K\varphi\}\rangle$ on $U_i$, then there exist an extension $E_i'$ of $\Delta_i' = \langle D_i, W_i \cup \{\neg K\varphi\}\rangle$ on $F_i'$, such that $P_i \subseteq GD\big(E_i', F_i', \Delta_i'\big)1$ and $S_i \subseteq E_i', U_i \subseteq F_i'$.

*Proof* Let $E_i$ be the epistemic extension of $\Delta_i = \langle D_i, W_i \rangle$ on $F_i$ and $F_i$ be the veridical knowledge agent i meet, and at the same time let $E_i'$ be the epistemic extension of $\Delta_i' = \langle GD(E_i, F_i, \Delta_i), W_i \cup \{K\varphi\}\rangle$ on $F_i'$ and let $E_i''$ be the epistemic extension of $\Delta_i'' = \langle GD(E_i, \Delta_i) - \text{CONTRA - BLOCK}, W_i \cup \{K\varphi\}\rangle$, then we will get $E_i' = E_i''$ and $F_i' = F_i''$, $GD\big(E_i', F', \Delta_i'\big) = GD\big(E_i'', F_i'', \Delta_i''\big) = P_i$, where $P_i$ is the applicable default set of $\Delta_i'$. According to semi-monotonicity, if $S_i'$ is the extension of $\langle GD(E_i, F_i, \Delta_i), W_i\rangle$ on $U_i$ and $E_i'$ is the epistemic extension of $\Delta_i' = \langle D_i, S_K \cup \{K\varphi\}\rangle$ on $F_i'$, then $E_i'$ must be the epistemic extension of $\Delta_i'' = \langle D_i, W \cup \{K\varphi\}\rangle$ on $F_i'$, where $S_K$ is the fact sets in the extension $S_i'$, that is $S_K = \{K\alpha | K\alpha \in S\}$. Therefore we can conclude that the extension of the constrained default theory $\langle D_h, W_h \cup \{K_i\varphi\}\rangle$ can be obtained by $\langle D_h, E_{k_h} \cup \{K_h\varphi\}\rangle$ when the agent $h$ obtains an actual knowledge. Therefore the agent $i$ can get the only intuitive result by communicating with other agents and constantly receiving veridical knowledge to construct a cognitive process.

**Theorem 1** Shows that we can find one theorem that only consider the maximal applicable default rule set $P$ in $GD(E_i, F_i, \Delta_i)$ on $W \cup \{K\varphi\}$ when the knowledge the cognitive subject $i$ meets is veridical knowledge. After the acquisition of the extension $S$ of $\langle GD(E_i, F_i, \Delta_i), W \cup \{K\varphi\}\rangle$on $U$, we can get the extension $E_i'$ of $\langle D_i, S_K \cup \{K\varphi\}\rangle$ on $F'$ by the fix point extension theorem, and then $E_i'$ must be the extension of $\langle D_i, W \cup \{K\varphi\}\rangle$ on $F_i'$. However, the reverse is not necessarily the case because there is possibility of being $P \not\subset GD(E'', F'', \Delta'')$.

## 9.4 Summary

The common views of the system in object-oriented methodologies can use for describing agents: “static” for the object structure objects and their structural relationships; “dynamic” for describing the object interactions; and “functional” for describing the data flow of the methods of the objects. In this paper we discuss

the characteristic of the "dynamic" updating when agent meets veridical knowledge in the logical framework and furthermore we proved the related theorem for information acquisition, which show the usefulness of logical tools in formulating the properties of multi-agent systems. According to the characteristics that each agent updating its own belief set through communication with each other in the multi-agent system, we focused on the properties and acquisition of the extension when its knowledge background set is changing. In order to formalize the process of cooperative communication in the multi-agent system, we focus on the acquisition of extension in the dynamic epistemic theory based multi-agent system when its background set experienced variety changes, and we especially aims at the extension of incompatible knowledge managing in the multi-agent system. This paper explored how to reduce the complexity of verification process by reasoning about information change in multi-agent system via default reasoning.

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# Chapter 10
# A Survey of Cloud Computing

**Yadong Gong, Zongquan Ying and Meihong Lin**

**Abstract** Recently, Cloud computing has become a very attractive computing paradigm which aims to provide reliable and customized computing environments for widespread Internet users. In our paper, we give a survey of cloud computing, which highlight its key concepts, architecture, state-of-the-art implementation, and some main challenges. The purpose of this paper is to provide a good guidance of the design challenges of cloud computing and also demonstrate several important research directions in this area.

**Keywords** Cloud computing · Architecture · Challenge

## 10.1 Introduction

Cloud computing has become as a very popular paradigm for hosting and delivering services over the Internet. The goal of such computing model is to make a better use of various distributed resources, put them together in order to achieve higher throughput and be able to resolve large-scale computation problems. Cloud Computing is not a completely new concept for the development and operation of Internet applications. It allows for the most cost-effective development of scalable web portals on highly available infrastructures.

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Cloud computing offers some features that make it attractive to various business owners, as shown below [1, 2].

No up-front investment. Cloud computing uses a pay-as-you-go pricing model. Under such model, the service providers do not need to invest in the infrastructure to start gaining benefit from cloud computing, and it simply rents resources from the cloud according to their own needs and also pays for the usage.

Reducing business risks and maintenance expenses With the help of the service infrastructure to the clouds, the service providers' business risks (such as hardware failures) are transferred to infrastructure providers, who often have better expertise and are better equipped for managing these risks. Moreover, a service provider can keep the hardware maintenance and the staff training costs in low level.

Reducing operating cost Resources in a cloud environment can be rapidly allocated and reallocated on demand. Thus, the service providers do not need to provision capacities according to the peak load. This provides huge savings because resources can be released to save on operating costs when service demand is low.

Convenient access Services hosted in the cloud are usually Internet-based. Therefore, they are easily accessible through a variety of devices with Internet connections. These devices not only include desktop computers, but also PDAs and cell phones.

High scalability Infrastructure providers a large amount of resources from data centers and also make them easily accessible. The service providers can easily expand their services to large scales in order to handle rapid increase in service demands [3].

Although cloud computing has given considerable opportunities to the IT industries, it also brings many particular challenges which should be carefully discussed. In this paper, we present a survey of cloud computing, highlighting its key concepts, architecture, state-of-the-art implementation as well as research challenges. The aim of this paper is to provide a good understanding of the design challenges of cloud computing and identify important research directions in this area.

The remainder of this paper is organized as follows. In Sect. 1.2 we provide the definition of cloud computing. In Sect. 1.3, we describe the business model of cloud computing and present its related products. The research challenges are detailed in Sect. 1.4. Section 1.5 we conclude this paper.

## 10.2 Definition

Till now, many formal definitions have been proposed in both academic and industrial communities, in this paper, we bring the one provided by U.S. NIST (National Institute of Standards and Technology) [4]:

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

The above definition includes cloud architectures, security, and deployment strategies. In particular, five essential elements of cloud computing are clearly articulated [5]:

On-demand self-service Consumers with an instantaneous need at a particular timeslot can avail computing resources (such as CPU time and network storage) in an automatic fashion without resorting to human interactions with providers of these resources.

Broad network access these computing resources are delivered over the network and used by various client applications with heterogeneous platforms (such as PDAs and mobile phones) situated at a consumer's site.

Resource pooling A cloud service provider's computing resources are 'pooled' together in an effort to serve multiple consumers using either the multi-tenancy or the virtualization model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. The motivation for setting up such a pool-based computing paradigm lies in two important factors: economies of scale and specialization. The result of a pool-based model is that physical computing resources become 'invisible' to consumers, who in general do not have control or knowledge over the location, formation, and originalities of these resources (e.g., database and CPU).

Rapid elasticity for consumers, computing resources become immediate rather than persistent: there are no up-front commitment and contract as they can use them to scale up whenever they want, and release them once they finish scaling down. What's more, resources provisioning appears to be infinite to them, the consumption can rapidly rise in order to meet peak requirement at any time.

Measured Service Although computing resources are pooled and shared by various consumers (i.e., multi-tenancy), the cloud infrastructure is able to use appropriate mechanisms to measure the usage of these resources for each individual consumer through its metering capabilities.

## 10.3 State-of-the-Art

In this section, we first discuss the business model of cloud computing, and then present its related commercial products.

### *10.3.1 Business Model*

Conceptually, end users acquire computing platforms or IT infrastructures from computing Clouds and then run various applications inside. Therefore, computing Clouds render users with services to access hardware, software, and digital resources, thereafter an integrated computing platform as a service, in a transparent way [3]:

Hardware as a Service (HaaS): Hardware as a Service was introduced in 2006. With the rapid advances in hardware virtualization, IT automation, usage metering and pricing, and related some other field, users could buy IT hardware, or even an entire data center, as a pay-as-you-go subscription service. The HaaS is flexible, scalable, and manageable to meet the users' needs, and such examples can be found at Amazon EC2 [6] and Enomalism [7].

Software as a Service (SaaS): Software or an application is hosted as a service and provided to customers across the Internet. This mode eliminates the need to install and run the application on the customer's local computers. SaaS therefore alleviates the customerr's burden of software maintenance, and reduces the expense of software purchases by on-demand pricing. One example of the SaaS is the Application Service Provider (ASP) [8]. The ASP approach provides subscriptions to software that is hosted or delivered across the Internet. Microsoft's "Software + Service" model gives another example: a combination of local software and Internet services interacting with one another. Google's Chrome browser gives a good SaaS scenario: a new desktop could be offered, through which applications can be delivered in addition to the traditional Web browsing experience.

Data as a Service (DaaS): Data in various formats and from multiple sources could be accessed via services by end users on the network. Users could manipulate the remote data just like operate on a local disk or access the data in a semantic way in the Internet. Amazon Simple Storage Service (S3) provides a simple Web services interface that can be used to store and retrieve, declared by Amazon, any amount of data, at any time, from anywhere in the Internet. The DaaS could also be found at some popular IT services, e.g., Adobe Buzzword. Elastic Drive is a Web-based distributed storage application that allows end users to mount a remote storage resource such as Amazon S3 as a local storage device.

### *10.3.2 Related Products*

Amazon Web Services (AWS) [6] provides a set of services, which offers cloud-based computation, storage, and some other functionality that enable organizations and individuals to deploy applications and services on an on-demand basis and at commodity prices. AWS' services can be accessed over HTTP, utilizing REST and SOAP protocols.

Microsoft's Windows Azure platform includes three components and each component provides a collection of services to end users. Windows Azure offers a Windows-based environment for running applications and storing data on servers in data centres; SQL Azure supplies data services in the cloud based on SQL Server; and .NET Services give distributed infrastructure services to cloud-based and local applications. Windows Azure platform can be used not only by applications running in the cloud but also by applications running on local systems.

Google App Engine is a platform for traditional web applications in Google-managed data centres. Recently, the supported programming languages include Python and Java. Web frameworks which run on the Google App Engine include

Django, CherryPy, Pylons, and web2py, as well as a custom Google-written web application framework which is similar to JSP or ASP.NET. Google handles deploying code to a cluster, monitoring, failover, and launching application instances as necessary. Current APIs support some features such as storing and retrieving data from a Big Table nonrelational database, making HTTP requests and caching. Developers have read only access to the file system on App Engine.

## 10.4 Research Challenges

Since Cloud Computing is still in its initial stage, current adoption is associated with some challenges shown as follows:

Charging Issue From the perspective of a cloud provider, the elastic resource pool (through either virtualization or multitenancy) has made the cost analysis more complicated than regular data centers, which often calculates their cost based on consumptions of static computing. Moreover, an instantiated virtual machine has become the unit of cost analysis instead of the underlying physical server. A good charging model needs to incorporate all the above factors as well as virtual machines (VM) associated items such as software licenses, virtual network usage, node and hypervisor management overhead, and so on.

Costing Model Cloud consumers should carefully consider the tradeoffs among communication, computation and integration. Although migrating to the Cloud can significantly reduce the infrastructure cost, it will raise the cost of data communication, i.e., the cost of transferring an organization's data to and from the public and private Cloud and the cost per unit of computing resource used is likely to be higher.

Security Issue The security issue has played a core role in hindering the popularization of Cloud computing. There is no doubt that putting end users' data, running users' software at someone else's hard disk using someone else's CPU appears daunting to many. Well-known security issues such as data loss, phishing, and bonnet (running remotely on a collection of machines) pose serious threats to organization's data and software. Moreover, the multitenancy model and the pooled computing resources in cloud computing has introduced new security challenges that require new techniques to resolve.

Service Level Agreement Issue Since the end users of cloud computing based systems cannot control the underlying computing resources, they have to ensure the quality, reliability, availability and performance of such resources when users have shifted their core business functions to their entrusted cloud. In other words, it is very vital for users to obtain guarantees from providers on service delivery. Typically, these are provided through Service Level Agreements (SLAs) negotiated between the providers and end users. The first issue which needs to do is the definition of SLA specifications in such a way that has an appropriate level of granularity, namely the tradeoffs between expressiveness and complicatedness, so that they can cover most of the consumer expectations and is relatively simple to be weighted, verified, evaluated, and enforced by the resource allocation mechanism on the cloud.

## 10.5 Conclusion

This paper discussed the state-of-the-art and challenges of cloud computing. We articulated the definition, business model and related products in cloud computing. We analyzed a few challenges on the way towards adopting cloud computing.

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# Chapter 11
# Electric Power Client Credit Assessment Based on GA Optimized BP Neural Network

**Xinli Wang**

**Abstract** Judging from the characteristics of electrical products and power supply enterprises, this paper combines quantitative and qualitative analysis together, and establishes a electric power client credit assessment indicator system on the basis of analysis on factors influencing electric power client credit. The method of using genetic algorithm to optimize connection weight and threshold value of BP overcomes the defects of falling into the regional minutiae and slow velocity of convergence, builds the electric power client credit assessment model, and conducts empirical study. The research result indicates that BP neural network optimized by genetic algorithm plays a scientifically practical role in assessment of electric power client credit risk, supplying a reference for risk elusion of electric power clients.

**Keywords** Genetic algorithm · BP neural network · Credit assessment

## 11.1 Introduction

At present, the status is that there are few researches on power client credit assessment, and the assessment indicator system is not established soundly yet. There are mainly two methods to study power client credit assessment, quantitative assessment and qualitative assessment [1]. Applying hierarchical analysis method, . This paper uses genetic neural network to build assessment model, and conducts assessment on power clients via machine learning [2]. The empirical analysis

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indicates the model presented in this paper can determine accurately power client conditions, and serve as a solution to eluding client risk for power supply enterprises [3]. However, grounded on weight modification philosophy of error gradient descent, inevitably the training of BP neural network has the problem of falling into regional minutiae; while genetic algorithm has its origin in global parallel search algorithm of natural selection and genetic rules, and so features in strong macro search ability and global optimization [4]. Combining , initial weight and threshold value of BP network optimized by genetic algorithm together can conduct weight values in a large scope and solve the problem of falling into regional minutiae easily. It is rare for the combination of genetic algorithm and neural network to be applied in power client credit assessment. Based on the empirical research on power clients in Baoding City, neural network model optimized by genetic algorithm can realize effective credit assessment of power clients.

## 11.2 Building of Power Client Credit Assessment Indication

In accordance with China's basic condition and relative references, the indicator system of power client assessment is as follows: Character. This factor focuses on whether power clients have willingness and behavior to pay electricity fee complying with the agreement, and whether the historical payment record is kept well. If the historical default has caused damage, power suppliers could take it into consideration to retract clients' credit grant; Capability. This factor means the capability of power clients to utilize electric power to produce products or service in order to make profit; Capital. This factor refers to analysis on power clients' capital. What should be noticed is that not only clients' net capital and also debt amount should be analyzed; collateral. This factor examines whether power clients can provide collateral under the condition of short-term default and whether the collateral is abundant and reliable. To those defaulting in a huge amount electricity fee, suppliers can reduce corporate losses via creditors' right regroup; Condition. This factor is aiming at deciding whether the environment and industry of a power client can improve its business. Environment involves internal environment of the client including running characteristics, running methods, technical situation, and external environment outside the client, such as labor relations, political status, social environment, business cycle, seasonal change, economic situation, GDP, etc.; industry includes industry development, and competition, etc.

## 11.3 Building of Genetic Neural Network Model

### *11.3.1 BP Neural Network Model*

BP neural network is a multiple layer forward network of error anti-transmission algorithm training; its training can be divided into 2 steps: Input message flows into

input layer, and arrives at output layer via hidden layer, processing and calculating the real output value among nerve cell node layer by layer. This process is called positive convey of information flow; There is an error between real output of algorithm network and expected value of training sample, in condition that this error is less than granted value, specify weight adjustment based on it, and modify connection weight of each nerve cell node from backward to forward. This process is called contradictory modification. The 2 processes complete 1 time learning iteration, learning of BP network is conducted repeatedly in continuous iterations until network output error reduces to granted precision, or to schedule learning times. As to group '$t$' sample, assume BP network output layer node '$k$', hidden layer node '$j$', input value and output value. of input layer node '$i$' are indicated, respectively by $\text{in}_k^t$, $\text{in}_j^t$, $\text{in}_i^t$ and $\text{out}_k^t$ $\text{out}_j^t$, $\text{out}_i^t$, $w_{kj}$, $v_{ji}$, indicate hidden layer and output layer, connection weight between input layer and hidden, nerve cell of hidden layer and output layer uses Sigmoid as output layer function, so the definition of error function $E$ of output layer is as follows:

$$E = \frac{1}{2}\sum_{t=1}^{t}\sum_{k=1}^{k}(d_k - \text{out}_k^t)^2 \tag{11.1}$$

$d_k$ In the function indicates corresponding expected output value. The essence of BP algorithm learning method is to modify weight constantly in order to trend error function equal to 0. According to the principle of error gradient descent, $W$ and its adjustment can be indicated as:

$$\Delta w_{kj} = -\eta\frac{\partial E}{\partial w_{kj}},\ \Delta v_{ji} = -\eta^t\frac{\partial E}{\partial v_{ji}} \tag{11.2}$$

$\eta$, and $\eta^t$in the equation indicate step size, or learning speed. Modification process of weight is iteration, that is:

$$w_{kj}(n+1) = w_{kj}(n) + \eta\sum_{t=1}^{t}\delta_k^t\text{out}_j^t \tag{11.3}$$

$$v_{kj}(n+1) = v_{ji}(n) + \eta\sum_{t=1}^{t}\delta_j^t\text{out}_j^t \tag{11.4}$$

In the formula:

$$\delta_k^t = (d_k^t - \text{out}_k^t)\text{out}_k^t(1 - \text{out}_k^t) \tag{11.5}$$

$$\delta_j^t = \left(\sum_{k=1}^{k}\delta_k^t w_{kj}\right)\text{out}_j^t(1 - \text{out}_j^t) \tag{11.6}$$

### 11.3.2 Realizing of BP Algorithm Optimized by Genetic Algorithm

Genetic algorithm has its foundation in natural selection and genetic theory, is a highly effective global optimization search algorithm via the combination of the principle of survival of the fittest in biological evolution and random information exchange system of population internal chromosome. GA regards possible solution in question domain as an individual or chromosome in the population, encodes each individual into symbol string format, simulates Darwin's biological evolution of genetic selection and natural elimination, and conducts repeatedly operations of inheritance, crossover, and mutation of genetics. Conduct evaluation on each individual according to scheduled target adaptive function; obtain better population based on evolution principle of survival of the fittest, search better populations for the optimized individual via global parallel approach and finally obtain optimized solution as required. The procedure of BP network initial weight optimized by GA is as follows.

Coding of chromosome and generation of initial population together creates network weight by routine method, give serial numbers to weight and threshold value from left to right, and top to bottom. Each group of complete neural network weight is equivalent to a chromosome, and there are $P$ chromosomes of this kind in total that is population scale $P$. Weight chromosome applies real number to encode, consisting of average generated real numbers at random between $[-5, 5]$; real number coding is the direct natural description of continuous parameter optimized questions, i.e.

Selection of Objective Function and Fitness Function Objective function of GA uses error quadratic sum of neural network. GA takes fitness function as its evolution objective, only in the direction of increasing. So, there must be some proper switch between fitness function and objective function applying reciprocal of error quadratic sum. In order to ensure that the coding value of fitness function is not too small, 1 larger coefficient $M$ is inducted, and the fitness function if as follows.

$$F(Wi) = \frac{M}{E(W_i)}(i = 1, 2, \ldots\ldots, p) \tag{11.7}$$

In the function, $F(Wi)$-fitness function; $E(W_i)$-objective function, $M$ -coefficient.

Evolution Operation. Evolution operation is conducted via selection operator whose features further determine evolution trend of a biological population. Selection uses standardization geometry distributing sort. The process is to arrange the chromosome in descent order of adaptive values. And then distribute series probability designed in advance to each individual, with larger value corresponding to higher selection probability and smaller to lower.

Crossover and Mutation. Crossover operations select parent chromosome based on a specific crossover probability '$P$'. While, this paper selects algorithm or direction-based crossover at random among which the former can guarantee post

generation is localized between 2 parent chromosomes and the later can expand search space effectively. Algorithm crossover:

$$\begin{cases} V_{r1}^{'} = \alpha V_1 + (1-\alpha)V_2 \\ V_{r2}^{'} = \alpha V_2 + (1-\alpha)V_1 \\ V_{r1}^{'} = \alpha(V_1-V_2) + V_1 \\ V_{r2}^{'} = \alpha(V_2-V_1) + V_2 \end{cases} \tag{11.8}$$

Direction-based crossover:

$$\begin{cases} V_{r1}^{'} = \alpha(V_1-V_2) + V_1 \\ V_{r2}^{'} = \alpha(V_2-V_1) + V_2 \end{cases} \tag{11.9}$$

In the functions, $V_1$ $V_2$-chromosome vector α-random numbers between [0, 1].This paper uses self-adaptive mutation operator to conduct self-adaptive adjustment on mutation probability, and the purpose is to adjust search scope self-adaptive, and improve its search ability, convergence performance, and velocity of GA.

## 11.4 Analysis of Application of Genetic Neural Network in Electric Power Client Credit Evaluation

This paper selects 20 clients of Baoding Power Bureau in 2008 as the research subject, obtains original data by field research and referring to related experts, and then deals with all the data. The former 15 companies serve as training sample, and later 15 ones as testing sample. The 22 indicators mentioned above are used as input value to build a genetic neural network with a 3-layer structure, input layer having 22 nodes, hidden layer 4 and output layer 1. MATLAB coding is used to find the solution, and after trial calculation runs using parameters below. Expectation error is 0.02, population scale is 200, and initialized space of weight is [−5, +5], and selection probability is 0.05. Simulation result indicates that initial weight and threshold value of BP network optimized by genetic algorithm can effectively solve the problem of easily falling into regional minutiae in BP algorithm, and greatly.Improve the training velocity. Due to limited space, this paper only displays part of output value of training samples and error absolute value between output value and original objective, and for details, pls. refer to Table 11.1. For error absolute value between output value and original objective of testing samples, pls. refer to Table 11.2. Trained by GA, BP neural network approximately needs only 4 trainings to reach error objective. Table 11.1 displays the retrained error of BP neural network after being trained by GA. On the basis of the credit simulation result of the 20 power clients and realistic situation, the assessment accuracy by genetic neural network can reach up to 97.96 % (Fig. 11.1).

**Table 11.1** The result and error of training sample

| Number | Network output values | Evaluation results | Absolute error |
|---|---|---|---|
| 1 | 0.9762 | Very good | 0.012 |
| 2 | 0.8832 | Very good | 0.005 |
| 3 | 0.8951 | Very good | 0.008 |
| 4 | 0.3806 | Bad | 0.009 |
| 5 | 0.5219 | General | 0.015 |
| 6 | 0.7861 | Good | 0.010 |
| 7 | 0.4531 | General | 0.003 |
| 8 | 0.7612 | Good | 0.014 |

**Table 11.2** The result and error of testing sample

| Number | Network output values | Evaluation results | Absolute error |
|---|---|---|---|
| 1 | 0.3524 | Bad | 0.011 |
| 2 | 0.9912 | Very good | 0.003 |
| 3 | 0.8664 | Very good | 0.005 |
| 4 | 0.6823 | General | 0.002 |
| 5 | 0.7245 | General | 0.008 |

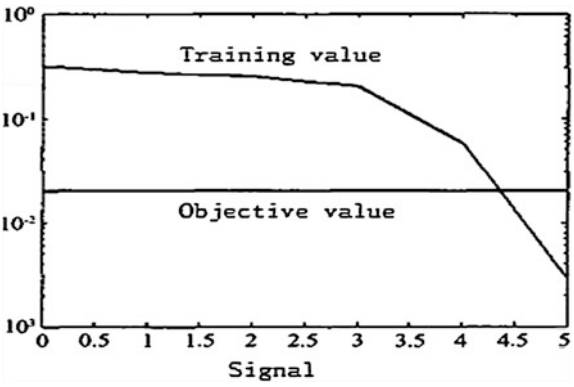


**Fig. 11.1** After the training by GA, BP trains error

## 11.5 Conclusion

Initial weight and threshold, value of BP network optimized by genetic algorithm is used to build the model to assess clients' credit, and this method has the advantages of global optimizing, fast convergence velocity, and objective, precise assessment result. GA effectively reduces the probability of falling into regional minutiae in BP algorithm, and greatly improves its training velocity. The output result and absolute error of training samples and testing samples indicate that genetic neural network assessment model plays a theoretical and practical role in assessment of electric power client credit, supplying a reference for customer relation management of electric power suppliers.

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# Chapter 12
# Study on Gaussian Priory Model for Space Time Adaptive Processing

**Jiamou Wang**

**Abstract** Exile of Bayesians approach from mathematical statistics hampered development of stable theory of CFAR and STAP. Many heuristic corrections appeared therefore to various aspects of these theories. But, it seems better to begin creating the generalized Bayesians theory, following which one can obtain the processing algorithms in fast varying conditions without corrections. A priory statistical model of TI was reasoned with this purpose as the Pareto-Gaussian (PG) process belonging to SIRP ones. Preference of PG process consists of its simplicity and compatibility with CFAR -STAP problems. The PG model allows accounting for: (1) (Quasi Gaussian TI of highest entropy $(\eta = 0)$; (2) essentially non Gaussian TI $(\eta < -1/2)$.

**Keywords** Space time adaptive processing (STAP) · Constant falls alarm rate (Cfar) · Limited falls alarm rate (Lfar)

## 12.1 Mathematical Statistics Evolutions Statement of Problem

Classical investigations on statistical reception and information theory 1945–1960 by Kotelnikov, Shannon, Woodward, Middleton, and Kalman were based on Bayes theorem of the probability theory and MS. Meanwhile, the evolution of MS took place, initiated by R. Fisher's scientific school (England) [1]. The MS in 1950–1960 "liberates itself" gradually from assumptions of the presence of a priory distributions and the Bayesian approach. The Bayesian approach to MS was practically eliminated

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from the textbooks and monographs on MS by Vander Warden, Cramer, Kendall & Stuart, and Anderson etc. Only some mathematicians (Savage, Raiffa, de Groot) discuss rehabilitation of a priory probability in "subjective" or "experimental" form. But elimination of Bayesian approach from MS could not remove it totally from engineering and economics. E. Neyman (coauthor with E. Pearson of NP method) published in 1962 the paper [2]. M. De Groot in 1970 published his book [3]. A. Kolmogoroff accepted: "Bayesian approach plays leading role in solving a large part of the MS problems" [4]. This all helps to reverse evolution of MS toward the Bayesian approach. Adherents of non Bayesian statistics reason now their partiality only by absence of general a priory models [4].

Meanwhile, the question arose about replacing the manual adjustment of gain of radar receivers according to TI variance by an automatic one. Many statistical theories of CFAR, for example [5, 6], and of STAP with CFAR, for example [7, 8], have been developed. But most of cited works were based on non Bayesian approach, dominating at definite period in MS [9, 10].

Now, it is difficult to understand, how can we reconcile the principles of non Bayesian statistics and requirements of CFAR without STAP? Most of users of non Bayesian statistics consider usually only the one-dimensional "non random but unknown" variables. As such variable we must consider a false alarm probability F. But the false alarms manifest themselves at the time interval much longer than that usually spent for signal reception. For the bandwidth $B = 1$ MHz the false blips follow through $1/\mathrm{BF} = 10$ ms as an average. To discriminate between probabilities $F = 10^{-4}$ and $F = 10^{-3}$, the time interval much longer than 10 ms is necessary. All this has direct relation to STAP.

The CFAR problem is lately connected to the STAP [7, 8] one.

Given the hypotheses of known inverse covariance matrix (ICM) of TI, the multichannel processing of narrowband radar signal $Y$ reduces to

$$R = \Phi^{-1}X, R^{*T}Y = W \tag{12.1}$$

Here $R$ is the weighting vector, $*T$ stands for Hermitical conjugation, $\Phi$ is covariance matrix (CM) of TI. The CM $\Phi$and its inverse (ICM) $\Phi^{-1}$ are usually evaluated using Fisher's ML method that is sufficiently precise only in asymptotic case. Fisher himself was sorry of failing to proof the advantages of ML method in general [1]. We are not first who consider corrections to CFAR and STAP. Knowledge Aided (KA) method with data collection about radar environment belongs to Bayesian ones too. But it doesn't account for fast change of jamming.

Diagonal Loading (DL) and Fast converging ML (FML) corrections to the ML were proposed using some priory information about the CM structures. Use of Wish art distribution as a priory remained unobvious, direct link between the DL, FML and Bays theorem has been lost by now, so we relate this both methods to the heuristic ones.

Accounting for non Gaussian properties of TI in forms of Spherically Invariant Random Processes (SIRP) and Compound-Gaussian Clutter can be considered as variants of introducing the a priory information into ML.

Manifold Monte Carlo simulations and significant progress in their technology (Importance sampling) led also to corrections of initial ML algorithms.

But instead of "patching the ML trousers", it seems better to develop the simple, but generalized a priory model of TI, permitting the Bayesians synthesis of signal processing. Such model is proposed as the probability density (pad) of the Pareto-Gaussian (PG) process. PG processes belong to the known SIRP.

Preference of PG processes is due to simplicity and compatibility with CFAR-STAP problem. Possibility of additional KA processing is also envisaged, but not elaborated in detail. A priory PG pdf of random variance $D$ is non zero only for $D_0 < D < A$ ($D_0$ is internal noise variance).

$$p(D|\eta) = D^{\eta} / \int_{D_0}^{A} D^{\eta} dD \tag{12.2}$$

The uniform pad of variance $D$ of external interference $(\eta = 0)$ and standard deviation $\sqrt{D}(\eta = -1/2)$, both having large entropy, belong to Pareto distribution. By varying parameters $\eta = -1/2$ $D_0$, A, we can obtain probability distributions close to speckle ones (We bull, log-normal, $K$) observed when range resolution increases. Using the PG pad for matrix Eigen values, we can relate CFAR to STAP.

Our first aim is to investigate results of using Bayesian PG approach in comparison with similar results of ML approach and existing corrections to: (a) CFAR without STAP; (b) STAP without CFAR. Our second aim is to show the paths of creating the Bayesian PG-KA theory (Fig. 12.1).

## 12.2 Pg and Pg-Ka Theories of Char Without Step

For the KA-PG CFAR a priory pad of TI variance can be evaluated theoretically as the weighted sum of pad $p(D|\eta)$ and pads $p_{KA}(D_\beta)$ with weights $\mu(\beta = 1, 2, K(\sum \mu\beta \leq 1)), p_{KA}(D|\eta) = \left(1 - \sum_{\beta} \mu_\beta\right) p(D|\eta) \times \sum_{\beta} \mu_\beta p_{KA}(D_\beta)$.

According to the problem stated above, we assume below that $\mu_\beta = 0$, and consider pdf $p(D|\eta)$ only. The received samples are assumed to be divided into

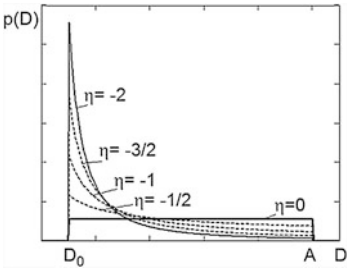


**Fig. 12.1** The pare to pad

informing and training sets, as in [7]. Unlike [7], the Bayesians approach is used (here in the mean square form).

Let us introduce now:

adaptive threshold $Z_0 = Z_0(s)$ depending on the training statistics $s$ and preset value of $F$; false alarm probability $F(Z_0|D)$ for the known TI variance for signals with random phases $F(Z_0|D) = \exp(-Z_0^2/2D)$ training statistics $s = \sum_{i=1}^{v} |Y_i^{(s)}|^2$, $p(s, D) = p(s, D)p(D)$, where $p(D) = p(D|\eta)$ is the a priory Pareto pad (12.2) of D; $p(s, D)$ is the conditional $\chi^2$PDF of $s$ (very asymmetrical for small sample support $v$).

$$p(s|D) = p(s|D, v) = \frac{1}{2^v D^v \Gamma(v)} s^{v-1} e^{-s/2D} \tag{12.3}$$

Bayesian estimate of conditional probability of false alarm $\hat{F} = \hat{F}(Z_0|s, \eta)$ is found by unconditional minimization of the square of its estimation errors over interval of possible values $D$

$$\frac{d}{d\hat{F}(Z_0^2|s, \eta)} \int_{D_0}^{A} \left[\hat{F}(Z_0|s, \eta) - F(Z_0|D)\right]^2 p(s, D|\eta) dD = 0 \tag{12.4}$$

Here, $p(s, D|\eta) = p(s|D)p(D|\eta)$. For both Gaussian and non-Gaussian TI, we have:

$$\overset{\wedge}{F} = \int F(Z_0|D)p(s|D)p(D|\eta)dD / \int p(s|D)p(D|\eta)dD \tag{12.5}$$

Using (12.2), (12.3), we can obtain

$$\overset{\wedge}{F} = \left(1 + \frac{Z_0^2}{s}\right)^{-(v-\eta-2)} \times \frac{\left[\gamma\left(\frac{s+Z_0^2}{2D}, v-\eta-2\right) - \gamma\left(\frac{s+Z_0^2}{2A}, v-\eta-2\right)\right]}{\left[\gamma\left(\frac{s}{2D_0}, v-\eta-2\right) - \gamma\left(\frac{s}{2A}, v-\eta-2\right)\right]} \tag{12.6}$$

Where incomplete gamma functions are used:

$$\gamma(a, \mu+1) = \int_0^a \xi^\mu e^{-\xi} d\xi \tag{12.7}$$

Values $s \gg D$ are almost improbable, and we can account for A→∞. If it is so, then we have:

$$F = \left(1 + \frac{Z_0^2}{s}\right)^{-(v-\eta-2)} \left[\gamma\left(\frac{s+Z_0^2}{2D_0}, v-\eta-2\right) \Big/ \gamma\left(\frac{s}{2D_0}, v-\eta-2\right)\right] \tag{12.8}$$

Figure 12.2 shows adaptive Bayesian thresholds $Z_0^2(s)$ versus value of $s$/ for sample support $v = 8$ and $v = 40$. Similar non-Bayesian (ML) threshold is shown

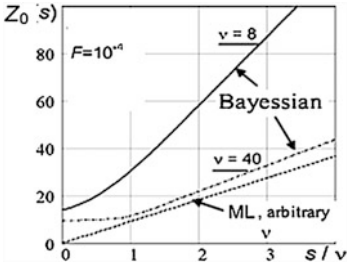


**Fig. 12.2** The new (for single channel reception) nonlinear dependences

for comparison. Bayesian thresholds are obtained for uniform ($\eta = 0$) a priory pdf of $D$, non-Bayesian ones are obtained using ML approach for $F(Z_0|D) = F_0$: $Z_0^2(s) = \ln(1/F_0) \arg\max_D [p(s|D)]/v = s\ln(1/F_0)/v$.

The new (for single channel reception) nonlinear dependences (Fig. 12.2) of Bayesian CFAR threshold $Z_0^2$ versus $s/v$ prevent unwanted increase in false alarm rate of non Bayesian CFAR due to receiver's internal noise. Let us compare false alarm probabilities of PG CFAR and ML LFAR for Gaus sian interference with pdf (12.2) for $\eta = 0, 2D_0 = 1, A \to \infty$ Expression $F(Z_0|D) = \exp(-Z_0/2D)$ is substituted into (12.5) in both cases. But, in the first case transcendental equation is solved to find the threshold. In the second case threshold $Z_0$ is determined from (12.8) using variance $\hat{D} = s/v$ ML estimate and given $D_0 = 0$.

Dependencies (Figs. 12.2, 12.3) show underestimation of the threshold $Z_0$ by the ML method, especially for small $s$ and. This leads to rise in false alarm probability $F$ with respect to the present value $F_0$ (Fig. 12.3).

## 12.3 Bayesian Pg and Pg-Ka Theories of Step Without Char

Let us introduce the training sample matrix $S$ (TSM) formed by $m \times 1$vectors $Y_j^{(s)}$ of the TI independent samples:

$$s = \sum_{j=1}^{v} Y_j^{(s)} \left(Y_j^{(s)}\right)_{j_2}^{*T} \tag{12.9}$$

For PG-KA STAP the CM estimate could be presented in the form: $\hat{\Phi}_{KA} = \left(1 - \sum_{\beta} \mu_\beta\right) \frac{1}{v} S + \sum_{\beta} \mu_\beta \hat{\Phi}_{KA\beta}$. Where $\sum \mu_\beta \leq 1$ the number of coefficients $\beta$ quantity can be >1. The sum can be transformed into integral. A set of summands allows considering different operation conditions and internal possibilities of processing equipment.

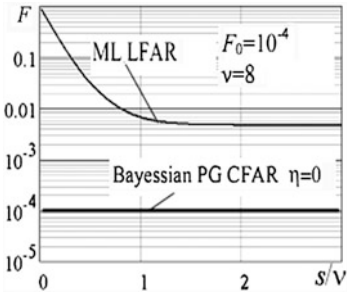


**Fig. 12.3** Underestimation of the threshold

As before, we consider in detail only case of $\mu_\beta = 0$. To simplify the following analysis let us represent TSM (12.9) in diagonal form [9]:

$$S = \sum_{i=1}^{m} \Lambda_{\text{samp}i} U_{\text{samp}i} U_{\text{samp}i}^{*T} \tag{12.10}$$

Here $A_{\text{samp}i}$ is the sample eigenvalue, and $U_{\text{samp}i}$ is $i$th eigenvector of TSM. All eigenvectors are orthonormal:

$$U_{\text{samp}i}^{*T} U_{\text{samp}j} = 0, \text{ if } i \neq j \; \left|U_{\text{samp}j}\right|^2 = 1 \tag{12.11}$$

And

$$\det\left(\sum_{i=1}^{m} U_{sampi} U_{sampi}^{*T}\right) = 1 \tag{12.12}$$

The ML estimate of ICM has the form

$$\hat{\Phi}_{\text{ML}}^{-1} = \nu S^{-1} \sum_{i=1}^{m} \Lambda_{\text{samp}i}^{-1} U_{\text{samp}i}^{*T} U_{\text{samp}i} \tag{12.13}$$

Whereas the unknown true ICM of TI is

$$\Phi^{-1} = \sum_{i=1}^{m} \Lambda_i^{-1} U_i U_i^{*T} \tag{12.14}$$

Bayesian PG ICM estimate differs from both (12.13) and (12.14):

$$\hat{\Phi}^{-1} = \sum_{i=1}^{m} \hat{\Lambda}_i^{-1} \hat{U}_i \hat{U}_i^{*T} \tag{12.15}$$

Eigen values $\Lambda_i$ of true ICM in diagonal presentation (12.14) are doubled variances of quadrature components of TI in single-channel receiver. We use for them a priory Pareto pdf, which is non-zero only if $\Lambda_0 \leq \Lambda_i \leq \infty$

$$p(\Lambda_i|\eta) = \Lambda_i^{\eta} / \int_{\Lambda_0}^{\infty} \Lambda_i^{\eta} d\Lambda_i \tag{12.16}$$

Let us use a priory information that $\Lambda_i \geq \Lambda_0$. Here $\Lambda_0$ is the noise eigenvalue. Since the absence of priory information about eigenvectors for $\mu_\beta = 0$, let us admit them into (12.14) and their estimates in (12.15) become equal to sample eigenvectors in (12.13):

$$U_i = \hat{U}_i = U_{\text{samp}i} \tag{12.17}$$

## 12.4 Conclusion

The main objective of this paper has been achieved: attention has been drawn to the Bayesian theory of STAP and CFAR. It is shown that the maximum likelihood method is not always applicable for solving the STAP with CFAR problems.

Nevertheless, this paper doesn't fully satisfy the authors, since they intended to provide here the Bayesians solution based on the PG a priory model for the CFAR threshold setting in STAP systems. We hope that this paper will be the first step toward the cooperative solution of this problem.

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# Chapter 13
# Three-Dimensional Finite Element Model of Human Dent Facial Complex

**Yi Deng, Xiaorong Zhang, Ji Yao and Haipeng Zhou**

**Abstract** This study explains and demonstrates how to construct the 3-D finite element model of dent facial complex with the original DICOM data of CT, for the analysis of their biomechanical characters. The establishment of 3-D finite element model of maxillary complex: spiral CT scanner, then CT workstation outputted CT images in DICOM format to personal computer, using ANSYS and Mimics software established the 3-D finite element model of maxillary complex of human being. The establishment of maxillary complex three-dimensional finite element model, which was made up of 350125 units and 583391 nodes, included maxillary, arch wires, teeth of 14, maxilla cavity structures. Model and modeling were of the same size with a good geometric similarity. It had scalability which made it possible to attach brackets and wires, implants to start-related studies. The finite element model had better biomechanical characters. It was feasible and effective to the stress analysis in the process of orthodontic treatment.

**Keywords** Maxilla · Human being · Three-dimensional finite element model · Finite element · Orthodontics

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## 13.1 Introduction

The basic principle of the Malocclusion correction method is to impose a variety of external forces on the misplaced teeth or deformed jaw, or to remove the abnormal muscle and induce the histological alterations via biomechanical responses produced by jaw, suture, periodontal tissue, so that the edentulous system gets new balances in formation and function and normal development, which is a biomechanical movement with complex biomechanical contents.

Orthodontic force is the stress-force source produced by the teeth and the supporting tissues. The changes in size, direction, point of the force affect the stress distribution. Therefore, biomechanical analysis is particularly important in the orthodontic field, of which the finite element analysis method reflects its powerful features. The finite element method is a theoretical analysis method, combined with modern computer technology. With the development of finite element technique and the improvement of modeling technique, the calculation results have a good simulative prediction.

## 13.2 Materials and Methods

### *13.2.1 Medellin Material*

Select ozone-maxillary of some normal permanent teeth with following characteristics: complete upper dentition, the teeth on the upper dentition arranged neatly, no obvious malocclusion, no protrusion and retraction in the upper maxillary, basic coordination between the teeth and jaw, not the third molar tooth in the teeth bow, and integral teeth shape without defects in adult head CT films.

### *13.2.2 Establishment of Three-Dimensional Finite Element Model of Nasomaxillary Complex*

In this study, we took advantage of spiral CT scan to obtain the model space geometry information, in which raw data were output in DICOM format. Then, MIMICS software was employed for image segmentation to extract the upper jaw, that is, the inner and outer contour of the hard tissue of the dentition, which were output as IGES form files. Last, IGES files were imported into ANSYS software, and then according to the inner and outer contour of the hard tissue of the two adjacent faults, built planes based on lines, and the box based on the planes, so as to establish the three-dimensional geometric model of maxillary complex.

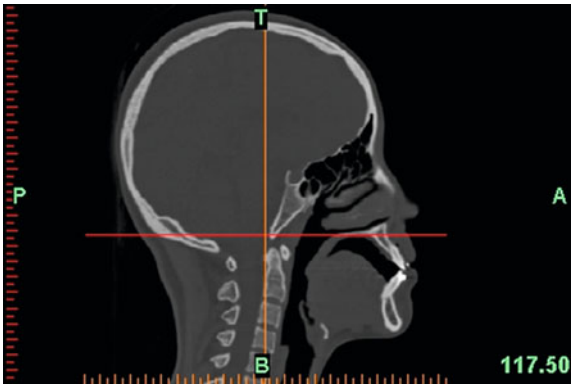


**Fig. 13.1** Original fault map of CT scan

### *13.2.3 Spiral CT Scan*

The entire head was scanned from the parietal to the mandible using the dual-source 64-slice CT of the German Siemens company, in which the thickness of the reconstruction layer was 0.6 mm and the layer distance was 0.3 mm. The original scan data was output to the CT image workstation as DICOM format files (Fig. 13.1).

### *13.2.4 Image Segmentation to Extract Geometric Information of the Mason Maxillary Hard Tissue for 3-Dimensional Reconstruction*

DICOM image data was imported into the MIMICS software to get image information of hard tissues including skull, jaw, and part of the cervical spine. Erase tool was adapted to the layer processing method, by which the pixels of the skull, nasal bone of facial cranium bone, cheekbones and mandible, and cervical vertebrae, were removed. Finally, all the pixel information of maxillary-group teeth would be obtained so as to establish three-dimensional geometric model of mason maxillary complex via Calculate 3D tool (Fig. 13.2).

### *13.2.5 Extract the Inner and Outer Contour of Each Layer of Hard Tissues*

Based on the obtained 3D models of maxillary group teeth, Calculate plotlines from 3D could be utilized to extract inner and outer contour. Finally, image information containing the inner and outer contour of models was output as an IGES format files (Fig. 13.3).

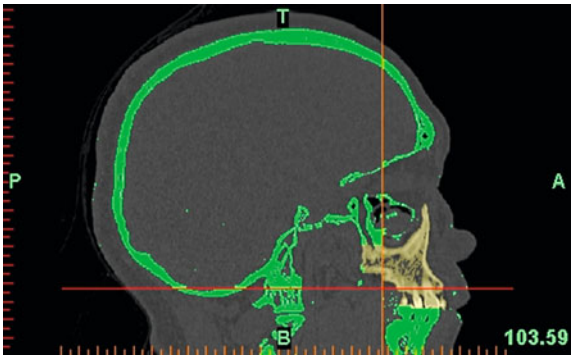


**Fig. 13.2** Image segmentation of hard tissues and extraction of inner and outer contour

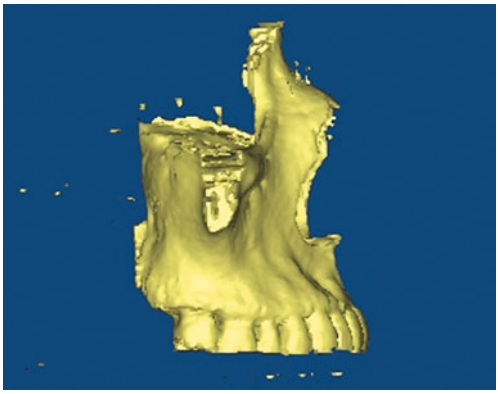

**Fig. 13.3** 3D reconstruction of mason maxillary complex

### *13.2.6 Establishment of Geometric Solid Model of Mason Maxillary Complex*

The establishment of geometric solid model of mason maxillary complex requires first creating enclosed entity planes and then building up enclosed box from planes. By joining points between every two layers, inner and outer contour lines forms enclosed planes and the box could be created (Fig. 13.4). After importing IGES format contour line files output by MIMICS to ANSYS, one could see it is composed by many small line segments (Fig. 13.5). As establishing the entity model requires smooth whole lines, the fitting function in the preprocessing module was used to get fitted smooth inner and outer contour lines from these small segments. Then we took every two layers as a group to establish planes. Due to the complex change of cross-sectional planes of hard tissues, creation of the planes should base on the structure of maxillary and teeth. In the process of plane establishment, the possibility of mesh generation in the next step should be considered to minimize the formation of large-curvature planes. Finally, according to

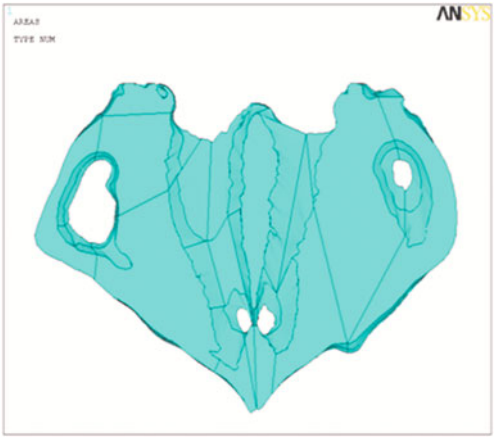

**Fig. 13.4** Lines and planes between the upper and lower layers

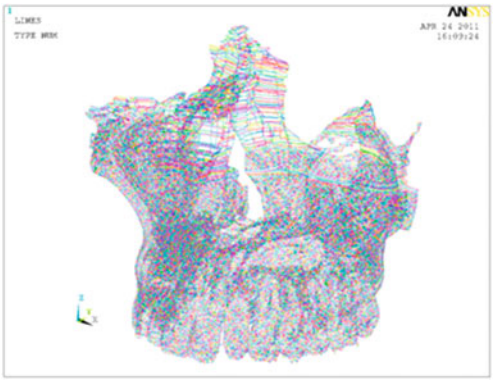

**Fig. 13.5** Nasomaxillary complex modeling lines

the solid model geometry, the corresponding boxes were enclosed from planes by referring to CT reconstruction tomography map and anatomical experience (Fig. 13.6).

## *13.2.7 Module Introduction*

The SOLID 187 is a high gradient 3D 10-node element, suitable for the division of the irregular box. It is composed of 10 nodes, each of which has degrees of freedom in three directions, and can simulate plasticity, creep, stress, large deformation, and large strain.

Beam 188 unit is a space beam element. It utilizes two nodes and each node has three translational degrees of freedom and three tensional degrees of freedom. The unit, based on Timoshenko beam theory, is added with shear deformation effects

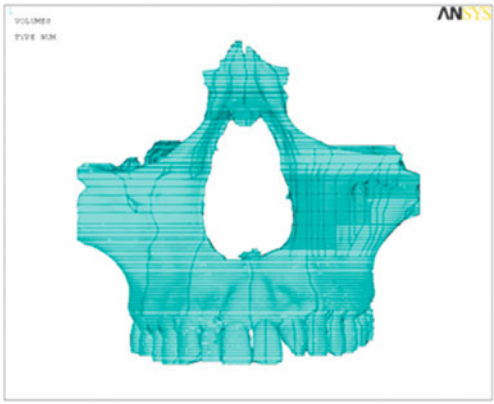


**Fig. 13.6** Box model of nasomaxillary complex

including stress stiffening and large deformation and take into account stretching, compression, torsion and bending. This unit can carry out analysis of plasticity, creep, stress hardening, swelling, large deformation, and large strain.

### *13.2.8 Mesh Generation of the Model*

This study employed 10-node solid 187 units to generate meshes and get a 3D finite model of mason maxillary complex with 350,062 units and 583,391 nodes (Fig. 13.7). On the basis, we built a 0.46 × 0.64 mm arch wire using beam 188 unit and the finally number of units were 350,125. Fig. 13.8 showed arch wire contained mesh generation map of 3D finite model of nasomaxillary complex. The location of the arch wire was basically ensured through the center of clinical crowns of the front teeth and thus 14 teeth in the maxillary were completely linked together by the arch wire to make the dentition move as a whole.

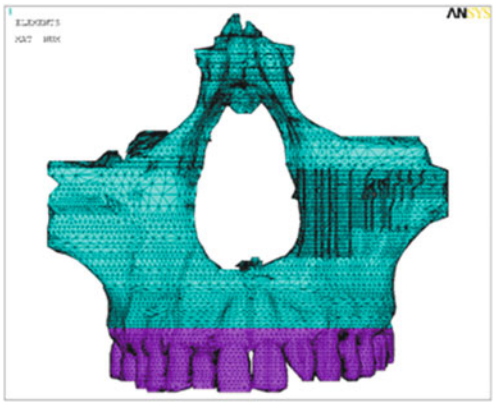


**Fig. 13.7** Mesh generation map of 3D finite model of nasomaxillary complex

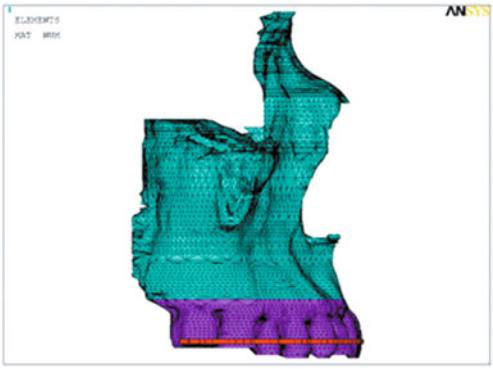

**Fig. 13.8** Arch wire contained mesh generation map of 3D finite model of nasomaxillary complex

**Table 13.1** Parameters of model materials

| Material types | Elastic modulus (E) (Gpa) | Poisson ratio (V) |
|---|---|---|
| Alveolar bone | 13.700 | 0.30 |
| Teeth | 20.700 | 0.30 |
| Archwire drawhook | 176.000 | 0.30 |

Set materials organized in the model as continuous, mean, and isotropic linear elastic material with characteristic of small deformation. Elastic modulus and Poisson ratio of a various structure materials are listed in table 13.1.

## 13.3 Results

Established mason maxillary complex 3D finite element model of permanent teeth's odoneo-maxillary. This model included the maxillary as well as a complete upper dentition with 14 teeth, nasal cavity, bilateral maxillary sinus, and other structures. Modeling starts from the inner and outer contours of the CT scan fault lines, built planes from lines and then the box by the planes. The model was consistent with modeling objects in size and had a good geometric similarity.

All the teeth in the upper maxillary were completely linked together by the arch wire to make the dentition move as a whole. Finally, arch wire contained mesh generation map of 3D finite model of nasomaxillary complex was established. The model can be randomly split to extract an individual part for a separate study. Moreover, the model was scalable, and brackets, arch wires, implants, and other components could be added to it to carry out related researches.

This study used the medical image processing software, MIMICS, and gained the inner and outer lines' data of the established model directly from the CT scan data. It took the full use of electronic computing technology with fast modeling and has guidance value in clinic.

## 13.4 Discussion

Finite element method to the complex structure, morphology, loading, and material mechanical properties, stress analysis is an important means of oral biomechanical study [1, 2], has been widely used in research in the field of Oral Implant logy, repair, orthodontic [3, 4]. To this end, scholars have been seeking a reliable, fast method of modeling, and mechanical analysis of the auxiliary Dental Tissue.

The modeling approaches. The ground section method Traditional modeling methods used to map the coordinates of faults' external shape layer by layer by artificially measuring specimens, or specimen model section and ground section methods, specifically [5].

The 3D measuring method refers to, through scanning the odoneo-maxillary model and holographic method to measure it so as to gain 3D data and then establish the 3D model in the computer. Noncontact laser scanning is a presently common used method. It does not need directly contact with the object and has high accuracy and fast speed as well as a reflection of the morphology of the odoneo-maxillary model [7]. At Present, the development trend of this method is to collect data directly from the patient's oral cavity and to apply them to CAD/CAM designing of all-ceramic crown, for the purpose of improving production automation and efficiency of the dental prosthesis [9].

CT image processing method the main process is as following: obtaining the original data. After determining the range of modeling, set some parameters on the CT scan of the measured object; obtaining 2D images. CT films are imported into the computer through scanning, video, and other methods, and then stored image files for use; obtain the contour line map and based on that draw the contour line vector map of each fault; Establish 3D finite element mesh model, that is, building finite element model based on image contours. However, the commonly used CT modeling in China " film shooting and scanning" process to transfer data, vulnerable to lose some valuable information.

Directly modeling method from DICOM data DICOM format is the standard jointly issued by the ACR-NEMA. After patients finish CT scan, films do not have to be generated and mass of data are able to be saved or transferred with the DICOM standard. The process of reconstructing odoneo-maxillary tissue CT or MRI scan; reading DICOM data; image segmentation; contour extraction and contour curves generation; modeling and input contour line data into finite element software, then using the appropriate pre-treatment module to generate entity and meshes. DICOM files can provide very accurate data information. This method simplifies the procedure of CT modeling, directly saves and transfers data, avoiding repeated operation-induced partial data distortion or loss, which realized the automation-assisted modeling in real.

## 13.5 Conclusions

This study established a 3D finite element model of the nasomaxillary complex and provided the model basis for researches in this field. This model has a high geometric accuracy and good biomorphic similarity. Later, according to the requirements, the model can be modified and added with additional implants, brackets and other devices to facilitate more in-depth study on mechanical mechanism.

**Acknowledgments** This work was supported by the National Natural Science Foundation of China (NO81060089).

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# Chapter 14
# Study on Dynamic Prediction of Surplus Gas in Iron-Steel Plant

**Jun Song, An-chao Zhang and Hai-kun Zheng**

**Abstract** This paper analyzes the advantages and disadvantages of mainstream prediction methods of gas system in iron-steel plant, proposes a set of general forecasting methods based on EMC (energy management center) for China's gas surplus in the current situation, establish a hybrid model which include the production and consumption mechanism of single device and the simulation of surplus gas. Application results show that: the method is suitable for different types of enterprises in varying construction degrees; model results can meet the data accuracy requirements; prediction analysis can be an early warning of instrument malfunction and system failure, also a scientific basis for buffer equipment purchases, production, and maintenance plan adjustment.

**Keywords** Iron-steel plant · Dynamic prediction · Gas system · Simulation

## 14.1 Introduction

China's iron-steel plant is mainly a blast furnace—converter long process, which requests that the amount of gas occur at any time is always greater than demand in order to meet the production. That is to say gas system is not balanced but dynamic surplus, medium- to long-term prediction is very difficult to achieve policy-making and management so that dynamic prediction become prevalent with the EMC developing.

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Jebaraj proposed the importance of energy model is used to prediction. To meet the dynamic prediction request of china's iron-steel plant, a hybrid model including the production and consumption mechanism of single device and the simulation of surplus gas was proposed, the dynamic prediction of surplus gas only to predict the main process. In normal production status, the gas output and consumption of main process only associated with the material conditions, device parameters, and operating parameters which are not often changed that trigger-counting can meet the forecast requirements; In abnormal production status, the gas output and consumption exists functional relationships such as periodic function, piecewise function, slope function that suitable for solving by simulation. Trigger-counting method is used to dynamic forecast for normal production status, and simulation method is used to dynamic forecast for abnormal production status including a number of complex functions.

## 14.2 Dynamic Mathematical Model

Based on sample data of 2009 in an iron-steel plant, analysis the production and consumption data of main process in abnormal production status in chronological order, establish AR (M, N) time series models of equipment under different conditions, change time series models into the equivalent linear models which are dynamic mathematical models of gas system. The following examples are still three kinds of gas production in abnormal status besides LDG production in normal status. (Figs. 14.1), (14.2)

$$M_i(t) = \begin{cases} t \times k(t) + \xi_t'' \ldots\ldots\ldots\ldots\ldots \text{re-air} \\ (I + t \times k'(t)) + \xi_t \ldots \text{off-air} \\ K(t) \times I + \xi_t' \ldots\ldots \text{by-air} \\ 0 \ldots\ldots\ldots\ldots\ldots \text{stop-air} \end{cases} \tag{14.1}$$

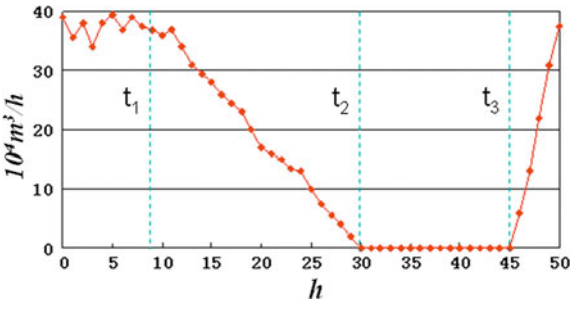


**Fig. 14.1** BFG curve of off-air-re-air status

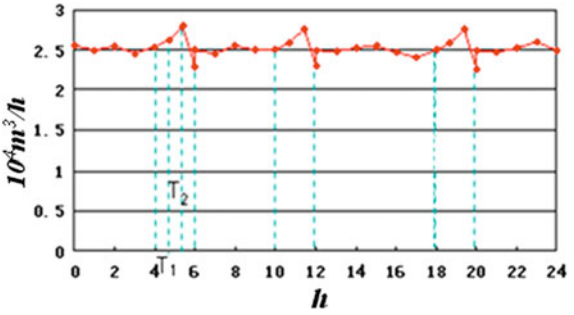


**Fig. 14.2** COG produce curve of repair status

$$J_i(t) = \begin{cases} J + \delta_t \ldots\ldots\ldots\ldots \text{early-stage} \\ (1 + a(t))J + \delta_t' \ldots\ldots\ldots\ldots \text{medium-stage} \\ (1 + a(t) - b(t))J + \delta_t'' \ldots \text{last-stage} \end{cases} \tag{14.2}$$

where, $M_i(t)$ express BFG occurrence of $i$-blast furnace on time t; $k(t)$ and $k'(t)$ respectively express off-air and re-air slope of $i$-blast furnace; $I$ express mean gas output of $i$-blast furnace in normal status; $K$ express cut-air rate of by-air status; $\xi_t$, $\xi_t'$ and $\xi_t''$ express disturbance; $J$ express gas production of repair early-stage, $a(t)$ and $b(t)$ respectively express the increase volume on the slope function of repair medium-stage and reduction under the slope function of repair last-stage; $\delta_t$, $\delta_t'$ and $\delta_t''$ express disturbance.

LDG is a cyclical recovery in the oxygen blowing period, but only CO and $O_2$ in flue gas up to the standard in the recovery period, Whether recovery or not depends on capability of gas tank, user needs and other kinds of gas surplus status.

$$Q_L(t) = \begin{cases} L + \varphi_t \ldots\ldots\ldots\ldots (t_k + (n-1)\mu) \le t \le (t_k + (n-1)\mu + \mu\eta)).\text{and}.(t \notin [t_s, t_l]) \\ 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (t_k + (n-1)\mu + \eta\mu \le t \le (t_k + n\mu).\text{or}.(t \in [t_s, t_l])) \\ Q_L'(t) = Q_{\min} + \lambda k \ldots\ldots (k \in 0, 1..k_{\max}) \end{cases} \tag{14.3}$$

where, $Q_L(t)$ express LDG produce volume on time t; $L$ express the mean recycled gas amount of recovery period; $\varphi_t$ express disturbance; $t_k$ express delay Length; $n$ express cycle ordinal; $\mu$ express cycle time; $\eta$ express the Recovery period proportion of the total cycle; $t_s$ and $t_l$ ,respectively express the end of no-waiting production time and restart time; $Q_L'(t)$ express LDG recycling volume on time t; $Q_{\min}$express LDG minimum recycling level; $\lambda$ express step length; $k$ express the number of approximation; $k_{\max}$ express the maximum number of approximation when LDG meet the zero-elution.

## 14.3 Applications

### *14.3.1 Application in a Typical New Plant*

Plant A is a typical new plant: EMC construction is at low level; only a 3200 $m^3$ blast furnace and a 220 t/h converter were put into operation; only BFG and LDG were produced; rolling process did not put into operation; a lack of buffer capability and gas users.

In Fig. 14.3, a 5-days-repair and 16-hours-repair in plan, respectively made blast furnace to off-air and re-air process; blast furnace off-air of nonplan and wait for the raw materials made BFG production change 16 times; occurrence of sudden failure caused the amount of blast furnace gas to stop recovery for 30 min. Comparison of predicted and the actual situation as follow.

As can be seen from Table 14.1, the predictive value of normal production calculated by mechanism model has deviation of less than 5 %; the predictive value of abnormal production calculated by the hybrid model has deviation of less than 10 %; the number of fluctuations of unbiased; predicted results can reflect the real status of gas produced.

In the second phase, plant A will add a 3200 $m^3$ blast furnace and a 220 t/h converter; BFG user will add 4 stoves, a BFG pure fired regenerative furnace and a sleeve white lime kiln. Plant A buffer device in first phase including a $8*10^4$ $m^3$ BFG tank and a mixed boiler, buffer device in second phase plan to add a $8*10^4$ $m^3$ BFG tank and a mixed capacity of $8*10^4$ $m^3$/h boiler, or add a $8*10^4$ $m^3$ BFG tank, or add a $8*10^4$ $m^3$ BFG tank and a mixed capacity of $8*10^4$ $m^3$/h boiler. To simulate the operation of gas system for a month, results of the above three programs are shown in Table 14.2.

As can be seen from Table 14.2, gas tank is mainly to let the pipe pressure stability, plays a minor role of large and long fluctuations that are suitable for mixed boiler to adjust; Gas tank matched with mixed boiler can play better results which makes gas system to achieve ‘zero bleeding’.

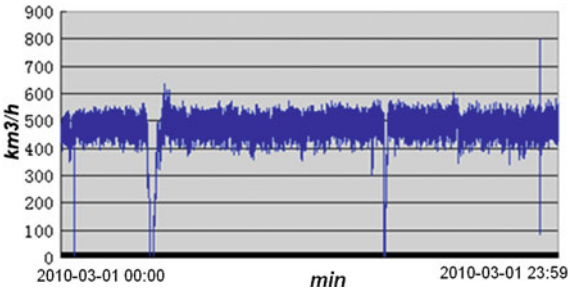


**Fig. 14.3** BFG dynamic predicted curves of plant A

**Table 14.1** Comparison of predicted and the actual situation

| Status | Predicted | Actual | Deviation (%) |
|---|---|---|---|
| Normal | 331275 $km^3$ | 340344 $km^3$ | −2.7 |
| Abnormal | 15506 $km^3$ | 16786 $km^3$ | −7.6 |
| Fluctuations | 18 t | 18 t | 0 |

**Table 14.2** Comparison of simulation results of three programs

| Item | Abnormal fluctuations (t) | Bleeding rate (%) | Pipe network alarm |
|---|---|---|---|
| Program 1 | 21 | 20.8 | 9 |
| Program 2 | 18 | 16.7 | 3 |
| Program 3 | 1 | 0.5 | 1 |

### *14.3.2 Application in a Typical Old Plant*

Plant B is a typical old plant of blast furnace—converter long process, the construct of EMC has reached the international advanced level.

From January to April 2010, deviation overtakes 10 % between predicted data and real-time data accumulated more than 58 times, causes illustrated in Table 14.3.

As can be seen from Table 14.3, dynamic prediction can found measuring instrument system malfunction to achieve the effect of timely replacement and maintenance of instruments; ensure early detection of incidents to provides strong support for the safe and stable operation of the gas system (Figs. 14.4), (14.5).

In the figures above, $20*10^4$ $m^3/h$ and $50*10^4$ $m^3/h$ express effective adjustment range of CCPP(combined cycle power plant) and boilers in plant B; curve at the time t1–t2 is fluctuation caused by two blast furnace maintenances complete coincidence; curves at the time t1′–t2′ and t2′–t3′, respectively are fluctuations caused by separate maintenance of single 1,000 $m^3$ blast furnace; curve at the time t4–t5 is fluctuation caused by two stove maintenances some overlap; curves at the time t4′–t5′ and t5′–t6′, respectively are fluctuations caused by separate maintenance of single stove (Figs. 14.6, 14.7).

**Table 14.3** Overrun deviation of statistical analysis

| Item | Prediction error (t) | Instrument failure (t) | Special accident (t) |
|---|---|---|---|
| BFG system | 7 | 20 | 4 |
| COG system | 4 | 10 | 2 |
| LDG system | 2 | 8 | 1 |
| Total | 13 | 38 | 7 |

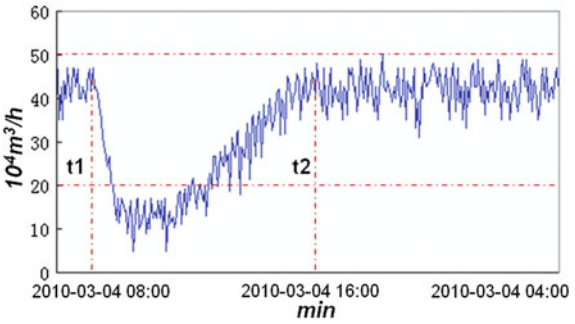


**Fig. 14.4** Abnormal fluctuation in gas forecast Fig

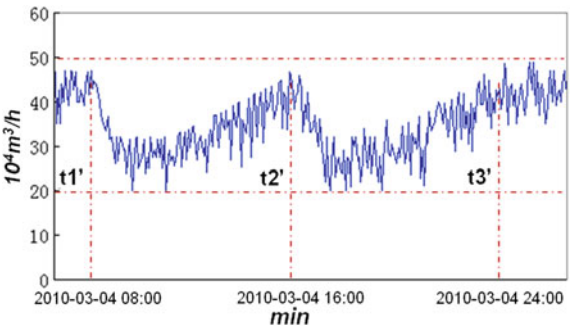


**Fig. 14.5** Smooth fluctuations in adjusted plan

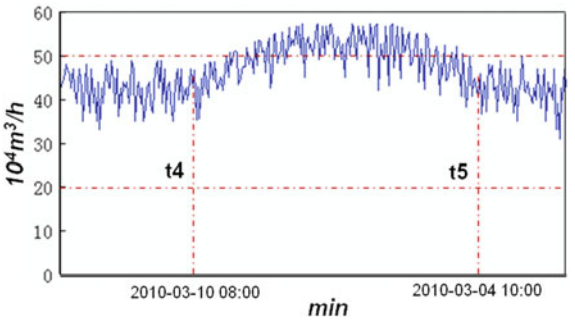


**Fig. 14.6** overrun 1 h in gas forecast

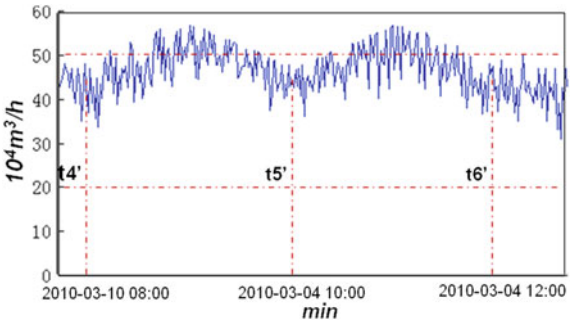


**Fig. 14.7** Instantaneous overrun in adjusted plan

## 14.4 Conclusion

Dynamic prediction accuracy to meet manager's need can forecast dynamic operation status of gas system which is consistent with the actual situation; Hybrid prediction method can be used in simulation programs to debug the transformation of equipment change; Plant with a high EMC building level can make early detection of incidents and instrument failure through comparative analysis of real-time data and forecast data to achieve security and stability of the system; According to the analysis of the dynamic prediction results and adjust the periods of the Abnormal fluctuations can reduce economic losses caused by surplus gas fluctuations.

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# Chapter 15
# Study of Talent Resources Agglomeration During the Industrial Transformation and Upgrade

**Xiaoxu Cai and Jia Zhang**

**Abstract** It is the consensus that talent resource is the first resource. With the development of knowledge economy and technology, and the increasingly upgrading of industrial structure, all kinds of talents flow frequently leading to talent resources agglomeration. This paper states the necessity and urgency of industrial transformation and upgrade according to the phenomenon in Suzhou. On the basis of the related statistical data in Suzhou, it also analyzes the agglomeration here and offers some suggestions and countermeasures for the agglomeration.

**Keywords** Industrial transformation and upgrade · Suzhou · Talent resources agglomeration

## 15.1 Presentation of the Question

Since the reform and opening, Suzhou develops significantly and its economic strength is remarkable [1]. After entering the period of "eleventh five-year plan", the basic functions of all kinds of development zones and industrial parks has improved little by little [2, 3]. At present, there are 20 Industrial Cluster and 7,000 Enterprises cluster in Suzhou concerning electronic information, new materials, petroleum, chemicals, machinery, textiles, and so on [4]. It is expected to realize a sales volume of 400 billion in 2011. Among the Industrial Cluster, some cluster's

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annual sales is over 10 billion, such as electronic information in Suzhou, iron and steel and Knitting wool in Zhangjiagang, silk textile and optical cable in Wujiang, and garments in Changshu. While the economic aggregate continues to rise, the industrial structure of Suzhou shows the conformability to its development. The unreasonable industrial structure restricts the sustainable development of economy, which includes the low-end industries, low value added products, low level technology, and low price competition. So the old development way is difficult to continue and need to be adjusted. Industrial transformation and upgrading is the effective method to dissolve the difficulties and challenges appearing in the process of the industrial development, which is also the strategy to realize the industry's economy development, clean development, safe development, and Sustainable development [5].

Industrial transformation and upgrading has an interdependence and interaction relation with talent demand whose change will certainly put forward new requirements for talents, which will lead to the adjustment of the talent structure. Reasonable and balanced distribution of talents in all fields will accelerate the speed of industrial structural adjustment to promote the development of national economy. High quality and high skill talent is the key factor in effectively solving the difficulties met in industrial transformation and upgrading. So there is great theoretical value and practical significance to study the present situation of talents in Suzhou and take advantages of the agglomeration effect of talents resources.

## 15.2 The Present Situation of Talent Resource Agglomeration and Its Problems in Suzhou

### *15.2.1 The Present Situation of Talent Resource Agglomeration*

A series of talent policy measures have been implemented for industry transformation and upgrading forming a talent-plan system in Suzhou. In 5 years, RMB3 billions has been invested in introducing and training talents of science and technology and innovative talents in shortage in some key and advantageous industries. Such measures are called new policy for talents in Suzhou. Because of the investment, many new strategic industries appear in Suzhou and become stronger and stronger, such as nanometer material, new type of flat panel screen, biological medicines, new energy, and smart grid. In Suzhou industrial park, there are 2,000 talents working in the field of nanometer material including two academicians, three persons belonging to national "thousand-person plan" and nine ones belonging to "hundred-person plan" of the Chinese Academy of Sciences. They have 300 patents in this field. It is expected to have 200 enterprises in the field of nanometer photo electricity and reach a value of 20 billion.

By the end of 2010, there are 1,049 thousand talents in Suzhou including 62 thousand high level ones such as graduates and talents with senior titles. At present, 30 persons are selected in national "thousand-person plan", which occupies the leading place among all national prefecture level cities. 139 persons belong to "the introduction plan of high level innovative talents" in Jiangsu, which is second to none in Jiangsu for three consecutive years. Industrial cluster is the carrier of talent aggregation in Suzhou, which plays an important role in economic development here. Talent resources have the following characteristics in Suzhou.

(1) The quality of labors is improved. The rate of talents employed rises. According to the 10 % sample survey, there are 663.4 thousand persons having jobs including 114.6 thousand talents accounting for 17.4 %, which is 12 % higher than that of "the fifth census". From the view of industry, there are 4 hundred talents in the primary industry, 57.6 thousand ones in the second industry and 56.5 thousands in the third industry, which accounts for 0.3, 50.3 and 49.3 % respectively. Compared with "the fifth census", the rate in the second industry rises 16.2 %, which is related with the increasing economic development in the recent decade.
(2) The amount of talents in the second industry increases fast while the rate is higher in the third industry. According to the 10 % sample survey, the amount of talents increases six times and one forth as much as before with the highest speed in the second industry having 57.6 thousand people. In the field of manufacture, 76 % talents work in ten fields such as electronic communications, special equipment manufacturing industry, and general equipment manufacturing industry.

From the rate of talents belonging, it is relatively higher in the third industry. The rate is 1.6 % in the first industry, 12.5 % in the second industry and 26.7 % in the third. In the third industry, the rate is highest in education field reaching 73.6 %, the second is 71.8 % in finance, the third is 64.9 % in hygiene and the forth is 63.9 % in scientific research, technical service and geologic exploration. (Table 15.1)

(3) The rate of White-collar talent is high and the rate of blue-collars has a large lifting space. Among the seven kinds of professionals, there are three kinds of mental labors: all kinds of professional technical labors, head of government sectors, party organizations and enterprises and institutions and clerical staff being commonly called white collar. The other four kinds are mainly physical labors called blue collar. According to the 10 % sample survey, the rate of talents among white collars is high in Suzhou, especially professional technical personnel at 65.56 %, which is 26.1 % higher than the Fifth Census. The talent rate of Clerical staff is also increased to 45.57 % in the Sixth Census from 21.71 % in the Fifth one.

**Table 15.1** The state of talents in each trade of Suzhou

| Industry | Ratio of owning talents (%) | Industry | Ratio of owning talents (%) |
|---|---|---|---|
| Overall | 17.3 | – | |
| First industry | 1.6 | – | |
| Second industry | 13.5 | Tertiary industry | 26.7 |
| Mining industry | 17.3 | Transportation, warehousing industry and postal industry | 13.3 |
| Manufacturing industry | 13.7 | Information transmission, computer and software industry | 57.3 |
| Fabric clothes, shoes, head-covering manufacturing | 5.5 | Wholesale and retail | 15.1 |
| Chemical resource and its products manufacturing | 19.8 | The hotel and catering industry | 9.5 |
| Medicine | 31.8 | Finance | 71.8 |
| Plastic manufacturing | 12.7 | Real estate | 26 |
| Metal manufacturing | 11.4 | Rent and commercial service | 39.8 |
| General equipment manufacturing | 19.8 | Scientific research, technical service and geological prospecting industry | 63.9 |
| Special-use equipment manufacturing | 37.2 | Irrigation works, environment and communal facilities management | 15.9 |
| Transportation facilities manufacturing | 18.9 | Neighborhood services and other services | 8.2 |
| Electrical machinery and equipment manufacturing | 20.2 | Education | 73.6 |
| Communication apparatus, computer and other electronic equipment manufacturing | 18.5 | Hygiene, social security and social welfare | 64.9 |
| The production and supply of electric power, gas and water | 34 | Culture, Physical Education and entertainment | 26.5 |
| Building industry | 9.8 | Public management and social organization | 57.4 |

Remarks: The rate of talents in certain industry refers to the amount of talents with college degree and above in this field. Resources from: "Suzhou talent status research" issued by Jiangsu Statistical Bureau

In addition, the talent rate of blue collars is very low in Suzhou. The talent rate in the fields of production, transportation, and equipment operation is only increased to 6.04 % in the Sixth Census from 1.06 % in the Fifth one having higher lifting space.

## *15.2.2 Problems Existing in Talent Aggregation in Suzhou*

### 15.2.2.1 Lack of High Level Talents

High level talents represent the top-notch scientific skill of a city. It is because of having so many high level talents that the cities as Beijing and shanghai have advantages of science and technology, who play an important role in the innovation of the field. In Jiangsu province, Nanjing has a unshakeable place in having the amount of high level talents and Suzhou has not had such ability.

According to the statistics of the "report on the development of Chinese talents" of 2009, professional talent index in Suzhou is the 35th high nationally, entrepreneurial personnel index is 32nd. And the quality of talents is the same. Suzhou has the lowest convenient in obtaining high level talent compared with 50 cities having a rate of 0.39, which reveals that Suzhou has not had a high level talent team having no circumstance in attracting high level talents. Because of aggregation effect of high level talents, investment should be increased in attracting high level talents. In addition, the status of research and development institutions can reflect the problem exiting in this field. Though there are some such institutions locating in Suzhou, the amount is not very large not having an obvious function in attracting high level talents.

### 15.2.2.2 Relatively Weak Innovative Ability of the Talents

Whether a city has competition depends on the output of the talents and their innovative ability, but not its amount. Though there are a million of talents in Suzhou, they are mainly employees in frontlines, only a small amount of whom are Science and technology talents and less ones in innovation. Because of the relatively weak Innovative ability of the talents, enterprises have relative weak technology and developing ability with weak endogenous innovation capacity. The amount of patent licensing for invention and the rate of patent in patent licensing reflect the innovative ability of talents in this area. In Jiangsu province, Suzhou has a leading place in this field, but its rate of patent for invention is low in patent licensing at the place of 12th in Jiangsu. (Table 15.2)

### 15.2.2.3 The Quality of Talents to be Improved

Scientific and technological talents are usually classified into two parts: talents in general scientific and technological activities and talents in R&D. The amount of the talents in these two fields and its rate can show the quality of the talents in this city. According to the data of 2010, Suzhou has no advantage in these fields falling behind Nanjing. In Suzhou, Scientific and technological talents account for 2.73 % of all personnel in work, second highest in Jiangsu. The talents in R&D occupy

**Table 15.2** The statistics of 2010 patent of each city in Jiang Su

| | Patent application number in 100 thousand people | | | Patent awarded number in 100 thousand people | | | Ratio of invented patent in awarded Patent (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number | Score | Order | Number | Score | Order | Number | Score | Order |
| Nanjing | 240.42 | 3.7 | 6 | 114 | 4.54 | 6 | 27.21 | 3.08 | 1 |
| Wuxi | 512.74 | 4.62 | 3 | 414.83 | 6.74 | 2 | 4.34 | 1.84 | 9 |
| Xuzhou | 115.67 | 3.27 | 9 | 57.42 | 4.12 | 9 | 3.37 | 1.79 | 11 |
| Changzhou | 345.68 | 4.05 | 4 | 197.96 | 5.15 | 5 | 6.15 | 1.94 | 4 |
| Suzhou | 737.39 | 5.39 | 1 | 440.45 | 6.93 | 1 | 2.97 | 1.77 | 12 |
| Nantong | 531.56 | 4.69 | 2 | 310.97 | 5.98 | 3 | 1.3 | 1.68 | 13 |
| Liangyungang | 48.17 | 3.04 | 12 | 28.97 | 3.91 | 11 | 7.85 | 2.03 | 3 |
| Huaian | 102.44 | 3.23 | 10 | 24.35 | 3.88 | 12 | 12.39 | 2.28 | 2 |
| Yancheng | 82.82 | 3.16 | 11 | 34.4 | 3.95 | 10 | 4.76 | 1.87 | 8 |
| Yangzhou | 223.73 | 3.64 | 7 | 84.96 | 4.32 | 8 | 5.65 | 1.91 | 7 |
| Zhenjiang | 334.11 | 4.02 | 5 | 210.69 | 5.25 | 4 | 6.17 | 1.94 | 4 |
| Taizhou | 170.73 | 3.46 | 8 | 90.84 | 4.37 | 7 | 4.07 | 1.83 | 10 |
| Suqian | 18.74 | 2.94 | 13 | 10.78 | 3.78 | 13 | 6.09 | 1.94 | 4 |

Resources from: Monitoring result of scientific and technological improvement and its statistic report, Jiangsu 2010

**Table 15.3** The analysis to talents quality in each city of Jiang Su

| | Scientific staff in trade related overall (%) | | | R&D staff in scientific talents (%) | | | Enterprise R&D staff in all employees (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Number | Score | Order | Number | Score | Order | Number | Score | Order |
| Nanjing | 3.21 | 3.96 | 1 | 50.39 | 3.49 | 12 | 4.69 | 3.96 | 1 |
| Wuxi | 2.22 | 3.37 | 4 | 60.18 | 4.61 | 2 | 3.58 | 3.4 | 4 |
| Xuzhou | 0.67 | 2.45 | 10 | 66 | 5.28 | 1 | 2.67 | 2.94 | 6 |
| Changzhou | 2.06 | 3.28 | 5 | 59.71 | 4.56 | 3 | 3.93 | 3.57 | 2 |
| Suzhou | 2.73 | 3.67 | 2 | 57.92 | 4.35 | 6 | 2.5 | 2.85 | 9 |
| Nantong | 1.29 | 2.82 | 7 | 51.84 | 3.66 | 10 | 3.03 | 3.02 | 5 |
| Liangyungang | 0.43 | 2.31 | 11 | 55.31 | 4.06 | 8 | 2.55 | 2.88 | 8 |
| Huaian | 0.33 | 2.26 | 12 | 58.24 | 4.39 | 5 | 1.49 | 2.34 | 12 |
| Yancheng | 0.69 | 2.47 | 9 | 54.89 | 4.01 | 9 | 2.16 | 2.68 | 11 |
| Yangzhou | 1.37 | 2.87 | 6 | 50.76 | 3.53 | 11 | 2.39 | 2.8 | 10 |
| Zhenjiang | 2.47 | 3.58 | 3 | 54.05 | 3.08 | 13 | 3.75 | 3.48 | 3 |
| Taizhou | 0.85 | 2.56 | 8 | 57.03 | 4.25 | 7 | 2.65 | 2.93 | 7 |
| Suqian | 0.17 | 2.16 | 13 | 58.97 | 4.48 | 4 | 1.13 | 2.16 | 13 |

Resources from: Monitoring result of scientific and technological improvement and its statistic report, Jiangsu 2010

57.92 % of all the talents in scientific and technological field, 6th highest in Jiangsu. Talents in R&D in enterprises account for 2.85 % in all staff, 9th highest in Jiangsu, far falling behind Nanjing, Tan tong, Xuzhou, Wuxi and so on, which is not conform to its status of high and new technology industry and the status of science and technology in Jiangsu. (Table 15.3)

#### 15.2.2.4 The Under Internationalized Talents Resource

The ratio of exterior residents and high-level experts is too low; accordingly, the degree of international talents is not high. The "sixth census" result shows the number of foreign residents in Shanghai and Beijing respectively is 208.6 and 107.4 thousand and the ratio it occupies in each city respectively is 1.48 and 0.9 %.However, the number in Suzhou is 38.3 thousand and ratio is 0.6 %. Moreover, most of them are from Chinese Taiwan and the ratio is about 63.1 %, who are mainly in manufacture industry. From here we can see, the degree of international talents is not high, which, in some degree, influences the open degree of all industries.

## 15.3 The Proposals and Countermeasures for Realizing Talent Aggregation in Suzhou

### *15.3.1 The Improvement of the Quality of Talent Resources*

A quite amount of talents have been accumulated in Suzhou at present, but most of them only have the potentials of working for the production, development, broadcast and application of science and technology. The data of 2010 shows that the rate of white collar talents is relatively high in Suzhou, among which the rate in professional technical field is the highest at 65.56, 26.1 % higher than that in "the fifth census". The rate of clerical staff and concerned ones is also increased to 45.57 % in "the sixth census" from 21.71 % in "the fifth census". In addition, the economy in Suzhou mainly includes manufacture. Talents in engineering technology, agricultural technology and scientific research and technology only accounts for a small part. To change the situation, it is a good way to develop vocational education training the talents with theory and practical skills. Developing vocational education is a common social phenomenon all over the world, especially secondary and high vocational education. For example, in 1963 American government released "the law of vocational education", which made vocational education a most active one and train a great amount of qualified technical personnel. Vocational education can spread science and technology accumulated by human being, develop the intelligence of human being and change the potential productivity into reality. At the same time, it can also assure enough new talents supersede the old ones in all fields. While developing high education, Suzhou should increase vocational education and the government should increase the investment in this field setting up perfect vocational system to bring more well-trained and qualified talents. As the fast development of manufacture and the increasing demand of scientific and technological talents in the recent 5 years, the government has invested much in developing vocational education and achieved good results.

### 15.3.2 Building and Perfecting the Carrier of High Level Talents

As a second-tier city, Suzhou has no advantage in developing carrier with only a few national vital labs and R&D institutions. At present, Suzhou should master the opportunity of developing economy and new high technological industries striving for attracting new carriers of high level talents to Suzhou. More investment should be put in some projects such as vital labs, provincial and ministerial R&D institutions and postdoctoral flow stations. In order to adapt the transformation from manufacturing type to R&D type in Suzhou, policies and financial support should be apt to the projects striven by enterprises trying to get great breakthrough in the following few years. At present, there are 8 provincial vital labs, 9 provincial and ministerial R&D institutions and 20 postdoctoral flow stations. After constructing development carrier, Suzhou should perfect the development mechanism of high level talents and the incentive mechanism encouraging them to invest in business and furthest stimulating their enthusiasm. At the same time, Suzhou should attract top-ranking scientific and technological talents at home and abroad to study and work here to promote the effective development of high level talents in Suzhou.

### 15.3.3 Improving Standard and Building the Preferred City for Innovative Talents

In "Suzhou talent development program for long and medium term (2011–2020)"issued by Suzhou government, it specifies that the ratio of high-education population in working-age population should reach 26 % in 2015 and 31 % in 2020. At present, this ratio in permanent resident population is 17.4 % and in resident population is 23.5 %, but the ratio in floating population is only 10.7 %, which is 6.4 % lower than that in resident population. Since the floating population is almost as large as resident population in Suzhou, it is necessary to improve the settling standard of floating talents. In this way, the amount and the quality of talents can be increased and Suzhou can change its character from labor input city to the preferred city for innovative talents.

### 15.3.4 Building Green Channel to Attract Talents by All Means

Suzhou should devote major efforts to propaganda its talent policies and entrepreneurial environment to attract talents by TV, broadcast and network forming a situation of talent promotion and service, strengthening working consciousness for talents, widening working fields for talents, enriching working methods for talents

and making working brands for talents. All residents should respect labor, knowledge, talents and creation building an environment for talent aggregation and talent development and enhancing the charisma and attraction to talents. At the same time, Suzhou should build green channels for all kinds of talents to invest here actively using domestic and foreign talent resources to accelerate the construction of a comprehensive international standard talent market to offer a public service platform for talent recruitment. Suzhou can introduce some vital talents demanded by the business development with purpose making full use of its comprehensive advantage.

### *15.3.5 Unblocking "Bottleneck" Training Innovative High Level Scientific and Technological Talents*

There are 1.04 million talents in Suzhou but high level talents are only 46 thousand, which is obviously not enough. At present, the ratio of high level talents in Suzhou is lower than that in Beijing, Shanghai and Shenzhen. Suzhou is lack of high level management talents, leading high new technological talents, high level technical talents and internationalized talents familiar with international practice and rules, which has become the bottleneck of the construction of talent teams. Without enough echelon type talent team, Suzhou has no way to realize its industry upgrading. Firmly centering on the construction aim of "three districts and three cities" and the main clue of industrial transformation and upgrade, Suzhou should continue to implement the strategy of "strengthening its power through talents" and "talents first" increasing the investment in introducing talents to improve the leading function of high level talents. For construction of talent mechanism, Suzhou should take the opportunity of constructing learning-type city using the whole strength of the society to train talents. For the investment in training talents, Suzhou can set up a funding mechanism called "three-in-one"—that is part of the fund from government, part from enterprises and the left from individuals.

For the usage of training fund, Suzhou can build a preferential system for talent training, which means that training in popular specialties should use personal expenses; in common specialties can get proper financial support and in the specialties in short can get vigorous support. By innovating talents cultivating system, Su Zhou should try to cultivate her own high-level talents who can dominate industrial high-land. By optimizing talents structure to accelerate the industrial upgrade, it can provide strong talents guarantee for the economic and social development of Su Zhou.

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# Chapter 16
# Study of the Food Supply Capacity in Chengde

**Yuecong Zhang and Fu-Wei Cheng**

**Abstract** According to the actual food production of various types of ecosystems (cropland, grassland, aquatic, forests) in Chengde and the food nutrition conversion table, if we convert various types of food into three major nutrients (heat, protein, fat) needed by the survival of humans, we come to the actual food supply capacity in Chengde. The results show that: The supply of the three major nutrients is enough, but the supply capacity is different. With corn and pork as the main source of food supply, the food supply structure is inconsistent to the consumption structure. The contribution of cropland accounts for the vast majority; the proportion of food supply from grassland is much higher than that of China; the proportion of food supply from aquatic is low, with an average of 0.53 %; the proportion of food supply from forests is growing fast. The per capita food supply capacity of three major nutrients from cropland in Chengde is lower than that in China, with that from grassland far higher and that from aquatic far lower. We should adjust and optimize the industrial structure, improve the nutrition structure, and the living standards in Chengde.

**Keywords** Chengde · Food provision · Food nutrition · Food supply and demand balance

## 16.1 Introduction

Food is the foundation of the survival and development of human beings. The regional prosperity is predicated on the food safety, which arouses wide concern of the governments of each nation and international community. So domestic and

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overseas scholars have abundant studies on global/regional food safety and its influencing factors, grain security warning and the coping strategies of the international organizations [1, 2].The existing methods about the research on the capacity of the food provision are classified into two categories: the food resources potential research starting from the natural productive forces [3, 4] and the analysis or prediction on actual output of the crop or food average per capita [5, 6]. While there were few researches on actual balance between supply and demand of food production combined with nutritional requirement level. Relevant research has been usually concentrated on the grain production capacity of farmland ecosystem. Actually, human's food source is much more than grain, also including oil, meat, milk, etc. Therefore products from animal husbandry, aquaculture and forestry are still the significant food sources. With the living standards rising and consumption structure changing, the capacity of food provision of ecosystems except farmland has been encouraged. As a result, consumption of grain ration per capita has reductive tendency while that of fruits, vegetables, livestock products, and aquatic products has increasing tendency [6]. Nevertheless, nutrients from different food sources vary widely. Therefore, the grain index as the only food safety evaluation criteria cannot meet the decision making demand. Food nutrient safety is the important content of the conception of food safety. Comprehensively grasping the history, current situation and future of Chengde's food provision and evaluating the capacity of Chengde's food provision from food nutrient perspective are the prerequisite for working out the regional development policies rationally.

## 16.2 Data Sources and Research Method

Data originate from Chengde statistic almanac. By using the more extensive food conception, that is, all kinds of human foods from different sources including products from animal husbandry, aquaculture, and forestry, this paper uses food nutrition transition model to calculate the available food nutrition supply capacity. According to the nutrition development aim for 2010 presented by Chinese Nutrition Society in The program for the development of China's food and nutrition (2001–2010), [7] with reference to the nutrient requirement criteria under different living standards of the residents, actual food supply capacity in Chengde can be calculated. Differences can be found out by comparing the actual food supply capacity in Chengde with that in China.

**Food Nutrition Transformation Calculation Model** Calculate according to the following food nutrition transformation calculation model [7], $NUTR_i = \sum M_j \cdot QN_{ij}$

In the expression, $NUTR_i$ is the total food nutrition of kind $i$, which comes from the main food products(heat: kcal, protein: kg, fat: kg); $i = 1, 2, 3$, represent heat, protein, fat respectively; $M_j$ is the total food products of kind $j$ (kg); $j = 1, 2, 3,...,n$, $n$ is the kinds of food products; $QN_{ij}$ is the conversion coefficient the food nutrition of kind $i$ change from the food product of kind j(heat: kcal/kg, protein: kg/kg, fat: kg/kg).

**Table 16.1** Nutrition requirements per-capita per day under different living standards

| Living standards | Heat/(kcal) | Protein/(g) | Fat/(g) |
|---|---|---|---|
| Subsistent | 2289 | 77 | 67 |
| Well-off | 2295 | 81 | 67.5 |
| Rich | 2347 | 86 | 72 |

**Food Supply Capacity Calculation Model** In the 1990s, China's Medium and Long Term Food Development Research Team presented the goals for Chinese people's meal nutrition and the main food consumption in the subsistent, bounteous, moderately well-off, rich four stages according to the actual condition of our country [8]. Furthermore, some scholars also provided a different classification of living standard of China from different aspects and set the reference nutrition value [7]. Compared with the above designated standard and combined the requirements of establishing general a well-off society of China which was emphasized in the 17th National Congress of the Communist Party of China, people's living standard in China is classified into three grades from low to high: subsistent model, well-off model, rich model. The nutrient substance requirement data of different models are in Table 16.1. According to the acceptable daily intake of the three kinds of nutrients according to different living standards, the population feeding capacity of China can be calculated.

$$NUTR_i = \sum M_j \cdot QN_{ij} \tag{16.1}$$

In the expression, $FP_i$ is the food supply capacity (person); $F_i$ is the main food products ($i = 1, 2, 3$, represent heat, protein, fat respectively, heat: kcal, protein: kg, fat: kg); $F_{pi}$ is the food consumptive level (kcal/person, kg/person).

## 16.3 Result Analysis

**The Food Supply Capacity of Farmland Ecosystem** Farmland ecosystem is the main food source for people. This paper has cultivated the food output of forty kinds of land crops from the farmland ecosystem (including grain crops, beans, potatoes, oil crops, vegetables, edible fungi, melon and fruit, greenhouse vegetables). According to Composition of Food Table in China compiled by Institute of Nutrition and Food Safety of Chinese Center for Disease Control and Prevention, the output of main crops of farmland ecosystem, through being substituted into the expression (16.1), is *converted* to three major nutrient content quantities. Table 16.2 is the results of food supply from farmland ecosystem during 2001–2008.

**The Food Supply Capacity of Grassland Ecosystem** Grassland is one of the most important ecosystems on land, and is also the main food source for people. It mainly produces pasture grass and provides meat products and dairy products, etc.

**Table 16.2** Food provision of cropland in Chengde

| Years | Heat/($10^8$ kcal) | Protein/(t) | Fat/(t) |
|---|---|---|---|
| 2001 | 28384.44 | 90342.49 | 30806.04 |
| 2002 | 23935.62 | 77282.14 | 26654.13 |
| 2003 | 20084.71 | 67197.26 | 21746.48 |
| 2004 | 34791.14 | 113765.85 | 41005.56 |
| 2005 | 38053.56 | 127282.48 | 44986.30 |
| 2006 | 37888.52 | 128704.83 | 43790.71 |
| 2007 | 40516.09 | 136637.76 | 45859.65 |
| 2008 | 45229.71 | 151589.94 | 52461.56 |

The output of main products of grassland ecosystem, through being substituted into the expression (16.1), is converted to three major nutrients content quantities (heat, protein, fat). Table 16.3 is the results of food supply from grassland ecosystem during 2001–2008. In 2008, the main food production quantity from grassland ecosystem in Chengde is converted to $9.43 \times 10^{11}$ kcal of heat, 62.2 thousand ton of protein, 69.7 thousand ton of fat. These nutrients can supply 1.13 million, 2.10 million, and 2.83 million people, respectively to reach a well-off standard of living. It is clear that fat of food from grassland ecosystem is substantial and it can compensate the insufficiency of that from farmland ecosystem. Compared 2008 with 2001, the supply of heat and protein of food from grassland ecosystem in Chengde has risen by 6.93 and 23.33 %, but that of fat has dropped by 3.54 %. That is because beef production, chicken production and milk production in 2008 has risen by 26.14, 82.16, and 66.91 %, respectively, but high fat pork production has dropped by 27.78 %.

**The Food Supply Capacity of Aquatic Ecosystem** Productive activities of aquatic ecosystem include halieutics and aquaculture of inland waters. According to the conversion coefficients of the different aquatic products (Composition of Food Table in China as the reference), through being substituted into the expression (16.1), three major nutrient content quantities are converted. Table 16.4 is the results of food supply from aquatic ecosystem during 2001–2008 in Chengde. It is clear that food supply capacity from aquatic ecosystem is lower but has rising tendency.

**Table 16.3** Food provision of grassland in Chengde

| Years | Heat/ ($10^8$ kcal) | Protein/(t) | Fat/(t) |
|---|---|---|---|
| 2001 | 8780.70 | 47699.58 | 72198.21 |
| 2002 | 9402.00 | 53076.79 | 76190.77 |
| 2003 | 10056.74 | 57078.42 | 81017.03 |
| 2004 | 10734.29 | 61112.62 | 86178.01 |
| 2005 | 11537.32 | 66033.79 | 92201.21 |
| 2006 | 12689.79 | 73168.52 | 100862.02 |
| 2007 | 7890.98 | 50788.83 | 59237.89 |
| 2008 | 9434.41 | 62213.64 | 69728.37 |

**Table 16.4** Food provision of aquatic in Chengde

| Years | Heat/($10^8$ kcal) | Protein/(t) | Fat/(t) |
|---|---|---|---|
| 2001 | 41.06 | 663.69 | 154.18 |
| 2002 | 43.62 | 705.28 | 163.73 |
| 2003 | 46.01 | 743.82 | 172.71 |
| 2004 | 68.94 | 1114.71 | 258.75 |
| 2005 | 122.46 | 1986.79 | 457.12 |
| 2006 | 230.55 | 3733.10 | 863.35 |
| 2007 | 196.29 | 3177.77 | 735.20 |
| 2008 | 209.25 | 3387.64 | 783.77 |

**Table 16.5** Food provision of forest in Chengde

| Years | Heat/($10^8$ kcal) | Protein/(t) | Fat/(t) |
|---|---|---|---|
| 2001 | 1728.37 | 1685.49 | 1200.39 |
| 2002 | 1918.87 | 1745.23 | 1192.20 |
| 2003 | 2153.17 | 2274.02 | 1456.71 |
| 2004 | 3083.08 | 3234.26 | 1918.93 |
| 2005 | 4174.65 | 6515.42 | 7596.60 |
| 2006 | 5151.31 | 7573.24 | 7517.50 |
| 2007 | 6402.73 | 9308.15 | 8552.78 |
| 2008 | 6989.11 | 9992.72 | 9968.28 |

**The Food Supply Capacity of Forests Ecosystem** Forest ecosystem is the biggest land ecosystem on land. Compared with other ecosystems on land, it has the most complicated constitution, the most completed structure, the vigorous energy transformation and nutrient cycling, so its biological productivity is the highest and ecological effect is the strongest. Forest can provide not only abundant wood and various forest by-products but also play an important role in maintaining biosphere stability, improving the ecological environment, etc. During 2001–2008, the forest coverage in Chengde is 43.8–48.56 %. According to the different forest products (such as edible forest products), through being substituted into the expression (16.1), three major nutrient content quantities are obtained. Table 16.5 is the results of food supply from forest ecosystem during 2001–2008 in Chengde. It is clear that food supply capacity from forest ecosystem has obvious rising tendency.

## 16.4 The Total of Food Supply and its Sustaining Population in Chengde

**The Total of Food Supply in Chengde** The aggregate supply of food nutrition content from various types of ecosystems (cropland, grassland, aquatic, forests) in Chengde can be added algebraically to obtain the actual aggregate supply of food nutrition content during 2001–2008 (Table 16.6).

**Table 16.6** Total actual food provisions of Chengde

| Years | Heat/($10^{12}$ kcal) | Protein/(ten thousand t) | Fat/(ten thousand t) |
|---|---|---|---|
| 2001 | 3.893 | 14.039 | 10.436 |
| 2002 | 3.530 | 13.281 | 10.420 |
| 2003 | 3.234 | 12.729 | 10.439 |
| 2004 | 4.868 | 17.923 | 12.936 |
| 2005 | 5.389 | 20.182 | 14.524 |
| 2006 | 5.596 | 21.318 | 15.303 |
| 2007 | 5.501 | 19.991 | 11.439 |
| 2008 | 6.186 | 22.718 | 13.294 |

Taking 2008, for example, the actual food supply capacity in Chengde has $6.186 \times 10^{12}$ kcal of heat, 227.18 thousand tons of protein, 132.94 thousand tons of fat. According to China's development goals in 2010 suggested by the Chinese Nutrition Society (on the basis of *Social Blue Book in 2010* published by the Sociology Institute of Chinese Academy of Social Sciences), the food and nutritional needs can be worked out (Table 16.7).

The total supply of heat, protein, and fat has reached and exceeded the total social demand in 2008. In 2008, calculated by comparatively well-off standard of living, the total food demand of Chengde holding the proportions of the total food supply are 50.02 % of heat, 48.07 % of protein, and 68.46 % of fat. While calculated by rich standard of living, those are 51.15 % of heat, 51.04 % of protein, and 73.02 % of fat.

From the point of view of food supply structure, taking 2008, for example, corn supply holding the proportions of farmland ecosystem are 66.89 % of heat, 51.83 % of protein, and 65.42 % of fat, holding the proportions of the total food supply are 48.91 % of heat, 34.58 % of protein, and 25.81 % of fat. Pork supply holding the proportions of grassland ecosystem are 52.85 % of heat, 26.78 % of protein, and 66.98 % of fat, holding the proportions of the total food supply are 8.06 % of heat, 7.33 % of protein, and 35.13 % of fat. Fish supply holding the proportions of aquatic ecosystem are 98.41 % of heat, 98.15 % of protein, and 98.83 % of fat, holding the proportion of the total food supply is very small. Chinese chestnut supply holding the proportions of forests ecosystem are 22.83 % of heat, 36.25 % of protein, and 6.06 % of fat, holding the proportions of the total food supply are 2.58 % of heat, 1.59 % of protein, and 0.45 % of fat. Apple supply holding the proportions of forests ecosystem are 22.47 % of heat, 6.04 % of protein, and 6.06 % of fat, holding the proportions of the total food supply are

**Table 16.7** Total food demand of Chengde in 2008

| Population | Living standard | Heat/($10^{12}$ kcal) | Protein/(ten thousand t) | Fat/(ten thousand t) |
|---|---|---|---|---|
| 3693810 | Subsistent | 3.086 | 10.381 | 9.033 |
| 3693810 | Well-off | 3.094 | 10.921 | 9.101 |
| 3693810 | Rich | 3.164 | 11.595 | 9.707 |

**Table 16.8** Population-providing-ability under different living standards (unit: 106 individuals)

| Years | Heat | | | Protein | | | Fat | | |
|---|---|---|---|---|---|---|---|---|---|
| | Subsistent | Well-off | Rich | Subsistent | Well-off | Rich | Subsistent | Well-off | Rich |
| 2001 | 4.660 | 4.647 | 4.544 | 4.995 | 4.749 | 4.472 | 4.267 | 4.236 | 3.971 |
| 2002 | 4.225 | 4.214 | 4.121 | 4.725 | 4.492 | 4.231 | 4.261 | 4.229 | 3.965 |
| 2003 | 3.871 | 3.861 | 3.775 | 4.529 | 4.305 | 4.055 | 4.269 | 4.237 | 3.972 |
| 2004 | 5.827 | 5.811 | 5.683 | 6.377 | 6.062 | 5.710 | 5.290 | 5.251 | 4.922 |
| 2005 | 6.450 | 6.433 | 6.291 | 7.181 | 6.826 | 6.429 | 5.939 | 5.895 | 5.527 |
| 2006 | 6.698 | 6.680 | 6.532 | 7.585 | 7.211 | 6.791 | 6.258 | 6.211 | 5.823 |
| 2007 | 6.584 | 6.567 | 6.421 | 7.113 | 6.762 | 6.369 | 4.678 | 4.643 | 4.353 |
| 2008 | 7.404 | 7.385 | 7.221 | 8.083 | 7.684 | 7.237 | 5.436 | 5.396 | 5.059 |

2.54 % of heat, 0.27 % of protein, and 0.45 % of fat. Hawthorn supply holding the proportions of forests ecosystem are 29.10 % of heat, 10.71 % of protein, and 12.89 % of fat, holding the proportions of the total food supply are 3.29 % of heat, 0.47 % of protein, and 0.97 % of fat. Wild almond and the big flat (the sweet almond that is home-grown almond) supply holding the proportions of forests ecosystem are 11.98 % of heat, 33.47 % of protein, and 68.48 % of fat.

It is clear that corn and pork are the main sources of food supply, holding the proportions of the total food supply are 56.97 % of heat, 41.94 % of protein, and 60.94 % of fat. Chinese chestnut, apple, hawthorn, are the main sources of food supply from forests ecosystem, holding the proportions of forests ecosystem are 86.38 % of heat, 86.48 % of protein, and 93.49 % of fat. The fat supply of wild almond and the big flat (a sweet home-grown almond) holds the proportions of that from forests ecosystem is 68.48 %.

**The Population Sustained By Food in Chengde** By using the total food supply in Chengde (Table 16.6), combing nutritional components under different living standards and the food supply capability model in 2.2, we can get the population-providing-ability under different living standards (Table 16.8). The three nutrient supplies are enough, but the capability is different. Among them the protein supply capability is the strongest and it can supply a population of 4.472–8.083 million. The fat supply capability is the weakest and it can supply a population of 3.971–5.436 million and it rose to a subsistence level of 5.436 million in 2008. As a matter of fact, at present the cooking oil in Chengde is mainly imported from other areas and the market supply is vulnerable to regional markets. Therefore there is a great need to main the planting areas and production of oil crops and to pay enough attention to improving the fat supply capability.

**The Food Source in a Proportion of the Total Supply** If we average the proportion of the three food nutrients (heat, protein, and fat) from the four ecosystems, we get the average proportion of the food supply from the four ecosystems (Fig. 16.1). The farmland ecosystem maintains a dominant place for a long time in the food supply accounting for an average of 54.31 % from 2001 to 2008, high above the countrywide level. The grassland ecosystem accounts for an average of 40.37 % which is far above the countrywide average level. The aquatic

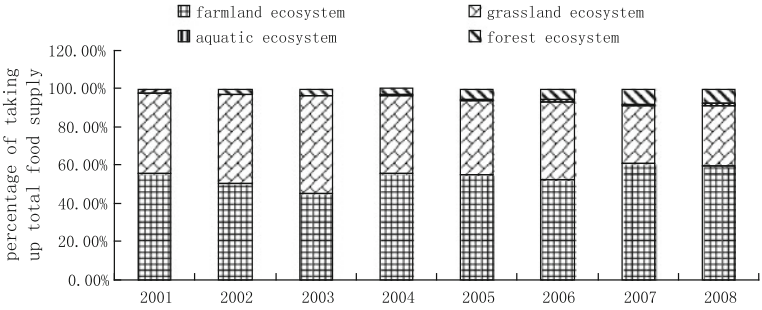


**Fig. 16.1** Food provision percentage of each food source

**Table 16.9** Comparison of the average food provision of ecosystems from 2001 to 2004

| | Average level in China | | | Average in Chengde | | |
|---|---|---|---|---|---|---|
| | Heat/($10^4$ kcal) | Protein/ (kg) | Fat/ (kg) | Heat/($10^4$ kcal) | Protein/ (kg) | Fat/ (kg) |
| Farmland ecosystem | 101.34 | 31.70 | 13.21 | 74.77 | 24.31 | 8.38 |
| Grassland ecosystem | 2.37 | 2.22 | 1.65 | 27.18 | 15.27 | 22.01 |
| Aquatic ecosystem | 3.48 | 5.65 | 0.91 | 0.14 | 0.22 | 0.05 |
| Forest ecosystem | | | | 6.19 | 0.62 | 0.40 |

ecosystem accounts for a small proportion with 0.53 % in average. The forest ecosystem accounts for a small proportion at first with 2.63 % in average in 2001. The growth has been accelerated since 2005 and reached 7.92 % in 2007. Generally , the proportion of the forest products has been growing and the growth has been accelerated in recent years (Fig. 16.1).

**Comparison of Food Supply Capability between Chengde and China** Comparing the average food supply capability of all ecosystems from 2001–2004 in Chengde with that in China, we can get Table 16.9.

From Table 16.9 we can see, the food nutrients (heat, protein, and fat) for each person on average from the farmland ecosystem in Chengde are lower than that of the countrywide average level. And that from the grassland is far above the countrywide average level. And that from the aquatic ecosystem is far below the countrywide average level.

## 16.5 Conclusion and Discussion

The heat and protein supply from the farmland ecosystem is sufficient while the fat supply is deficient. So the fat supply capability of the grassland ecosystem is relatively strong enough to compensate the deficiency of fat supply from the

farmland ecosystem. The farmland ecosystem maintains a dominant place for a long time in the food supply accounting for an average of 54.31 % from 2001 to 2008. The grassland ecosystem accounts for an average of 40.37 % which is far above the countrywide average level. The aquatic ecosystem accounts for a small proportion with 0.53 % in average. The forest ecosystem accounted for a small proportion at first with 2.63 % in average in 2001. The growth has been accelerated since 2005 and reaches 7.92 in 2007. Generally , the proportion of the forest products has been growing and the growth has been accelerated in recent years.

In terms of the total food supply and the total supporting population, the supply of the three major nutrients is superabundant, while the capability differs. Among them, the protein supply capability is the strongest and can supply 4.472–8.083 million people. And the fat supply ability is the weakest and can supply 3.971–5.436 million people. In terms of the food structure, corn and pork are the main food supply resources, accounting for 56.97 % in heat, 41.91 % in protein, and 60.94 % in fat of the total food supply.

Compared with China's per capita food supply capability, the per capita food supply capability of the three nutrients from the farmland ecosystem in Chengde is lower with that from the grassland ecosystem high above and that from the aquatic ecosystem far below.

Chengde should vigorously develop corn processing and export products, improving the added value of the products. By making full use of the location advantage, Chengde should increase the production of buckwheat, naked oats, and other non-pollution products. Chengde should increase the pork exports, aquatic product imports and make great efforts to increase the output from the aquatic ecosystem. It should also continuously increase the production of the ten leading agricultural products like edible fungus and potatoes and provide non-pollution, high quality, and safety products. It should protect the forest ecosystem and meanwhile continue to increase the supply of forest food, develop chestnut exports and the deep processing of hawthorn, mountain almond and apricot, and related industry. It also should improve the living standard of its people and the nutrient structure.

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# Chapter 17
# Modeling of Three-Dimensional Dynamical Behavior of Ropes Used in Fishery Based on *R* Language

**Yuwei Li, Xinfeng Zhang, Xiaorong Zou, Min Zhang and Yingqi Zhou**

**Abstract** Ropes are widely used in various kinds of fishing gear. In this paper, a numerical method is presented which is competent in predicting the three-dimensional dynamic behavior of cables. The dynamic behavior of cables were simulated using dynamical equations and *R* language. The method was based on the lump-mass and spring model and the implicit algorithm was applied to solve the stiff differential equations. The mathematics-mechanical analysis was provided on the basic characteristics of the model. The *R* platform was used in programming, simulation, and visualization of the results. The three-dimensional dynamic behavior of cables in different examples were presented successfully and verify the effectiveness of this method, and the motion process was consistent with the observed data in the ocean.

**Keywords** Numerical simulation · R language · Lump-mass and spring method · Implicit algorithm

## 17.1 Introduction

Ropes are the basic composition of fishing gear system and aquaculture facilities. Ropes are affected by different forces caused by some factors such as currents, water waves, subsurface turbulences in the ocean environment, and will change

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their shapes correspondingly. The dynamic behavior of ropes are nonlinear greatly, therefore would be only simulated by numerical methods. In recent years, there are mainly two ways to analyze the dynamic behavior of ropes. The two methods are based on the water tank experiments or in actual waters and numerical approaches. The numerical approaches included analytical solution, finite element method, and lump-mass and spring method [1, 2]. The first method could only get closed-form solution and be suitable for the simple static problems [3, 4]. The second method is traditionally suitable for the simple static and quasi-static problems and essentially unsuitable for solving nonlinear dynamical problem [5]. These two methods are mainly applied to analyze the static analysis.

The lump-mass and spring method was first presented by Walton and Polacheck in 1960 [6]. Since then, this method was applied in under-water mooring, towing, and hydrodynamic analysis. Huang described the three-dimensional shape of marine cables [7]. Wang applied lump mass method to study the dynamic analysis of two-dimensional changeable length cable [8]. Zhu et al. described the three-dimensional dynamic performance of marine cables [9]. But, the computation of these models are too complicated and very different to understand. In these models, the coordinated systems are mainly the local coordinate systems and must be converted. The nonlinear different equations are very difficult to solve and too huge. And most of these equations are solved by the explicit method such as the Runge–Kutta Method. For solving these stiff equations using the explicit method, the step size must be very small. However, these stiff equations solving by the explicit method are less stable and accurate than the implicit method. Most of these models have not considered the stiffness, which affects the step size and stability [10]. There are few papers to describe the dynamic behavior of ropes in fishery and because of the particularity of ropes with their twist, lateral resistance must be considered.

R is a scripting language for statistical data manipulation and analysis. It was inspired by, and is mostly compatible with, the statistical language *S* developed by AT&T [11]. *R* is free and many people are contributing to its development. Because of the high calculation performance, Berend Hasselman has developed a Package 'nleqslv' to solve these nonlinear and stiff equations [12]. But for the higher-order and stiff differential equations, there is some weakness. Zhang et al. described the part behavior of purse seine using *R* language [13]. There are few papers which describe the ropes used in fishery.

In this paper, we established the mathematics-mechanical models with the lump-mass and spring method to simulate the ropes in three dimensions (3D).The *R* platform was used to programme the complicated mathematical computation with the implicit method. The visualization of the 3D motion process was done by the *R* package '3D Real-Time Visualization Device System (RGL) for *R*'. The results of calculation were corresponding with the observed data in the ocean. The validity of this model was verified.

## 17.2 Methods

### 17.2.1 Numerical Modeling of Ropes

In this paper, ropes can be modeled as a finite number of lump mass points which are interconnected with springs without mass. And there was an assumption that no external forces exist on springs. There was only the tension force acted on springs. Generally, the ropes were regarded as the smooth cylinder. Due to the particularity of ropes used in fishery, we must consider the twist such as the warp in the trawl net. When the current flowed around the rope, the twist could cause the lateral resistance. In the water, the vortices induced vibrations which dissipated energy and increased global cable drag. Hence, we must consider the influence of the vortices on the drag coefficient. We considered gravity, buoyancy, and hydrodynamic force (drag force, lift force lateral resistance) acted on the lump mass points.

### 17.2.2 Equations of Mechanical Models

It was assumed that the ropes were in a state with spatial-temporally uniform current flow. Based on the Newton second law, the motion of point $i$ could be expressed as follows:

$$M_i a = \vec{T} + \vec{F} + \vec{W} + \vec{B} \tag{17.1}$$

where $a$ is the acceleration vector; $T$ is the tension force; $F$ is the hydrodynamic force exerted on the rope including drag force, lift force and lateral resistance; $W$ is the gravity force; $B$ is the buoyancy force, and $M$ is the mass of point $i$ including the added mass.

Each rope element was assumed to be a cylindrical element (Fig. 17.1). It was assumed that the angle between current and the rope is $\alpha$. There is a spring between neighboring points, based on the Hooke' law, the tension $T$ can be described as

$$T_{ij}| = \begin{cases} k \cdot \left(l_{ij} - l_{0ij}\right) & l_{ij} > l_{0ij} \\ 0 & l_{ij} \le l_{0ij} \end{cases} \tag{17.2}$$

where, $k$ is the stiffness of the rope. $l_{0ij}$ and $l_{ij}$ are the original length and deformed length between mass points $i$ and $j$, respectively.

Hence, the fluid dynamical coefficients in all directions are different. Then the drag force ($R_D$), lift force ($R_L$) and lateral resistance ($R_S$) can be expressed as:

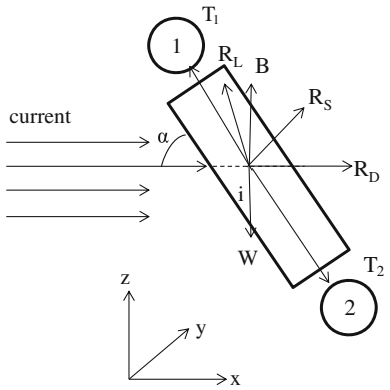


**Fig. 17.1** The schematic diagram of numerical model

$$
\begin{aligned}
R_D &= -\frac{1}{2} \cdot C_D \cdot \rho \cdot S \cdot V^2 \\
R_L &= -\frac{1}{2} \cdot C_L \cdot \rho \cdot S \cdot V^2 \\
R_S &= -\frac{1}{2} \cdot C_S \cdot \rho \cdot S \cdot V^2
\end{aligned} \tag{17.3}
$$

where, $C_D, C_L$ and $C_S$ are drag force coefficient, lift force coefficient and lateral resistance coefficient, respectively. The first two coefficients are decided by the angle between the current and the rope. The last coefficient is decided by the angle between the current and the rope and twist angle of the rope. $\rho$ is the water density; $S$ is the cross section area of the rope, $V$ is the relative velocity between current and the rope.

The motion of the $i$-th lump mass point can be expressed as:

$$
\begin{cases}
M_i \ddot{x}_i = (T_x + R_{Dx} + R_{Lx} + R_{Sx}) \\
M_i \ddot{y}_i = (T_y + R_{Dy} + R_{Ly} + R_{Sy}) \\
M_i \ddot{z}_i = (T_z + R_{Dz} + R_{Lz} + B_i - W_i + R_{Sy})
\end{cases} \tag{17.4}
$$

Hence, (17.4) can be changed into ordinary differential equations:

$$
\begin{aligned}
\ddot{x}_i &= f(x_i, y_i, z_i, \dot{x}_i, \dot{y}_i, \dot{z}_i, x_1, y_1, z_1, x_2, y_2, z_2; t) \\
\ddot{y}_i &= g(x_i, y_i, z_i, \dot{x}_i, \dot{y}_i, \dot{z}_i, x_1, y_1, z_1, x_2, y_2, z_2; t) \\
\ddot{z}_i &= h(x_i, y_i, z_i, \dot{x}_i, \dot{y}_i, \dot{z}_i, x_1, y_1, z_1, x_2, y_2, z_2; t)
\end{aligned} \tag{17.5}
$$

### 17.2.3 Programming and Algorithm

The Eqs. (17.5) is the implicit and high-order ordinary differential equations. For resolving directly in $R$, we use the intermediate variables such as $\dot{x}_i = q_i, \dot{y}_i = u_i, \dot{z}_i = h_i$. Then (17.5) could be converted to first-order differential equations:

$$\begin{aligned}
\dot{q}_i &= f(x_i, y_i, z_i, q_i, u_i, h_i, x_1, y_1, z_1, x_2, y_2, z_2; t) \\
\dot{u}_i &= g(x_i, y_i, z_i, q_i, u_i, h_i, x_1, y_1, z_1, x_2, y_2, z_2; t) \\
\dot{h}_i &= h(x_i, y_i, z_i, q_i, u_i, h_i, x_1, y_1, z_1, x_2, y_2, z_2; t)
\end{aligned} \tag{17.6}$$

The backward Euler method was used to calculate (17.6). There is an assumption that the total time t of the motion of rope is divided into $M$ steps, $n \leq M$. And d$t$ is time step and d$t = t[n+1] - t[n]$. Hence, the improved Euler method was used to solve the equation (17.6). And the improved Euler method is expressed as:

$$\begin{aligned}
x_i[n+1]^{[k+1]} &= x_i[n] + \frac{dt}{2} \times (q_i[n] + q_i[n+1]^{[k]}) \\
y_i[n+1]^{[k+1]} &= y_i[n] + \frac{dt}{2} \times (u_i[n] + u_i[n+1]^{[k]}) \\
z_i[n+1]^{[k+1]} &= z_i[n] + \frac{dt}{2} \times (h_i[n] + h_i[n+1]^{[k]}) \\
q_i[n+1]^{[k+1]} &= q_i[n] + \frac{dt}{2} \times (f_i(n) + f_i(n+1)^{[k]}) \\
u_i[n+1]^{[k+1]} &= u_i[n] + \frac{dt}{2} \times (g_i(n) + g_i(n+1)^{[k]}) \\
h_i[n+1]^{[k+1]} &= h_i[n] + \frac{dt}{2} \times (h_i(n) + h_i(n+1)^{[k]})
\end{aligned} \tag{17.7}$$

where $k$ is the $n$-th step of iterations in implicit Euler iterative calculation. And all the programming and the calculation of the models are completed in the R platform. We use the Think Workstation D10 to solve these equations at all points.

### 17.2.4 Simulation

In this paper, we considered two examples. The first example was that the ends of the rope were fixed. The second example was that one end was fixed at the boat and the other end was free end. And the boat towed the rope in the water. Then we used the above described method to simulate these two examples.

## 17.3 Visualization of the Results

After modeling and programming the rope in two examples using the implicit algorithm in *R* platform. The package of 3D Real-Time Visualization Device System for *R* (RGL) was used to visualize the results and display the three-dimensional dynamical behavior of the rope vividly. The results of the simulation and visualization display the motion process from the initial position to the stabilized state (Figs 17.2, 17.3 and 17.4).The calculation results were accord with the observed data in the water. Compared with the results of sun [14], the results of the second example were very coincident. Due to space limitation, we can only give some important images to display the motion process. The results show that

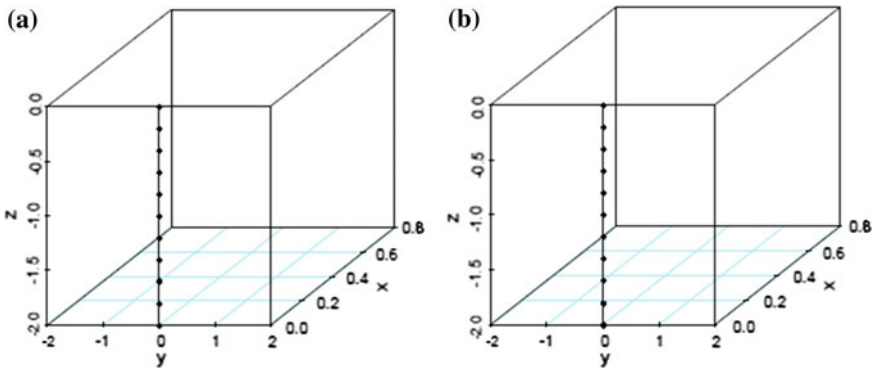


**Fig. 17.2** The initial shape of the rope (**a** the first example and **b** the second example)

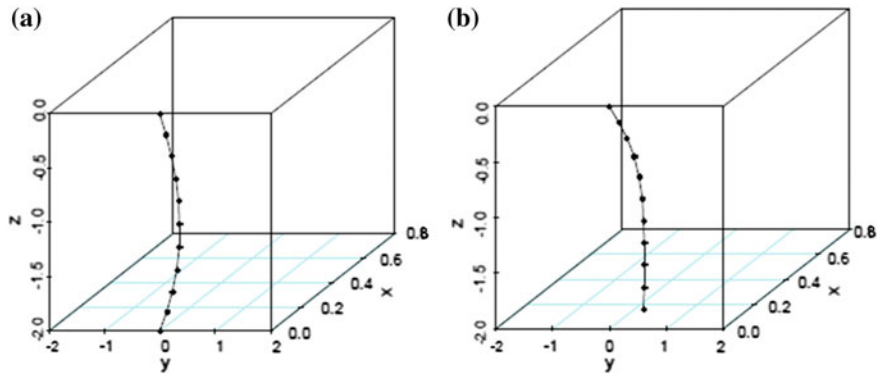


**Fig. 17.3** Beginning to expand by the current (**a** the first example and **b** the second example)

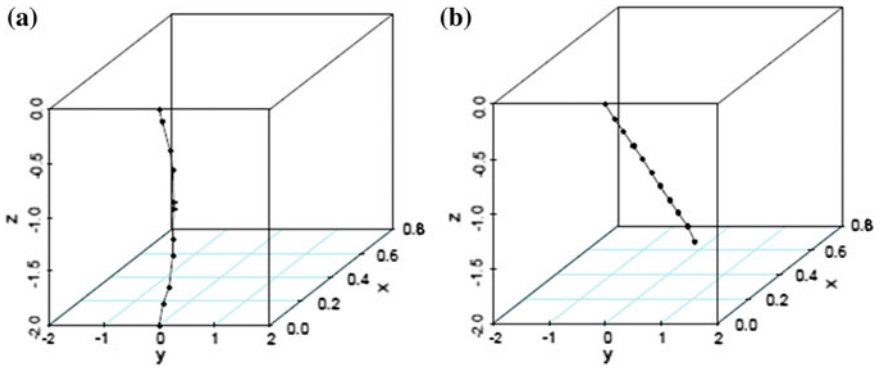


**Fig. 17.4** The stabilized state of part of rope (**a** the first example and **b** the second example)

lump-mass and spring method, implicit algorithm and *R* language can be used together to solve complicated engineering system such as the midwater trawl system and aquaculture facilities.

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# Part III
# Information Management and Applications

# Chapter 18
# Study on Specific Enzymes in *Actinidia Arguta* Fruit Softening

**Shuqian Li, Changjiang Liu, Guang Xin and Bo Zhang**

**Abstract** *Actinidia Arguta* fruit postharvest softening has two phases: the first stage, softening faster plays a main role with the phases of amylase enzymes seven: the Second stage softening slowly, has the main effect since the phases of enzymes are together with more than half of lactose hyaluronic acid enzymes. Ethylene release promotes the role of fruit softening protective enzyme peroxidase, catalane appears in late fruit softening, so no fruit softening in the phases of enzyme specificity.

**Keywords** Specific enzymes · *Actinidia Arguta* · Fruit softening

## 18.1 Introduction

Kiwi (*Actinidia SPP*.) is introduced to the New Zealand from their origin in China and then as a successful fruit crops developed world trade in the twentieth century. *Actinidia Arguta* (green to kiwi) and a (yellow kiwi) are two kiwi kind of commercial cultivated varieties. Recently, a new cultivation, *Actinidia Arguta*, has become a commercial of kiwi fruit-producing in several countries, including New Zealand. Fruit *Actinidia Arguta* thankful for their rich flavor consumers, especially for their small grape size and smooth, glabrous, edible skin. *Actinidia* of a wide range of species diversity and a rich genetic resources, it provides great continues

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to improve and enhance the sustainability of potential varieties of kiwi fruit industry of the world. Although all business kiwi fruit varieties can use at present traditional breeding has developed technology, considerable progress to promote the adoption of the breeding programmes kiwi a series of molecular tools and biotechnology. Recently, a large data sets 132577 *Actinidia* said sequence tags (est), mainly from four *Actinidia* species (*Actinidia prawns, a, a, a deliciosa arguta eriantha*) have been released. Genomics method, the function of the gene that system functional genomics methods in model plant *arabidopisis thaliana*, etc., the use of *Actinidia* gene three varieties of improvement, has become a very attractive prospect [1, 2].

Gene function analysis model plant species some limitations especially if model lack of specific biochemical pathway or development process of candidate genes are expected to participate. This requirement, clarify this kind of the function of the gene, conversion system are interested in plant species must establish transformants generate stable in a highly efficient, reliable, and renewable method. Agriculture conversion is a perfect method for transferring specific gene into a wide range of species of plants. Kiwi fruit varieties conversion agreement has already *Actinidia deliciosa* report, *Actinidia shrimp* and *Actinidia eriantha*. The root agrobacterium-mediated strains were out obvious differences in their ability, this article to all sorts of factory transfer species and a more use four root cancer agrobacterium-mediated strains show that strain EHA105 generated transformants the highest percentage, in the *Actinidia* to [3, 4]. Other factors, including the influence of *Actinidia* conversion efficiency contrast type, regeneration and transition conditions and *Actinidia* species. Meeting et al. won 26–62 % of the transformation frequency use hypcotyl and 3-mm stem section from *Actinidia deliciosa*, incubation and *Actinidia* EHA101 farming. Fraser found that all test (to *Actinidia Actinidia* genotype and *a. deliciosa*) is a response to a range of tissue culture conditions and relatively easy to renewable agreement. Compared to other woody species, such as apple and orange, relatively high interest rates and regeneration of conversion got *Actinidia deliciosa* and *Actinidia* it to. However, *Actinidia* lower interest rates *eriantha* display regeneration and conversion. The fruit of *Actinidia Arguta* is very unique flavor and fragrance [5]. Recently, 7,257 est get fruit and flower petals *Actinidia Arguta*. As a part of the functional genomics approach to understanding *Actinidia Arguta* smell and taste, a varieties tested conversion system the species, but the result is disappointed, because Browning and considerable necrosis occurs in shoot regeneration stage conversion. In the application of *Actinidia eriantha* development conversion agreement *Actinidia Arguta*, a considerable degree of comparative observation Browning. This led to a few callus get it, although confirmed as transformants b-glucuronidase (gus) activity dyeing, these callus gradually became brown died. No shoot regeneration reached in these trying (king, unpublished data) [6]. Here, we the reason for the investigation and callus tissue culture in Browning and/or necrosis agriculture *Actinidia Arguta* during this process, we showed the said, by reducing the basal salt concentration of media combined with light intensity decreased, an effective and renewable system many kinds of exogenous *arguta Actinidia* can be

realized. To develop this reliable and strong conversion system will greatly help understand genetic function in this it bizarre fruit species [7].

## 18.2 Materials and Methods

Winter-dormant *Actinidia Arguta* the cane genotype K2D4 collection plants and food research orchard in Te vomit, New Zealand. Establish the in vitro organization culture [8].

EHA105 root carcinoma strains agrobacterium-mediated, harbor binary plasmid pART27-10, are used in *Actinidia Arguta* conversion. This paper pART27-10 of the plasmid carrying CaMV 35 promoter-driven uidA gene (including a tobacco yellow dwarf virus insert) monitoring GUS expression and a promoter-drivenn eomycin phosphor transferase nopaline synthase ii (nptII) antibody gene kanamycin [9].

An amount of 15 ml of LB liquid medium (Miller's LB broth base; Invitrogen) containing 100 mg $l^{-1}$ spectinomycin dihydrochloride was inoculated with Agrobacterium tumefaciens EHA105 (pART27-10) and grown in an orbital shaker (Gallenkamp, UK) at 250 rpm and 28 °C overnight. Bacterial cells were pelleted at 5,000 g for 10 min, and then resuspended in 10 ml Murashige and Skoog (MS) liquid medium (MS basal salts and vitamins plus 2 % sucrose) supplemented with 100 lM acetosyringone. Young leaves from in vitro grown shoots were excised into approximately 398 mm leaf strips. Leaf strips were immersed immediately into Agrobacterium suspension cultures for 30 min then blotted dry with sterile filter paper (Whatman; Schleicher and Schuell). Inoculated leaf strips were transferred onto co-cultivation medium M1 and incubated at 24 °C ± 2, 16 h photoperiod with cool white fluorescent light (*36 lmol $m^{-2}$ $s^{-1}$, except for the experiment of the influence of light intensity) for 2 days. After cocultivation, the leaf strips were transferred to a range of regeneration and selective media depending on different experiments. Each Petri dish (90 mm diameter) accommodated 30 leaf strips. There were three replicates per treatment resulting in 90 leaf strips for each treatment. Three experiments were carried out to investigate the optimum culture medium and conditions for transformation of *Actinidia Arguta*. The influence of light intensity was investigated using three different light conditions: direct light (36 lmol $m^{-2}$ $s^{-1}$), indirect light (3.4 lmol $m^{-2}$ $s^{-1}$) and darkness, respectively (light intensity was measured with Quantum/Radiometer/Photometer; L1-COR). The influence of basal salts was investigated using five levels of strength of MS (Murashige and Skoog 1962) basal salts and vitamins (Duchefa) applied to regeneration media M2– M6. The influence of plant growth regulators was investigated designing five combinations of plant growth regulators in the regeneration media M7– M11 to evaluate or optimise the transformation efficiency. In these experiments, leaf strips were cultured in regeneration medium M2 after cocultivation. Callus formation from the leaf strips was assessed 3 weeks after Agrobacterium cocultivation and the number of calli showing browning and/

or necrosis was determined 6 weeks after the inoculation. All treatments and cultures were subcultured to a fresh medium at 4-weekly intervals. The calli formed from the leaf strips in 3–5 weeks were excised individually and transferred to relevant medium treatments for further selection and regeneration. Adventitious buds initiated from the calli were excised individually and transferred to shoot elongation medium M12 plus 50 mg $l^{-1}$ kanamycin sulphate, 150 mg $l^{-1}$ Timentin. Elongated shoots were transferred to rooting medium M12 for root induction. Rooted transgenic plants were transplanted to 500-ml pots with potting mix composed of peat, pumice, and vermiculite and placed in a misting chamber for 3 weeks in a containment greenhouse. Plants were progressively acclimatized to ambient light and temperature conditions in the containment greenhouse [10].

## 18.3 Histochemical GUS Staining

Cocultivation 4 weeks, infected with leaves, induce injuries of the organization, the density of the regeneration buds and leaves and roots ZuHua analysis by for stable GUS dyeing expression of executive GUS solution ml-1 5-bromo-4-chloro-3-indolyl 1 mg indican acid (X-Gluc), 50 mM sodium (pH value of 7.0), and 20 % methanol (king et al. 2006). Organization was completely covered in gus dyeing solutions and training in 37 °C overnight. In order to remove the chlorophyll, the organization immersed in 70 % ethanol overnight before being photographed.

## 18.4 Polymerase Chain Reaction Analyses

Genomic DNA was isolated from young leaves of putative transgenic and control plants, grown in a containment greenhouse using QIAGEN DNeasy_ Plant Mini Kit (Qiagen) following the manufacturer's recommendations. The DNA samples were analysed by polymerase chain reaction (PCR) to detect the presence of the uidA and nptII genes using gene-specific primers. The primers for uidA were 50-AGTCGAATTCATGTTACGTCCTGTAGAAACC-30 and 50-AGTCAAGCT TTCATTGTTTGCCTCCCTGCTG-30; and for nptII were 50-AGAGGCTAT TCGGCTATGAC-30 and 50-CCATGATATTCGGCAAGCAG-30.PCR amplifications were performed according to the manufacturer's instructions (Expand High Fidelity PCR System; Roche) and contained *100 ng of genomic DNA, or*1 pg of the positive control plasmid pART27-10, using the following cycle conditions: an initial denaturation at 94 °C (2 min); with 35 cycles at 94 °C denaturation (30 s), 60 °C annealing (30 s), 72 °C extension (2 min); followed by a final extension at 72 °C (5 min). The expected sizes of the amplified products for the uidA and nptII genes were 1,809 and 542 bp, respectively.

## 18.5 Results and Discussion

In order to understand the light intensity in the influence of *Actinidia Arguta* Browning the haploid plants and callus, leaf strip, with the root cancer agriculture cocultivated EHA105 (pART27-10) were placed in three different light conditions, from cocultivation through to the regeneration process. No clear indication of Browning and/or necrosis spots appear on the leaf took three light conditions within 2 weeks of culture. From 3 weeks, callus formation callus initiated and new light green color in the summary node of the edge appear, the strip. The highest frequency callus formation appeared in indirect light treatment (3.4 lmol $ms^{-1}$), with 88.9 %. Callus formation of 66.7 % directly in the light of the under treatment (36 lmol $ms^{-1}$), only 56.6 % of the leaf blade long-lanceolate display callus formation in the darkness of the treatment. Article leaf for not cocultivated and root, direct light conditions (36 lmol $ms^{-1}$), callus formation rate is 73.3 %, slightly higher than the cocultivated treatment. Assessment of the progress of the conversion and callus tissue sample survey of different treatment ZuHua dyeing gus. The results show that, have a very high GUS in all positive treatment (data did not show), this shows that different illumination condition have no effect on the ability of the root cancer agrobacterium-mediated infection haploid plants. Brown and/or necrosis spots began to appear in rat or surface of callus in all the lighting conditions from week 4. Then, the severity of the Browning as time increases, when worsened by subcultured callus to a fresh medium. Most of the haploid plants or callus induction organization died in Browning and/or necrosis cocultivation within 6 weeks, although they fared slightly better of indirect light treatment, 88.9 % of the organization cultivating callus and show the Browning, compared with 93.3 and 97.8 % black chocolate directly light conditions. The infant flower opens its bud and no accidents have callus three light therapy. In contrast, only 24.4 % of as Agrobacterium-infected control and display rat callus induction Browning and 57.8 % of these calli-initiated the density of the bud.

Tissue culture in Browning is a common problem found in organizational culture, especially woody plant species. Browning usually occurs in the phenolic compounds filter and then become the oxidation. Oxidation in culture phytotoxic phenol medium can be induced to, cause necrosis, and ultimately die organization (Preece and Compton 1991). There are several different ways to overcome this problem, such as frequent subculture, adding antioxidants to the media reduce light condition and adjust the structure of the medium. W (2006) report, the Plumbago culture zeylanica keep downy light conditions (3–5 lmol $ms^{-1}$) show less than the growth in normal Browning light conditions (50 lmol $ms^{-1}$). It is in our findings, suggests that low light intensity of Actinidia conditions in the first saw off arguta Browning 3 weeks, and at the same time, improve co-cultivation callus induction and direct light or dark environment. Although Browning indirect light compared to reduce treatment, light and dark environment directly in the six-month culture, not an accidental bud get these therapy and all rat and callus turned completely brown, black within 2 months. In contrast, as Agrobacterium-infected control rat,

exposed to the light direct illuminate conditions, but not so serious Browning and 58.7 % of these of callus produce condemn the bud, show that the root or antibiotics are kanamycin selection in the media can damage health of affected tissue culture, they were more likely to Browning. Of salt media of satisfactory for the regeneration of many plant species lady; however, some salt concentration is too high or components can even for some plant species poisonous (Adams et al. 1979). Browning is observed tissue culture of tar in the medium (M2) lady root cocultivation after 4 weeks. However, in reducing salt medium basal lady, rat looks green, health and no Browning callus strength to reduce the salt media to mitigate the basement and ms a direct relationship between callus observations of the percentage of the strength of the basement and display Browning salt lady. For 5 MS basal salt advantage test, we found that low intensity of basement salt in the medium lady, in healthy tissue cultivation and callus seems to. In the tar basement salt medium lady, all rat and callus eventually become brown and death. In contrast, callus culture in 1/5-strength and basal lady medium induced salt Browning level minimum at 50 %. The number of haploid plants in 4/5–3/5 that Browning – 2/5– and 1/5–ms strengths basal salt media are 88.3, 61.7–55.3 and 50.0 %, respectively. However, in 1/5 rat basal salt production lady media callus less (28.3 %) than in 2/5 (41.7 %), 3/5 (40), and 4/5 (67 %), this means that reduce the basal salt concentration in induced callus cultivating can influence. Considering the both the sides of the balance Browning and callus induction tissue culture, the best power base salt lady should between 2/5 and 3/5, when the two basement salt media produced similar lady proportion (40 and 41.7 %) of the callus, and have a similar level of contrast Browning (61.7 % and 55.3). These are personal leaves from callus resection with and be transplanted into a new media (with the same concentration of basement salt and corresponding lady callus) further regeneration and choice. Add in the 2/5 and 3/5 basal salt treatment launched in power lady friend 23 changeable speed, respectively, 21.7 % . The percentage of the bud of by chance from the two methods of forming obviously higher than 1/5–4/5–strength and basal salt media lady, this is accidental friends in only 3.3 % and 6.8, respectively. The percentage of kanamycin-resistant and the product of the accidental buds of us in this room is calculated by dividing the number of the timing of the generation of bud (only one is calculated each tissue cultures) total haploid plants. Usually, more than one clump of callus is from a single leaves gaza, but only a callus resection, were transplanted into a fresh medium.

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# Chapter 19
# Cross-Cultural Communication in International Business Activities

**Guoqiang Liao**

**Abstract** In international business activities, people of different cultures should follow some principles of intercultural communication in engaging in business activities, so as to reduce the friction, avoid communication obstacles, and make a deal done smoothly.

**Keywords** Business activities · Cross-cultural communication · Principles

## 19.1 Introduction

International business activity is not only a kind of economic activity, but also a kind of cultural activity [1]. Persons in intercultural business activities are always in a pluralistic and heterogeneous cultural environment. Particularly for economic exchanges in the western developed countries, the differences between the eastern and western cultures and the cultural differences between regions are inevitably reflected in the economy; sometimes commercial conflicts are even formed. Therefore, intercultural communication has become one of the most important factors that affect our international business activities; in some cases it is even a deciding factor [2]. To reduce the cultural conflicts in international business activities to the lowest level, it is of vital importance for us to follow the necessary cross-cultural communication principles in participating in international economic competition process, so that we can not only adapt to the economic environment between business main bodies but also to the mutual cultural environment, gain competitive advantage and take the initiative.

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## 19.2 Communication

Communication is, namely, behavior and process when humans emit and receive information. It is the phenomenon of the meaning given a certain action or result. Information can refer to verbal message and nonverbal message. Verbal message includes oral message and written message, and nonverbal message includes gestures, facial expressions, and body message, etc. Communication is dynamic, irreversible, with the features of being symbolic, systemic, self-reflective, interactive, and complex. When communication is involved in cross cultures, it becomes more complex.

## 19.3 Cross-Cultural Communication

The term "cross-cultural communication" is mentioned for the first time by Edward T. Hall, an American cultural anthropologist, in his book *Silent Language,* which was published in 1959. It can be a simple definition for communication between people with different cultural backgrounds. Cross-cultural communication includes cross-country, inter-ethnic, inter-racial, and inter-regional communication. Cross-cultural communicative principles are widely used, especially used in the training of foreign immigrants and students, multilingual education, foreign language teaching, and business personnel training.

## 19.4 Cross-Cultural Business Communication

Cross-cultural business communication is an important area of application, referring to communication of people with different cultural backgrounds in business activities. Some of the obstacles often occur in cross-cultural business communication, sometimes in languages, and sometimes in cultural aspects, or both. Potential obstacles to cross-cultural business communication are mainly from people's alienation, uncertainty, avoidance, a tendency to stereotype, prejudice, racial discrimination, culture shock, cultural superiority, and so on. In the communication of international business activities, people will unwittingly express their ideas with the help of the native language rules, communication habits, cultural background and way of thinking. In communication different cultural factors produce crossover and collision from time to time. By theory, in international business activities, each country has a set of business practices for their own operating behaviors. However, in reality, sometimes there is an international convention on the practice. In order to make both parties have successful exchanges, mutual trust and understanding in cooperation, they must have a mutual recognition of communication conditions, such as the statute of the market

exchanges accepted or followed by both sides. Although in the actual contacts, the accomplished market statute conditions find it difficult to completely avoid great differences, the common market statute can be seen as a series of responses and communication principles that partners apply to cover the cultural differences. If you do not understand foreign cultures and corresponding principles of business communication, you cannot have the ability of cross-cultural business communication, which may result in misunderstanding and conflict, and even affect the success of the communication. For example, China used to export a number of shoes to Egypt. Although the design is quite distinctive, the sole pattern looks like the Arabic "god". The Arabs believe that the product advertising has a desecration of their beliefs, and thus leads to their dissatisfaction and even anger. Later, one of our ambassadors personally participated in the coordination and explanation to ease the tension. And an American supermarket, in order to please some Japanese, entertained guests with Sushi and tea. It is a pity that the cooked fish and Chinese tea was offered. The salesmen did not realize that the fish in Japanese Sushi is raw and the Japanese tea ceremony is different from the style of Chinese tea. The above examples show that success or failure depends on many factors in international business activities. In addition to the need to be familiar with two languages, familiarity with two cultures and principles of business communication is clearly the key.

## 19.5 The Principles in Cross-Cultural Business Communication

### *19.5.1 Cooperative Principle*

In cross-cultural business communication activities, language and business knowledge skills are mutually complementary. Learning the language and culture is to understand communication skills. To deal with foreign businessmen by writing or face to face, you need to use your knowledge from business English and cross-cultural comparison and follow some principles of cross-cultural communication. American linguistic philosopher HP Grice said in a speech made in Harvard University in 1967, that in order to ensure the smooth progress of the conversation, the two sides must abide by some basic principles, namely the principle of cooperation. He believes that verbal communication between people always cooperates with each other; both sides want to understand each other and work in together, contributing to the success of the speech communication. Therefore, they always comply with some principles of cooperation, in order to achieve this desire. The principles that the speaker and hearer should abide by in conversation are summarized below by Grice.

Grice came up with the following maxims of conversation:

Maxim of Quantity: Make your contribution as informative as required. (Do not say too much or too little.)

Make the strongest statement you can.

Maxim of Quality: Do not say what you believe to be false.

Do not say that for which you lack adequate evidence.

Maxim of Relevance: Be relevant (Stay on topic).

Maxim of Manner: Avoid obscurity of expression.

Avoid ambiguity.

Be brief (avoid unnecessary prolixity).

Be orderly.

Broadly speaking, these maxims can be summarized as the maximization of how to achieve communication effectiveness and efficiency. Constitution of the basis of these rules is such an assumption: In the normal circumstances, conversation participants pursue their own communicative goals based on above unwritten maxims. If there is any deviation from that, the other participants may think of the implication.

Cooperative principle and conversational maxims partly illustrate conversational implicatures, i.e., participants assume that a speaker is being cooperative, and thus they make conversational implicatures about what is said. For example, when a speaker makes an apparently uninformative remark such as "War is war," the addressee assumes that the speaker is being cooperative and looks for the implicative the speaker is making.

### *19.5.2 Politeness Principle*

In the 1980s, British linguist Leach (GN Leach 1983), on the basis of Grice's "cooperative principle", brought forward "politeness principle" from the angle of rhetoric and genre. Leach emulated Grice's "cooperative principle" in divided Language Communication and put forward six maxims: tact, generosity, approbation, modesty, agreement, and sympathy. The first and second form a pair, as do the third and the fourth. These maxims vary from culture to culture: what may be considered polite in one culture may be strange or downright rude in another.

Tact Maxim: a. minimize cost to other; b. maximize benefit to other.

Generosity Maxim: a. minimize benefit to self; b. maximize cost to self.

Approbation Maxim: a. minimize dispraise of other; b. maximize praise of other.

Modesty Maxim: a. minimize praise of self; b. maximize dispraise of self.

Agreement Maxim: a. minimize disagreement between self and other; b. maximize agreement between self and other.

Sympathy Maxim: a. minimize antipathy between self and other; b. maximize sympathy between self and other.

The core contents for the maxims of the politeness principle are as follows: the speaker should respect others and give them some conveniences as much as

possible; get benefits as little as possible, leaving the others more profits; let both parties feel respected in order to obtain the goodwill of each other, so that the communication can be carried out smoothly, and one can get greater benefits.

## 19.6 Following the Principle Flexibly

"Politeness principle" and "cooperative principle" are used in people's daily communication in a complementary manner, which has a very broad description of the use of languages. Therefore, they are also tact principles referred to or complied with in our international business activities and conversations. Courtesy is both a universal phenomenon for all social communities and a personalized communication principle, subject to different cultural backgrounds of different language groups. Politeness reflects a nation's quality and culture. Therefore, politeness principle is of flexibility and diversity in cross-cultural business communication. In intercultural business communication, if the speaker and hearer vary widely in cultural values or the differences are even totally unacceptable to each other, polite discourse may hurt each other, resulting in communication failure. So, in successful cross-cultural business communication, bicultural is even more important than bilingualism, for the word makes sense only in its culture.

The Eastern and Western cultures have different politeness criteria and implementation strategies. Han culture values modesty guidelines, while Western culture is to highlight the appropriate criteria. Modesty guidelines require people to minimize their own praise and try to belittle themselves. Western culture agreeably accepts praises to avoid damaging each other's face, so it is polite. Therefore, Westerners tend to express their happiness or thanks for compliments, adopting a catering rather than a negative way. By doing so, they can avoid being inconsistent with flatterers and embarrassment. However, the Chinese people are mostly accustomed to decline compliments. They advocate being "humble" and respect for others, but this practice might give Westerners a face threat.

In traditional Chinese culture, "courtesy" is rooted in the Confucian "rites", emphasizing "humble oneself as a sign of respect for others" and "the Golden Mean", encouraging modesty; western culture, influenced with the tradition of Western freedom and equality, emphasizes the individual and personal values, promoting individual self-confidence and down-to-earth attitude. Different cultural psychology and polite manners will affect cross-cultural communication in both English and Chinese. If some very polite sayings in Chinese culture are introduced into English conversation, such as "Please visit my Humble House", only to find the native English listeners greatly puzzled. Though Chinese way is in compliance with the guidelines of modesty, it will hinder the smooth communication.

Language is part of the culture, and the culture always lays a deep imprint on the use of the language. Cultural identity is a human tendency for cultural common view and recognition. It is the sublimation of human natural cognition and ideological guidelines that govern human behavior and value orientation. Cultural

identity in cross-cultural business communication is mutual; human needs such mutual cultural identity, in order to transcend the obstacles of cultural communication. In some cases, cultural differences will give a negative impact on cross-cultural communication. Sometimes for politeness or harmonious relationship, Chinese people are often greeted, "Where are you going?", and "What are you doing?" Such "gossip" in Chinese culture tends to make many native English speakers puzzled, or even displeased with those "Warm greetings". From the psychological reactions they might think that these are our privacies, unnecessary for others to intervene. That is to say, "It's none of your business!"

It is interesting that sometimes people with the same English cultural backgrounds will come across problems in their communication. A British lady is said to go to New York for a high-tech business conference. There the excellent report by an American impressed her deeply, so she could not help going up to congratulate him: "Your report was like a bomb (very successful)!" However, the American got very unhappy when he heard that. It turned out that in the American cultural background, the word "bomb" often means "messed up or unsuccessful", which is not a kind compliment at all! Thus, we can see that to communicate effectively in the international business activities, understanding the social and cultural backgrounds in different countries, different regions and flexible use of the principles of business communication are of great necessity; otherwise it will lead to communication failure.

## 19.7 Conclusion

"Politeness principle" or "cooperative principle" is no doubt of a positive guiding significance in cross-cultural business activities, and is the communicative principle worthy to follow and learn from. However, due to cultural differences and some other factors, slavishly following any of the principles is undesirable. For instance, the politeness principle itself has some limitations and shortcomings. Its greatest weakness is that the appropriateness of courtesy is not given full consideration and the contextual factors in certain circumstances are ignored, which might affect the degree of politeness. Polite use of a language is a factor of using the language appropriately. Tactful wording is subject to constraints of social and cultural factors. Therefore, the degree of politeness of the language is also subject to social and cultural factors. In more and more future cross-cultural business communicative activities, we must pay attention to the embodiment of the politeness principle in business English, to the cultural practices of politeness principle, and to the use of a different method of communication in a different context. We should deal well with the maxims of politeness principle and their relationship with communicative differences, and strive to reach the recognition of different cultures. Only in this way we can safeguard and maintain flexible and effective cross-cultural communication principles, establish good contacts with foreign businessmen, promote successful bilateral trade, and get the communicative effects we expect.

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# Chapter 20
# Study on China's Social Value in the Period of Transition

**Ying Tong**

**Abstract** Along with the gradual development of the great practice of the opening-up and reform policy, Chinese society has stepped into a social transition period. As the values in the different areas are collided, the differentiation and conflict of values will certainly be aroused. However, this has a close relationship not only with the success and failure of the economic prosperity and reform of China, but also with the social stability and development of China. Besides, this is of very important and practical significance for the deconstruction and reconstruction of China's social values in the period of transition, the deepening of the construction of the socialism's core value system, and the realization of the cultural prosperity of socialism.

**Keywords** The period of transition · Values · Study

## 20.1 Introduction

Since the implementation of the opening-up and reform policy, Chinese society has stepped into a social transition period. Society is like an organism, because its own transition is also an evolution in itself. However, such an evolution is not smooth all the way. Studying China's social value in the period of transition is beneficial not only to the smooth realization of the transition of China's society, but also to effectively control the conflicts of value. It also plays a significant role in building up the core value system of China's socialism.

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## 20.2 Dual Characteristics of Value

The fundamental difference between human and other animals is that human can pursue and select the values. A great number of people always catch sight of the "needs" and "satisfaction" when discussing about values. However, in this process, the characteristics for the existence of values are often ignored. In fact, just because of the characteristics for the existence of values, the value choices of people are decided.

### *20.2.1 The Subjectivity of Value*

The universality, which can be reflected by the subjectivity of a value, promotes the value to overcome the main differences, and also is beyond any historical conditions. If a value is completely attached to its object but not itself, relativism will certainly be caused. The reason why good morals are recognized by people is that they are with stability. However, the reason why good morals are eternal is that the value world is with independence. Therefore, the subjectivity of value preserves the history of human and the integrity and identity of the morals of human. In the meantime, it promotes the spirit civilization of human to own a solid foundation in the development course [1]. It can be said that the yearning for the permanent peace was expressed in the argumentations of the Justice thinkers represented by Kant and Rawls and the rationalism thinkers, giving an embodiment to the universality of obligations.

### *20.2.2 Objectivity of Value*

In the book Collapse of Value, Scheler thought that value (especially the moral value) was only a kind of subjective idea, and was not in existence and had no meanings without the consciousness of human [2]. Also, the objectivity of value can be reflected from its expressive ways. The unitary of value clearly gives an expression to the limitation of value. However, the diversity of value makes the expressive ways for value varied. The reason why the objectivity of value is studied in this paper is that the objectivity of value is the foundation of the creation of new values. Only the objectivity of value is studied, a value definition can be given to the behaviors of people, and people can be promoted to consciously follow the guidance of value, and thus the value world can be enriched.

## 20.3 Deconstruction of China's Social Value in the Period of Transition

Viewing the traditional Chinese value, group was the commanding height beyond all doubts. Therefore, only the group value is often discussed. However, the individual value is ignored.

### *20.3.1 Expressive Forms of Social Value in the Period of Transition*

In the previous time, the dedications and obligations were only advocated by people, but the rights and demands were ignored [3]. Now, such a value has transformed to the value that people can enjoy their own individual rights and social reward matching with their contributions when people are performing the obligations and making the contributions to society. Therefore, the value orientation has dramatically changed along with the transformation of society. However, in this process, group value is greatly impacted [4].

Among the conflicts of social value in the period of transition, the conflict between morality and interests is the most intense beyond all doubts. Under the implicit action of the market value law, the connection between labors and economic benefits has also inspired laborers to generate unprecedented enthusiasm and creativity on labor [5]. Subsequently, the development of the social productive forces is dramatically promoted. However, it is necessary for Chinese people to see that the labor concept in of market economy will also induce the mass people in society to produce negative thoughts such as fetishism, hedonism, money worship and extreme individualism. Therefore, if these negative thoughts are not effectively kept within limits, Chinese communist party, Chinese nation and China's socialism will be possible to vanish [6]. This is enough to suggest that the modern China's interest value in the period of transition has been seriously distorted and extremely inflated.

### *20.3.2 Multiple Sources of the Conflicts of Social Value in the Period of Transition*

In the transition of the modern Chinese society, the emergence of the conflicts of social value is not accidental. This is because it has multiple sources, which can be mainly concluded from the following aspects.

#### 20.3.2.1 Change of the Economic Basis is the Social Source of Value Conflict

Since the opening-up and reform policy, China's economic system has been greatly transformed. That is, the single economic structure of the previous time has been changed by the multiownership structure. When the diversified beneficiaries are in the adjustment and integration of the relationship between structure and interests, the conflict of interests will become increasingly more superficial and violent. In the conflict of interests, beneficiaries are not only limited to a country, but also the differentiation of interests will make it possible for local places and individuals to become beneficiaries. In the meantime, the single national economic pattern like a game of chess will be replaced by the diversified economic pattern with a gradual step. This makes individual standards seriously conflicted with social standards. However, this can be reflected as the fierce conflict between individual value and group value in the field of human's concepts.

#### 20.3.2.2 Change of Survival Way is the Main Source of Value Conflict

The opening-up and reform policy is not only a huge impact on the economic system, but also a catalyst agent for the reform of China's political system. At present, China's political system is undergoing a transition from the rule of man to the rule of laws and from elite politics to democratic politics. In the reform course of China's political system, the ways of people's survival have been greatly changed quietly. In the transition from the planned economy to the market economy, it is necessary for Chinese people to emancipate the minds and make innovations, so as to speed up the change. Currently, the social dominant value also calls people to break the fetters of thoughts, promote the people's personality awakening, encourage people to absorb and create new value ideas on this basis, and thus choose a survival way that really fits their own needs.

#### 20.3.2.3 Communication of Diversified Value is the Cultural Source of Value Conflict

The opening-up and reform policy has promoted China to stand on the stage of world with a more confident and independent image again.

On the one hand, the "introduction" from the outside world can be boldly put into practice, and thus an all-round, multilevel and extensive foreign exchange can be implemented.

On the other hand, the "going out" strategy can be boldly applied, and thus China can be initiative to keep pace with the development of the world and Chinese nation can be promoted to be melted in this big global family.

Along with the communication of emerging culture, and influenced by the western value, the reference value standards in the minds of people are no longer

consistent. Among these values, some go against the traditional Chinese value and the Marxism value, but some have been accepted and absorbed by people [7]. The cultural exchange between the eastern and western worlds does not make value conflict eliminated, but sharpened.

## 20.4 Reconstruction of China's Social Value in the Period of Transition

In the reconstruction of China's social value, it is necessary to be guided under the theory of Marxism [8].

Only the theory of Marxism is applied in combination with China's real national conditions, China's social value can not only own special Chinese characteristics, but also will not deviate from the shipping lane of socialism. The theory of Marxism is the fundamental policy for the construction of Chinese communist party and country, and also the soul of the socialistic ideology.

### *20.4.1 Guiding Ideology and Basic Principle of the Reconstruction*

The reconstruction of China's social value in the period of transition can be a complex and difficult project. For this reason, it is necessary for Chinese people to follow the following basic principles in the reconstruction process.

First of all, it is necessary to adhere to the principle of "one central task, two basic points". The "one central task, two basic points" is one of the basic principles for Chinese people necessary to adhere to in the socialism's modernization construction. Thus, all we do should firmly focus on it.

Second, it is necessary to adhere to the principle of "attaching importance to social reality and focusing on the future development" [9].

Third, it is necessary to adhere to the principle of "utilizing resources reasonably and introducing foreign civilization achievements".

Therefore, in the reconstruction of China's social value in the period of transition, the excellent culture in traditional Chinese thoughts should not be abandoned, but also the development of the worlds can't be put in an opposite position. Innovation can be made on the basis of carrying on the domestic and foreign excellent cultures.

### *20.4.2 Value Orientation of the Reconstruction*

At present, Chinese culture and all other countries' cultures are mutually influenced and integrated with each other. Under such a situation, it is necessary to carry out

the reconstruction of China's social value in the period of transition, which is a very actual social reality. Besides, the traditional Chinese culture should not be abandoned and also foreign cultures cannot be blindly excluded.

Therefore, it is necessary to critically inherit the traditional Chinese value. The modern western value is constructed based on the humanistic thoughts, and this is also the basic category of the western value. Therefore, the western modern value is of very important reference role for the reconstruction of China's social value in the period of transition.

### *20.4.3 Main Contents of the Reconstruction*

Value mainly includes value subject, value object, and value means. Therefore, in the reconstruction of China's social value, it is necessary to give a consideration to these aspects.

If value subject is with a good social responsibility, it can deal with the relationship between personal interest and collective interest and the relationship between short-term interest and long-term interest very well and also has the ability to take reasonable measures if value conflicts emerge. On this basis, it is necessary for Chinese people to make an enhancement to the education of value subject, and make every effort to improving the national quality [10].

Jintao HU, general secretary of China, had deeply emphasized in the Sixth Plenum of the 16th CPC Central Committee that the basic contents of the socialism core system should include the Marxism guiding ideology, the common ideal of socialism with Chinese characteristics, the national spirit cored at patriotism, the times' spirit cored at reform and innovation, and the socialistic concept of honor and shame.

The proposal of the socialism core value system is of very important theoretical and practical significance for the reconstruction of China's social value in the period of transition. Therefore, using the socialism core value system as the ideological trend guiding society for the deepening of the relevant construction of this system is of great significance.

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# Chapter 21
# Study on Locational Choice of FDI in the Middle Areas

**Yu Liu**

**Abstract** The scale of FDI that china has drawn on has been very large, but the rate of central provinces is reducing nationwide. The factors influencing FDI are mainly market factors, cost factors, local government behavior, policy factors, gather effect and so on. The central provinces should continue to use their own location advantage to reduce location disadvantage and create location condition which are good for attracting FDI.

**Keywords** Foreign direct investment (FDI) · Locational factor · Locational choice

## 21.1 Analysis on the Locational Choice of FDI in the Middle Areas

There is a great difference for FDI in Chinese geographical distribution. The reason for the difference is the result from all kinds of economic and non-economic factors. Generally speaking we divide the locational factors influencing FDI into following kinds [1].

Market factors. According to the current situation, the size of the market is an important factor for the distribution of the foreign direct investment, and all the existing researches agree with the conclusion [2]. The index to measure the size of the market includes market size, the country's economic development speed, phase of economic development, population, trade policy and so on [3].

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Cost factors. The cost that economists mention most is the labor cost. Generally speaking, we are used to use the absolute cost of labor force, which has some defects. On the face of that, low wage cost has a huge attraction for FDI. But besides the absolute cost, FDI also cares about labor quality. If the central regions continue to rely on the low wages of sheer specified number, there will be no more competitiveness to attract FDI. What's more, information cost is also the important factor affecting cost, in which foreign direct investment enterprises care about much. And we can divide it into two kinds. One is FDI in the backcountry including coastal areas where it is convenient to the foreign direct investment enterprises to know characteristics of the local political and economic and reduce information cost. The other is investment in the central cities which require low cost to collect and send all kinds of information, which can also well explain why FDI in mainly in Beijing, Shanghai, Guangzhou, and some central cities from reform and opening to the 1990s.

Local government behavior factor. Local government behavior and its efficiency mainly affect operational cost of FDI. Government behavior of each region of China can well explain inflow difference of FDI. In fact, FDI enterprises think it is easy to overcome the defects of infrastructures and other tangible infrastructure, while it is difficult to overcome the problems of government behavior. Central provinces have many differences in the government behavior with coastal provinces

Policy factors. Chinese preferential policies for FDI can be divided into following kinds: the first is direct privilege including preferential land use, the income tax and the tax, labor employment and so on. The second is common privilege, such as financing environment, foreign exchange control, industrial policy, etc. Chinese regional development strategy has embodied obvious gradient order, so each region has different preferential policy at one time, which has a large effect on attracting foreign investment.

Agglomeration effect. Agglomeration scale and structure of the economic activity have a large effect on enterprise's information cost. In addition, the concentration degree would have more influence on the distribution of foreign capital. To an enterprise, the developed the industry contact network that is made of front, back, and horizontal industry contact is, the easier it is for the enterprise to hire the familiar labor, so external economy of scale can reduce cost. And we define the external economy of scale as city scale economy and industry scale economy.

The geographical location factor. The geographical position is an important factor affecting foreign direct investment, which can be well reflected from the cost. For example, the export-oriented foreign investment enterprises mainly reply on ocean transportation, and that is the reason why coasting port is the important center for export-oriented national economic development. Chinese eastern coastal provinces and cities, especially Guangdong and Fujian have great geographic advantages. The locational advantage of Guangdong is that it is border on HK and Macau, and people their have mutual language and culture, so it is easy to communicate with each other and social culture has close connection.

Resource endowment factor. Resource orientation and market orientation are two main motivations for the company's, the initial foreign direct investment. Compared to developed countries and regions. Chinese most abundant element is the labor resources. At the beginning of the reform and opening up, a large number of Hong Kong labor-intensive processing enterprises entered into the Pearl River delta and Guangdong, which forms an obvious pattern that front shops and back factories between Guangdong–Hong Kong. Besides human capital stock is also an important factor affecting foreign direct investment. Take 2008 case as an example, Beijing has 6,750 college students in every 100,000 people, Shanghai has 4,371, Anhui has 1,658, while in central provinces Hubei has the most 2,724, and obviously there is great difference between central provinces and eastern provinces.

## 21.2 Advantage Analysis and Countermeasures for the Central Regions to Use FDI

Take full advantage of policy advantage in the central regions. On September 23, 2009, the standing committee of the state council discussed and passed planning to promote the rise of the central regions. The meeting proposed that we would try to realize the goal that the economic development level of central regions increased significantly, the developed vitality further strengthened, sustainable development ability improved significantly and new progress for construction of harmonious society to 2015. With the approval of the state council, Wuhan city circle and Hunan Changsha-Zhuzhou-Xiangtan urban agglomeration became the testing districts for construction and comprehensive supplementary reforms for the national resource conservation and environment-friendly society (two type society for short). Besides Zhongguancun, Wuhan Donghu high-tech zone has become the national independent innovation demonstration area after the approval of the state council, which shows that national macroeconomic policy is very good for the development of the central regions. So the central regions should make full use of policy advantages to build roads, railways, power, water conservancy and urban public utilities, and other projects that the nation supports and ecological environmental protection construction projects, encourage the foreign investment enterprise in eastern regions to invest in the central region again, and encourage them to invest the listed advantage industry and key areas in the central regions according to the national. The advantage industry directory in the midwest foreign investment.

Take full advantage of the existing rich natural resources. The central regions relatively have rich land, energy, water conservancy and mineral resources, and leading indicators for those. For example, the central regions have more than 140 mineral resources including important or rare minerals, and they have good related resources supporting with good developmental prospect. In addition, the central

regions have a lot of plains, mountains, pastures, lakes, and other natural ecological systems which are good for agriculture. At the same time tourism resources is also very rich. Rich natural resources will become huge advantage to attract FDI.

Take full advantage of cost advantage. Now FDI entering the central regions mainly focuses on manufacturing. Take Hubei for example, in 2008 within the new approved foreign investment projects, manufacturing industry accounts for 172 projects, the rate in the general project proportion is 50.14 %, contracted foreign investment is $2.68,475 billion, and 61.90 % of the total contract value. The biggest characteristic of manufacturing is land intensive and labor intensive. After statistics, compared to eastern regions, the ownership of land per capita is larger in the central regions, and the price is much lower than east. Besides the cost of electric power, water conservancy, transportation, and other infrastructure is low, which is easy for foreign-owned enterprise to control fixed cost in the manufacturing and improve the competitiveness of the manufacturing products. At the same time, labor price in the central region is much lower than threats; the average wage of on-the-job workers is 19,597 in Hubei 2008 that is 9,632 lower than the national average level 29,229, much less compared to wages of coastal cities.

Take full advantage of gathered economic factors. The central regions have been the important nationwide industrial production base all the time, and they have the biggest thick, thin, and special steel base, the biggest heavy machine tools and packing machinery production base, the second largest car production base and so on, which provide a good matching for foreign investment enterprises. Urbanization cluster effect is more like a region or city phenomenon, the experience proves that urbanization cluster effect of Guangzhou in the Pearl River delta region and the outer area, Shanghai in the Yangtze River Delta region and its outer area is the key to attracting FDI. At present, the central regions have formed the central plain urban cluster, Wuhan "8 + 1" urban agglomeration, Changsha-Zhuzhou-Xiangtan urban agglomeration and so on that all have an important effect on the formation of the urbanization cluster effect and attracting foreign direct investment.

Perfect market economic system. Compared to the eastern regions, the development of the market economy is still relatively a low degree in the central regions, and there are a mass of non-market economic behaviors in the economic activity. Foreign investment is also facing many institutional factors. So we must: (1) Cut government administrative intervention strength. Try to simplify the pr approval link of projects, improve affairs efficiency of local government and perform official duties according to law. So we can reduce the foreign capital enterprise operating costs and their concerns about the uncertainty of future. (2) Clear the department which is in charge of foreign capital management clear its function division, coordinate management responsibilities, try to reduce and eliminate mutual shuffle which often appears, reduce the operation difficulty of the foreign capital enterprises. Reduce the link, speed up the rhythm, improve efficiency and firmly prevent the phenomenon that damage foreign interests to draw water to one's own mill. (3) Improve the quality of management staff, we should

according to international practice experience of management enterprise, manage the foreign capital enterprise, reduce interference with human factors. (4) Improve the service level; keep up with the development requirements of the foreign capital enterprises.

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# Chapter 22
# Study on Rural Social Security on Local Residents Developmental Consumption

**Dan Li and Yingyao Wang**

**Abstract** According to survey of the influence of the constitution of rural social security on local residents' developmental consumption in Jinjia village and Changlin village, actually people send 100 questionnaires, receive 86 copies in which 78 copies are effective, and 49 copies in Jinjia village while 29 copies in Changlin village. Through the survey, we can find deficiencies of rural social security in Harbin and throw out suggestions on the rural social security policy.

**Keywords** Rural social security · Harbin consumption

## 22.1 Revenue Estimation

### *22.1.1 Agricultural Revenue Estimation*

As in the location of the investigation, all the farmers grow the corn, attach some fish breeding and poultry rising [1]. Through the investigation, we know that in the location of the investigation, income of yield per unit area of the corn is 550 yuan, and the monetary income of per unit of all kinds of cattle is as following (Table 22.1):

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**Table 22.1** The monetary income of per unit of domestic animals in Xiangyang village

| Domestic animals | Cattle | Pig | Horse | Chicken | Duck | Goose |
|---|---|---|---|---|---|---|
| Income (yuan/head) | 4,500 | 1,500 | 4,500 | 60 | 60 | 100 |

### *22.1.2 The Non-Agricultural Revenue Estimation*

In the non-agricultural revenue, we mainly carry out statistics of status that farmers go out for work, and estimate the non-agricultural income of the family based on that [2]. According to the different nature of work, we divide the status that farmers go out for work into four kinds to estimate wages of various sectors, as following (Table 22.2):

## 22.2 The Influence of the Constitution of Social Security on Local Residents' Developmental Consumption

In the analysis of the research on the influence of the constitution of social security on local residents' developmental consumption, the independent variable is the degree of diversification in the constitution of social security, while the dependent variable is the developmental consumption index for analysis [3, 4].

### *22.2.1 The Influence of the Constitution of Social Security on Local Residents' Developmental Consumption in Jinjia Village*

From Fig. 22.1, we can find that in Jinjia village the farmer's social security types are mainly concentrated in the cooperative medical service type and cooperative medical and commercial insurance type. Social security diversity of no social security type, cooperative medical service type, and cooperative medical and commercial insurance type is respectively the worst, moderate, and the highest.

Combining the statistic treatment of the survey, we can get the result that

Annotations 1: In school proportion means that the proportion of the in school people of a family is over 100 % (most proportion in questionnaires). Durable

**Table 22.2** Wages of various sectors

| Sectors | Labor properties | Service properties | Technical properties | Commercial properties |
|---|---|---|---|---|
| Estimate wage (yuan/month/person) | 2,000 | 2,000 | 2,500 | 3,000 |

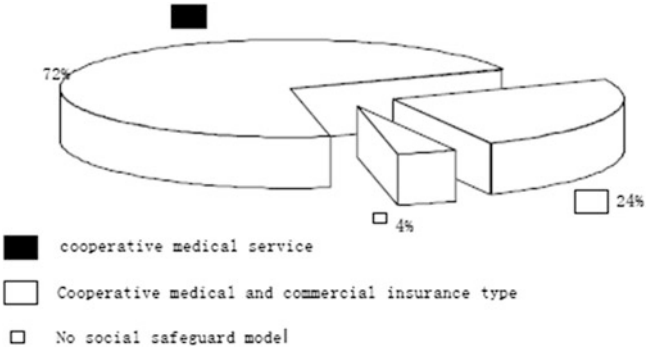


**Fig. 22.1** Farmers' social security types Jinjia village

enjoy goods consumption and agricultural implements mean average consumption of each group. Tourism consumption means the proportion of people who have the tourism experience. Medical Consumption I mean the proportion of times to go to hospital except serious illness last year (6–10 times). Medical Consumption II means average times to buy cold and fever medicine ever year in each group.

From Table 22.3, the high the degree of diversity is in Jinjia village, the obviously the index of farmers' durable enjoy goods consumption, agricultural implements, tourism consumption, and medical consumption II grow. On the other hand, the in school proportion of no social security type is 100 % which is higher than that of other two groups, which means that the degree of diversity of social security has nothing to do with farmers' consumption in education. The higher the degree of diversity is, the more moderate frequency for people to go to hospital is.

### *22.2.2 The Influence of the Constitution of Social Security on Local Residents' Developmental Consumption in Changlin Village*

Using the same analysis method to research the influence of the constitution of social security on local residents' developmental consumption in Changlin village, we get the statistical results of social security types in Changlin village as following (Fig. 22.2):

We can find that in Changlin village the farmer's social security types are mainly concentrated in the cooperative medical service type, cooperative medical and endowment insurance type, and cooperative medical and commercial insurance type. As the social security diversity of commercial insurance is higher than that of endowment insurance, so the social security diversity is of the cooperative medical service type. Cooperative medical and endowment insurance type and

**Table 22.3** The relationship between social security types and farmers developmental consumption in Jinjia village

| Social security types | In school proportion (%) | Durable enjoy goods consumption (per) | Agricultural implements (per) | Tourism consumption (%) | Medical consumption I (%) | Medical consumption II (time) |
|---|---|---|---|---|---|---|
| No social security type | 100.00 | 1.00 | 0.50 | 0.00 | 0.00 | 4.00 |
| Cooperative medical service type | 65.00 | 3.40 | 0.63 | 25.71 | 2.86 | 7.23 |
| Cooperative medical and commercial insurance type | 66.67 | 5.08 | 2.00 | 75.00 | 33.33 | 7.25 |

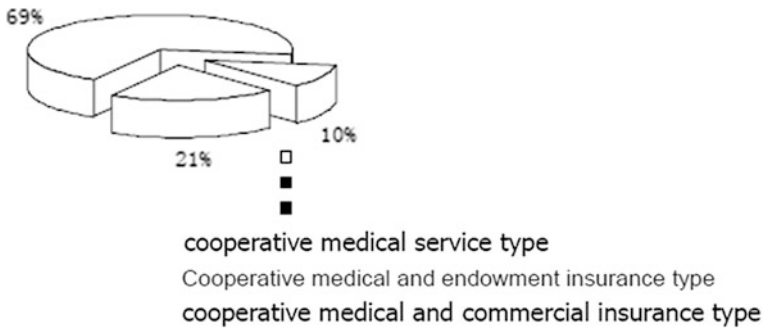


**Fig. 22.2** Farmers' social security types in Changlin village

cooperative medical and commercial insurance type are respectively the worst, moderate, and the highest.

We analyze the survey data of Changlin village and data packet processing results are as follows:

From Table 22.4, we find that only durable enjoy goods consumption and agricultural implements two indexes have positive correlation with social security degree. As for in school proportion and tourism consumption, the diversity of the social security system has both positive effect and opposite effect. With the diversity of the social security increasing, the farmers' frequency of medical consumption more and more tends to moderate level. We also find that in Changlin village not only medical frequency tends to normal level, as the social security is becoming richer; people's medical frequency also tends being regular. While the diversity of the social security has nothing to do with medical consumption II.

### *22.2.3 Analysis on the Relationship between Constitution of Rural Social Security and Developmental Consumption under the Condition of Controlled Income*

It is summed up that in Jinjia village variables that have positive correlation with the diversity of social security are durable enjoy goods consumption, agricultural implements, tourism consumption, and medical consumption II. While in Changlin village variables that have positive correlation with the diversity of social security are durable enjoy goods consumption, agricultural implements, tourism consumption, and medical consumption I. However, medical consumption II has little change negative correlation with the diversity of social security.

The above research conclusion has a premise that farmers' income change, and that has not removed the influence of farmers' income on farmers' consumption, which makes the research conclusion to a certain extent lack convincing

**Table 22.4** The relationship between social security types and farmers developmental consumption in Changlin village

| Social security types | In school proportion (%) | Durable enjoy goods consumption (per) | Agricultural implements (per) | Tourism consumption (%) | Medical consumption I (%) | Medical consumption II (time) |
|---|---|---|---|---|---|---|
| Cooperative medical service type | 80.00 | 3.15 | 0.80 | 30.00 | 15.00 | 5.95 |
| Cooperative medical and endowment insurance type | 100.00 | 5.33 | 1.33 | 0 | 33.33 | 5.67 |
| Cooperative medical and commercial insurance | 66.67 | 5.50 | 1.00 | 50.00 | 16.67 | 5.17 |

arguments. In the next test we are going to try to observe the causal relationships between statistics by controlling the income of the farmers in a certain error range in sample data.

In the sample of Jinjia village, in most samples farmers' income is between 10,000–29,999, when farmers' income is between 20,000–29,999, social security has a big diversification, so we choose samples in the range of 20,000–29,999 as the study sample data. It is the same that we will choose samples in the range of 60,000–69,999 as the study sample data.

Annotations 2: In the table per capita consumption means family per capita consumption, number of people in school is the family in school number, durable enjoy goods consumption means the number of durable goods that the family has, agricultural implement means the number of agricultural implements. T in tourism means once having tourism experience, F means having no tourism experience. In the average level, except the tourism means once having tourism experience, the other means the average level.

In Table 22.5, we can find that farmers' agricultural implements and tourism have positive correlation with diversification of social security, relating to controlling income unchanged, we can see that farmers' agricultural production and tourism consumption have positive relationship with farmers' participating in social security types. The richer social security types farmers' participating in are, the higher the consumption demand is.

From the data of Table 22.6 we can find that in Changlin village all indexes have no significant positive correlation, but number of people in school, durable enjoy goods consumption, and agricultural implements have positive correlation with diversification degree of social security. Combining with the research results of no control of the income, we can find that farmers' durable enjoy goods consumption is related to social security types, the richer social security types are, and the more farmer's consumption is.

**Table 22.5** Samples in the range of 20,000–29,999 in Jinjia village

| Social security types | Per capita consumption (yuan) | Durable enjoy goods consumption | Agricultural implements | Tourism |
|---|---|---|---|---|
| Cooperative medical service type | 413 | 8 | 1 | T |
| | 208 | 4 | 0 | T |
| | 178 | 3 | 0 | F |
| | 80 | 2 | 1 | F |
| | 160 | 3 | 0 | F |
| | 217 | 4 | 1 | F |
| Average level | 209 | 4.00 | 0.50 | 33.33 % |
| Cooperative medical and commercial insurance type | 177 | 3 | 1 | T |
| | 258 | 5 | 1 | T |
| | 55 | 1 | 2 | F |
| Average level | 195 | 3.00 | 1.33 | 66.67 % |

**Table 22.6** Samples in the range of 60,000–69,999 in Changlin village

| Social security types | Per capita consumption (yuan) | Number of people in school (person) | Durable enjoy goods consumption | Agricultural implements | Tourism |
|---|---|---|---|---|---|
| Cooperative medical service type | 133 | 0 | 6 | 0 | F |
| | 210 | 0 | 3 | 1 | F |
| | 210 | 0 | 3 | 0 | F |
| | 263 | 0 | 4 | 0 | T |
| | 203.75 | 0.00 | 4.00 | 0.25 | 0.25 |
| | 130 | 1 | 11 | 3 | F |
| Average level | 130.00 | 1.00 | 11.00 | 3.00 | 0.00 |
| Cooperative medical and commercial insurance type | 183 | 2 | 10 | 1 | F |
| | 110 | 0 | 3 | 0 | F |
| | 146.67 | 1.00 | 6.50 | 0.50 | 0.00 |

## 22.3 Conclusion

(1) Developmental consumption has a positive correlation with diversification degree of social security that has a positive effect on increasing the farmers' consumer spending of these aspects. The rural social security has important influence on farmers' development of consumption, which performs in farmers' durable; enjoy goods consumption, agricultural implements, tourism, and education. Increase the subsidy policy for rural home appliance and agricultural implements and reasonably control the market for household electrical appliances and agricultural implements, at the same time, complete market management work of household electrical appliances and agricultural implements. Appropriately expand the scope of the subsidies for home appliance of rural countryside and agricultural implements and increase the farmers' spending power for high-grade electrical products and small practical agricultural implements.

(2) With the perfection of social security system, peoples' Medical consumption is more and more reasonable that is not excessive or late for other causes, which plays an important role in increasing farmers' scientific medical consumption. China should standardize the drug market and control the price of medical treatment cost properly. At present cooperative medical service type is well carried out in the country, but many farmers still afford when facing comprehensive arrangement for serious disease, and they hope that the next health care reform will focus on limits of drug price.

(3) A large part of farmers' consumption is in their children's education. No matter what's the condition of their financial situation, as long as there are children who need to go to school, then most of their money will be spent on children's education that cannot be saved like other developmental

consumption. China should increase investment in education and strengthen the subsidy for farmers' children to reduce farmers' education consumption properly.

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# Chapter 23
# Study on Modern Service Industry Based on the Industrial Cluster

**Xiaozhong Bai and Jing Hu**

**Abstract** Compared with developed economy cities such as Beijing, modern services industry is Wuhan economic "short legs" and weak links. At present, there exist some problems such as small scale, production efficiency, etc., the reason is that the development of Wuhan services industry lack of industrial cluster advantage. Based on the analysis of the current situation of the modern service industry in Wuhan, the author puts forward countermeasures of energetically developing Wuhan modern services by industrial cluster advantage.

**Keywords** Industrial cluster · Modern service industry · Optimizing structure

## 23.1 Introduction

Accelerating the development of the modern services industry is one of the strategic choices for Wuhan, which is focusing on the construction of a modern and super-large city, to seek a sustainable development under the new situations of the globalization and the knowledge economy, which is suitable for its own development and also can drive the integration and upgrades of different industries [1, 2]. However, the exertion of the advantages of the modern service industrial clusters greatly contributes to its development [3]. On such a basis, in this paper, the author conducts an analysis on the mechanism of the industrial cluster

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advantages to promote the faster development of the modern service industry, and simultaneously study the modern service industrial clusters in Wuhan as well as their developments [4].

## 23.2 Modern Services Industry and its Cluster Advantages

Industrial cluster is an organizational form with high efficiency. The earliest study on the industrial clusters can be traced back to Marshall. In the early nineteen century, Europe was in the era of handicraft and there were some industrial clusters which formed are based on the geographical environments, natural resources, and historical cultures at the same time. Marshall pointed out in his book of "Principles of Economics" that the industrial clusters were able to bring external economy including the external scale economy and the external scope economy, and this economy could be acquired from a great number of similar enterprises concentrating in a specific region which was usually named as the distribution of the industrial areas. Porter thought that it was an aggregation of the enterprises and institution which were interrelated with each other within a specific region. In essence, the industrial cluster is a production form, and generates a complete and professional division system through the proper integration of industry and region, which can make this industry gain high production efficiency from the development of this region, and hence strong competitive advantage can form within a certain scope [5, 6]. A great deal of experience has proved that the industrial clusters, appearing in some regions with strong economic and social foundations, are driving the growth of the economies of all the countries.

Modern service industries mainly attain a development by relying on the high electronic information technologies and modern management ideas, operation models as well as organizational forms, which provide service sectors for the producers. However, there are no consistent definitions given to the concept of the modern service industrial clusters. Jiang Sangeng applied the concept of industrial cluster to the service industries, and believed that the modern service industrial clusters were the aggregations in the geographical spaces of the enterprises and relevant institutions from a certain industry. Li Jinhui mentioned that service industry cluster referred to a high concentration of a service industry in a region, from which the regional advantages that were larger than the growth rate of the scattered enterprises yielded. Jiang Sangeng put forward that the modern service industrial cluster could produce the assemble economy, which were specifically represented as the external economy from the aggregation, the reduction of the transaction cost, and the scale economy. Wang Weijuan and Ma Yingyao said that the enterprises could possess these competitive advantages in contrast to a single service enterprise, such as the market competition advantage, brand sharing advantages, service differentiation advantage, sharing service resources advantage, and service innovation advantage.

## 23.3 Current Situation of the Developments of the Modern Service Industries in Wuhan

In recent years, under the promotion of the coexistence of two industries, the service industries in Wuhan kept an excellent and fast development during the "eleventh five-year plan" period. At present, the GDP per capita in Wuhan exceeded $3,000, suggesting the urban service industries entered into a leaping stage. In the new regional competition, Wuhan has its own advantages to sustain the development of the service industries.

First of all, the development of the service industry accelerates much quickly, and the internal structure obtains a constant optimization. According to Wuhan Bureau of Statistics, the GDP in Wuhan achieved 456,062 million RBM in 2009, in which the service industry increased 226,942 million RBM, taking up 49.6 % of the area's total GDP, and growing 12.3 % compared with 2008. Besides, the GDP in Wuhan achieved 551,576 million RBM in 2010, in which the service industry increased 281,290 million RBM, taking up 50.9 % of the area's total GDP, and growing 12.5 %. However, in 2010, the percentage of the service industry in the total GDP in Wuhan exceeded 50 % for the first time, and its absolute amount ranked eighth in China's big and small cities.

Second, the gathering areas of the modern service industry have begun to take shape. The development of the service industry in Wuhan shows a concentration trend, and the service industrial systems with unique characteristics have formed in different areas. The "Wuhan Wall Street" in the Jianghan district has gathered the headquarters of 58 % of the banks of Hubei, six national financial headquarters, several foreign banks and the province's largest security, trust and future companies, creating a "financial ecological trial plot" in Wuhan and a bill settlement center for central China. Besides, the Wuchang district in Wuhan almost puts all colleges, universities, and research institutions together, and becomes the base for the culture and education. In addition, the New Town of Science and Technology in Wuhan East Lake is built to give priority to the modern financial industry focusing on the risk investments, the information service industry majored at software and network information, and the culture and cartoon industry based on animation.

Third, there are powerful supports from science, education, and information resources. The comprehensive strength of the science and technology education in Wuhan ranks third among the big and small cities of the whole country, after Beijing and Shanghai. At the end of 2006, there were 52 higher learning schools, 14 national and key laboratories, 13 national engineering technology research centers, 23 national enterprise technology centers, and 44 incubators of technological enterprises in Wuhan. The advantages of Wuhan in science, technology, and education are not available in other regions and the development of the science, technology, and education provides powerful technical and talent supports for the construction of the modern service center.

| | Wuhan | Nanjing | Chengdu | Shenyang | Qingdao | Dalian | Hangzhou | Ningbo |
|---|---|---|---|---|---|---|---|---|
| Productivity (10000RMB per Person) | 9.54 | 11.04 | 6.16 | 8.71 | 10.20 | 10.22 | 9.82 | 11.20 |
| Comparative Efficiency | 1.06 | 1.08 | 1.10 | 0.89 | 1.18 | 1.06 | 1.17 | 1.25 |

**Fig. 23.1** Comparisons on the productivities of the service industries in 2008 in eight cities

Compared with the cities such as Shenzhen, Beijing, and Shanghai having developed service industries, the modern service industry in Wuhan still has a big gap. First, the scale is small and the level is not high. Take Shanghai as an example. GDP of Shanghai in 2010 was 1,687,242 million RMB, in which the service industry increased 961,728 million RMB, taking up 57 % of the area's total GDP. However, the service industry in Wuhan increased 281,290 million RMB in 2010. Next, the systematization of the industrial clusters is low, and the brand industrial groups are insufficient. In recent years, there are foreign and domestic famous enterprises to continuously step into the service industrial clusters in Wuhan, which strengths the systematization of the clusters to some extent. However, the enterprises really having the control power and international competitiveness within the clusters are rare; the degree of the similarity among the service products is rather high; the enterprises give priority to the price competition for a long term, so the cost advantage of the clusters is weakened due to the price competition. Finally, the production efficiency in the service industry is low. According to Wuhan Bureau of Statistics, the social labor productivity of the service industry in 2008 in Wuhan was 95,400 RMB/person, which was lower than 112,000 RMB/person of Ningbo, 110,400 RMB/person of Nanjing, 102,200 RMB/person of Dalian, 102,000 RMB/person of Qingdao, and 98,200 RMB/person of Hangzhou. Thus, it ranked sixth among the eight cities in Fig. 23.1. The comparative efficiency was 1.06, which was also lower than that of Ningbo, Hangzhou, Qingdao, etc.

This sourced from the statistical analysis information released on the Website of Statistical Information of Wuhan.

## 23.4 Accelerating Development of Wuhan Modern Service Industry Through Service Industrial Clusters

The service industrial clusters have changed into one of the new growth poles in the developments of regional economies. From the perspective of the development strategy, the strategy of giving vigorous developments to the modern service industrial clusters in Wuhan city not merely is in conformance with the necessary needs of the developments at home and abroad and more importantly is an urgent task of the construction of the "two-oriented society".

### 23.4.1 Scientific Planning and Overall Arrangements

To further make optimizations on the conditions for the gathering of industrial clusters, it is necessary to do scientific planning and making overall arrangements. To cultivate and develop the modern service industrial clusters in Wuhan city, it is necessary to take the orientation of the cluster industries and the arrangements of spaces into consideration from the perspectives of the essential productive factors and the industrial relevance at the regional level, and also take actions that suit local circumstances in accordance with the future development strategy of Wuhan, so as to achieve the scientific planning.

### 23.4.2 Developing the Productive Service Industrial Clusters Greatly

Along with the construction of the manufacturing center of Wuhan city, the productive service industries attain vast developmental spaces. The modern logistics, finance and l insurance, science and technology, information service and education service can be selected as the breakthrough points at first. At the mean time, it is necessary to introduce the development experience at home and abroad, make explorations and trials on the development models of the production service industries in the industrial parks and clusters, so as to construct Wuhan city into the financial center, logistics center, information center, science and education center of Hubei province, and even central China. For this reason, the governments in Wuhan should take the initiatives to optimize the political environments, lower the market access threshold, improve the supporting environments for the development of the service industries, guide the industrial clusters toward the development of the standardization, specialization, and informatization, and make the transformation of these clusters exert a promotion role in the update of the manufacturing industry.

### 23.4.3 Absorbing and Training High-Quality and Professional Talents in Services

The modern service industrial clusters are the centers for high intelligence, high concentration, wide coverage, and high employment. The scales and qualities of the professional talents are the core elements for the service industrial clusters to receive a sustainable development. It is necessary for these clusters to rely on the knowledge, inspiration, and creative work of the professional personnel.

### *23.4.4 Cultivating the Industrial Cluster Culture and Creating the Cluster Brands*

The cluster culture can appear as the values and knowledge learning abilities of enterprises in the clusters, reflect a series of social spirits and humanistic environment such as worshipping the pioneering work, keeping honest and trustworthy, pursuing the brands and qualities, respecting knowledge, daring to take risks, making progresses and adhering to practices, and giving a certain tolerance to failure, etc. It is the irreplaceable resources to contact and attract the enterprises in the service industries, and is a key factor to promote the industrial clusters to attain development further as well. However, after the successful modern service industrial clusters at home and abroad are investigated, it is not hard to discover that there are a great number of unique social and cultural factors to exert an influence from Manhattan to London to China's Beijing Zhongguancun, Shanghai Lujiazui software park, and Shanghai CBD industrial cluster. In Wuhan city, the financial street on the Jianghan road, Wangjiadun business center, Wuhan Xinzhou logistics center, and Wuhan Guanggu have obtained certain well-known reputations and industrial scales. Therefore, it is necessary to attach high importance to the great development of the industrial cluster culture, strengthen the ability of enterprises in the clusters to learn, and foster the core competitiveness of the enterprise cluster culture in the next step.

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# Chapter 24
# New Model of Logistics Development

**Fu Rong Xiong**

**Abstract** With the global economy becomes increasingly integrated, regional competitions highlight the performance of the competition between the supply chain, logistics and thus more and more countries, regions, and business attention. "Logistics hot" also has been quietly rising in China, provinces, and even towns, have introduced logistics development policy and planning. However, under the urgent need for a cold wave of thinking, that is, how can we effectively promote the logistics of a region or city development? How to jump out of errors, take a real, consistent with national conditions and also adapt to the trend of urban logistics of international economic development path.

**Keywords** Logistics development · Current situation · New model · Construction · Strategy

## 24.1 Introduction

Modern logistics, which is regarded as a "black mainland" in the in-depth cognition, has transformed into the "third source of profits" that people yearn for and are willing to pioneer. It effectively improves efficiencies and reduces the logistics costs through the integration of all kinds of logistics activities. It is not only an important way and mean for all enterprises to acquire the "third source of profits", but also is a main factor to mirror the manifestation, combination, and utilization of social resources,

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the all-round reduction of social costs and the general improvement of the social efficiencies. At the mean time, it has become one of the objectives that people are seeking for at the present time. In addition, the development situation of the modern logistics industry has been confirmed as one of the important indexes to measure the entity economic development levels, the economic strengths and the modern management qualities of a country, a region, and an organization. Therefore, it is imperative to implement explorations on the new models of the new logistics developments under such a circumstance.

## 24.2 Problems in the Development of China's Logistics

### *24.2.1 Segmented Management Systems and Insufficient Macroscopic Coordination Management Agencies*

As it is known to all, the logistics industry touches upon a great number of sectors and industries. A large number of development policies, laws and regulations, development strategies and plans, organization and management as well as the coordination tasks of the modern logistics industry require the mutual cooperation, and the consistent management of multiple sectors and industries. At the present time, in the "three fixed programs" of the governmental departments, there has been no a governmental department which can clearly implement administrations on the logistics industry yet [1]. As a matter of fact, in China, the logistics industry is under the general management of the State Economic and Trade Commission (SETC). In the process of development, the logistics industry encounters the segmentation of its departments as well as the institutional obstacles from breaking many barriers between different departments. These have a negative influence and impose a restriction on the development of the logistics industry to a large extent. At the same time, they are the most important factors to exert a large restriction on the development of the logistics industry in China.

### *24.2.2 Shortage of the Policies to Promote the Development of Logistics*

On the one hand, the departments and industries such as the State Development Planning Commission (SDPC), SETC, Ministry of Railways, Ministry of Communications, Civil Aviation Administration of China (CAAC), State Post Bureau, Ministry of Education, and Ministry of Science and Technology which have a close connection with the logistics industry, as well as the governmental departs at all levels have formulated related policies and regulations, with the purpose of promoting the development of the modern logistics industry. However, the policies

and measures which have been formulated by the departments at all levels start from their own interests, and lack the coordination with other departments. As a result, they give rise to the insufficient or unreasonable implementations in the reality. On the other hand, as the development of the modern logistics industry is still in the initial stage in China at the present time, the theoretical system has not been sound, and the practical experience is still not abundant. Although the stage has supplied higher broad spaces to support the development of the modern logistics industry from the aspects of policy and publicity, the relevant policies to support and protect the development of the logistics industry are still in shortage in the reality.

### *24.2.3 Unsound Logistics Standardization Systems*

By now, Chinese governments have made a great deal of work in the construction of the logistics standardization systems. For instances, they have formulated the "logistics terms" and "commodity codes" according to the national standards, but there are still certain problems in the intensity of promotion intensity as well as the degree and range of its standardization. For example, the intensity of promoting the logistics identification and standardization systems is insufficient. Up to now, the logistics identification and standardization systems have been established in China and also some important national standards were issued, such as the "commodity codes", "Bar code in Dispatch Unit" and "Bar code in logistics unit". However, serious problems exist in the applications and promotions of these standards [2]. Take the "Bar code in Dispatch Unit" for an example. Its right application rate is less than 15 %.

### *24.2.4 Logistics Enterprises are Unable to Meet the Requirements of Social Development*

The increasing improvement of the economic mercerization drives more and more enterprises to need professional logistics enterprises to provide the highly efficient services for them. In China, a majority of the logistics enterprises are transformed from the traditional storage and transportation companies at the present time. Also, there have been some professional logistics enterprises with good developments at the markets of China. However, generally speaking, the service quality and efficiency of the logistics enterprises are still at a lower level. Thus, they have no abilities to comply with the requirements of the social development at the present stage, which can be mainly embodied in the single service item model. At the present time, a majority of the enterprises which are engaging in the logistics services is only able to supply the transportation and storage services, and have no

abilities to develop the networking and systemic logistics services. Besides, there are no comprehensive developments in the value-added logistics service aspects such as the distribution processing, logistics information service, inventory management, logistics cost controlling, and especially in the higher level logistics service aspects such as the logistics plan design and whole-process logistics service [3].

## 24.3 How to Construct New Models of Logistics Development

Logistics is the third source of profits for enterprises at the present time. Therefore, it is imperative and urgent to construct the new models of logistics development, which can be implemented from the several aspects which are shown in the following.

### *24.3.1 Establishing Unified Coordination and Management Institutions for the Logistics Industry*

The logistics industry has a close connection with a great number of departments and industries. However, the coordination among these departments or industries is necessary as well. As the reforms of China's governmental institutions develop into a comprehensive situation with a gradual step and the decoupling task of the governmental departments and the enterprises is completed, the conditions are created for the governmental departments to put the logistics industry under a centralized management. It is suggested to establish a logistics management institution under the leaderships of the relevant comprehensive economic departments of state and with the participation of other departments such as the communication departments, railway departments, domestic trade departments and foreign trade departments, with the purposes of uniformly guiding, organizing, and coordinating work of multiple communication departments, circulation departments and industries, strengthening the coordination with governments, formulating the normative policies and measures for the development of the logistics industry. Thus, through the guidance of polices, the improvement of management and the enhancement to service, good institutional environments can be created for the development of the logistics industry.

### *24.3.2 Integrating the Logistics Resources*

The modern logistics industry is with the characteristics of socialization, systematization, and networking. The integration of all kinds of logistics functions

and elements is the primary task of the development of the modern logistics industry. First of all, it is necessary to implement the asset reorganization. Through the reorganization, merger, and joint, the logistics industry can develop toward the intensification and cooperation. The logistics enterprises, which are newly established, will bring the advantages of Internet into full play, and can get a control on the dynamic logistics information timely and accurately, conduct a harmonious coordination among different logistics centers, construct a world integrated logistics network, and save the time and expense to the maximum, with the ultimate purposes of winning the competitive advantage and providing high-quality services for the customers. In addition, it is necessary to build up a strategic alliance. The enterprises within the same economic area have the abilities to integrate all of their unique resources. Therefore, the mutual complement and sharing can be accomplished, and simultaneously the scale management can be formed within the superior enterprises so as to reduce the operational costs. Besides, the expansion of the scales can be realized through the business cooperation and the establishment of strategic alliances. More importantly, however, they are achieved by taking advantage of the merger of enterprises.

### *24.3.3 Unified Planning for the Development of the Logistics Industry*

The modern logistics is highly complicated system engineering, as it involves a great number of industries such as the communications and transportation, agency service, storage management, processing and distribution, information network, marketing planning. It will give rise to the chaos at the markets if the planning for it is unreasonable. Therefore, it is necessary to do a good job of the planning for the development of the logistics industry, including the plans for the national, regional, and port logistics developments, etc. First of all, it is necessary to break the restrictions from different areas, departments, and industries, conduct the overall planning for the logistics according to the large circulation idea, make designs as a whole, arrange the comprehensive logistics centers or bases reasonably, and also construct China's large transportation channel based on planning. Next, it is necessary to invest the limited capitals into the areas which have many problems to be resolved in accordance with the national uniform plan. Thus, assorted and comprehensive transportation networks, well-improved storage distribution facilities and advanced information network platforms can be formed finally.

## 24.4 Standardizing the Access to Markets and Improving Market Supervisions

In order to avoid the disorders happening to the markets, it is necessary to standardize the access to the markets, improve the market supervisions, and strengthen the managements on industries by taking advantage of the methods such as the administrative intervention, the policy guidance, and the establishment of the constraint mechanisms. It is suggested to carry out the measures in the following.

First of all, it is necessary to classify and organize the existing laws, regulations, and policies which have a connection with the logistics industry, make modifications and improvements on the laws and regulations for the logistics industry in accordance with the developments and changes of the actual conditions, formulate and perfect the detailed rules for the implementation of management, plug up loopholes in the management, and enhance the macroeconomic regulation and control abilities further.

Second, it is necessary to expand the intensity of the supervisory control. The enterprises, which engaged in the logistics services in the previous time, are necessary to do examination and verification again in accordance with the conditions of the operational qualification in the evaluation on the qualification of the transportation service. Those, who cannot reach the conditions of the operational qualification, shall not be approved to deal with the logistics service. In addition, it is necessary to remove the poor-efficient logistics departments, and make the logistics activities of enterprises achieve the socialization, and hence foster an extensive and solid foundation for the market demands for the development of the logistics industry.

Third, it is necessary to establish a market access system, implement the qualification examination on the practitioners, business fields, operational abilities, and management and technological conditions for the operators who apply for the establishments of the warehouse rent and agent transport services, impose restrictions on the unqualified operators to access the logistics market, and get a control on the cut-throat competitions. At the same time, if the pilot enterprises of the logistics reach the conditions of the operation qualification, it is necessary to give an approval to them and change their licenses.

## 24.5 Conclusion

From the above analysis, it can be known that the development of the modern logistics is highly complicated social system engineering. It needs to start from multiple aspects. At the mean time, the governments at all levels can take the method of laying a stress on the support for the leading logistics enterprises. Specifically, the most important enterprises can be selected to run the pilot programs in the logistics, so as to cultivate the typical examples and conclude the

lessons from the practical experience. Hence, the theories and methods, which are applicable for China's actual conditions, can be worked out. Under the promotion of the leading logistics enterprises, the modern logistics industry in China can be driven to develop quickly, stably, and healthily.

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# Chapter 25
# Study of Protection of Water Environment in the Three Gorges

**Yanfang Zhang**

**Abstract** This article has introduced legal defects existing in protection of water environment in the three gorges from five aspects, which includes the lack of a ruling law, lack of special river basins administrative organization and coordination mechanism, the public having tenuous consciousness of environmental protection, defects in water use system, and lack of market mechanism for the pollution control. The author has put forward his own advice according to the above five aspects in the end, which are to formulate prevention and control regulations of the water pollution in three gorges, establish water environment management committee, encourage the public to participate in these activities, and perfect compensation systems for use of water and chargeback system for pollution discharge.

**Keywords** The three gorges · Protection of water environment · Problems · Suggestions

## 25.1 Introduction

The three gorges project is a world-famous and cross-century engineering which has received much attention. After the impoundment of the three gorges dam, the Yangtze River flow greatly slow down and its capacity of self-purification has

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fallen, and environmental capacity of pollutants has also fallen sharply while the level of pollution of water in the reservoir is increasing. In 2004, according to the Monitoring Results of the Ecology and Environment in Yangtze Three Gorges Project issued by the state environmental protection administration, it shows that at present, although most of the 26 wastewater treatment plant and 21 garbage disposal plant have been finished and put into use, and some ports in the reservoir region have ship garbage receiving place and garbage receiving ship, but the sanitary sewage and oil wastewater from ships are also rising. The amount of various pollutants in the reservoir region has a significant increasing trend, and the water environment is facing a serious pollution [1]. In the reservoir region of the three gorges, the protection of water environmental has achieved some good effect, the quality of water is overall good, but pollution of subprime river is relatively heavy, and in the three gorges reservoir region, local water area has formed the relatively obvious pollution zone, including the overweight pollution zone. Although in recent years the situation is improved but it is still not optimistic. How to use legal better to protect the water environment in the three gorges reservoir region has become a problem which is urgent to solve [2].

## 25.2 Problems About Law in the Protection of Water Environment in the Three Gorges

### *25.2.1 Lack a Ruling Law for Yangtze River Basin*

At present we lack a ruling law for Yangtze River basin. For example, in the Australian Murray—darling basin, a Murray—darling river basin agreements was concluded in October 1987, and the purpose of this agreement is to promote and coordinate effective planning and management activities in order to make use of water, land, and environmental resource in Murray—darling basin fairly, effectively, and sustainably[3]. This agreement has solved the affairs in the basin well and it provides a law for the watershed management. While in the Yangtze River we still lack a ruling legal instrument, which makes it hard for the river basin management department into handle affairs according to legal basis.

### *25.2.2 The Three Gorges Reservoir Region Lacks Special River Basins Administrative Organization and Coordination Mechanism*

Although China has established the Yangtze River water conservancy committee as the Yangtze River basin management institutions, and pass legislation to confirm its legal status and give it the management power. However, the Yangtze

River flows through 19 provinces, cities, and autonomous regions, if we only rely only on the Yangtze River water conservancy committee to manage the river basin in so many administrative areas, its efficiency and effect will not be ideal. As the most important and the most special valley, there has been no branch management mechanism which is specially established for the three gorges reservoir basin, which is not good for the protection of the water environment.

### *25.2.3 Both the Prosecutor and the Public has a Tenuous Environmental Protection Consciousness*

In the process of enforcing law in the three gorges reservoir area, many environmental protection personnel take individual as the standard and value personal interests, which is the primary reason why the environmental protection supervision is not good and law enforcement is lax. And this is one of the roots for the insufficient funds and low efficiency [4]. In addition, the ordinary people in the reservoir region have poor consciousness to protect ecology in the water environment, so there are many direct polluting behaviors, which is also one of elements to cause water environmental degradation.

### *25.2.4 Water Use System has Defects*

The new Water Law of the People's Republic of China, the 54 item formulates that people's governments at all levels shall actively adopt measures to improve the urban and rural residents' conditions of drinking water. Item 55 formulates that once using the water supplied by water project, people shall pay water charges to water supply department according to state regulations. The water price should be confirmed in accordance with the principle of compensation cost, reasonable profits, high quality and high price, fair burden. The specific measures will be formulated by people's government at or above the provincial level and the water conservancy administrative department at the same level or other water conservancy administrative department according to authority. Though the two rules has explicitly stipulated pricing principles and methods for water resources and government should take measures to improve the drinking water conditions, but there are no regulation for the fee to improve the relationship between the use of and sewage processing. At present, the people in reservoir region not only need to pay the raised price for the water, but also pay certain sewage processing fee. Although the burden is increased for ordinary people as long as it is helpful to perfect water price system and protection of water resources. The fact is that the fee is collected

but government and the environmental protection departments continue to declare the lack of funds and hope states to give more support. Water raise water is originally an scientific and effective measure to protect water resource, but the system is not strict enough so that the fee charged is mainly used to ensure the interests of water supply department, and it is rarely used for water resources management and protection, which increases people's burden and water environmental protection funds has not got ensured.

### *25.2.5 Lack of Market Mechanism for Pollution Abatement*

Currently in three gorges reservoir region, no matter sewage treatment, waste disposal or pollution charges has not introduced market mechanism because of the lack of competition, which leads to the high cost in pollution and low efficiency in garbage processing. Moreover, the water environment management funds primarily rely on state special financial, the sewage charge planned by national environmental protection bureau and income from electricity of the three gorges project, however, there is no social capital and foreign capital investment, and the special funds for three gorges water environmental protection has not been established. The lack of market mechanism has directly caused a bad result in pollution abatement, and pollution in many places is very serious.

## 25.3 The Suggestion to Strengthen the Legal Protection for Water Environment in the Three Gorges Reservoir

### *25.3.1 The Suggestion to Formulate Regulations About the Prevention and Control of Water Pollution in Three Gorges Reservoir Basin*

According to the advanced foreign experience of watershed management, we find that not only the river basins administrative agencies but also the watershed management special laws should be formulated so as to manage water by law. At present, China has not yet issued special law for the three gorges reservoir or the Yangtze River, the existing special legislation is the water pollution control ordinance for Yangtze three gorges reservoir area in Chongqing. Although 85 % of the reservoir area is in Chongqing, the ordinance does not apply to the whole reservoir area. The author thinks that in addition to the prevention and control law

for water pollution in Yangtze River basin, a more specific regulation like the Control regulations for water pollution in the three gorges reservoir basin is still needed. The law should be formulated by Chongqing and Hubei Province with River basins administrative agencies, so that Chongqing and Hubei Province do not need separate legislation, and the regulations can fully embody the characteristics of three gorges reservoir basin and needs, which will be useful for the water environment protection in the three gorges reservoir region.

### *25.3.2 Suggestion to Establish a Management Committee for the Three Gorges Water Environment*

The author suggests setting up a management committee for the three gorges water environment, and it will exercise the function of management and protection for water environment. At present, as the river basins administrative agencies the Yangtze River water conservancy committee is wielding various functions. But the author thinks that it is a bit farfetched for the Yangtze River water conservancy committee to manage the entire Yangtze River basin, and it turned out that the management efficiency of the Yangtze River water conservancy committee is not high. Both local environmental administrative departments and some state-owned enterprise which are responsible for pollution treatment project are calling for a special water environment management agency for the three gorges reservoir area to unified management. In addition to establishing a management committee for the three gorges water environment, we should also take the reference of foreign basin management such as establishing river basin and local coordination mechanisms and establishing the coordination agency in the management committee. The author thinks that the personnel of the coordination agency should be made up of members of three gorges water environment management committee, local government and local environmental protection department, and the coordination agency which represents multi-stakeholder will play an active role in the management of the three gorges reservoir area. Cooperating agencies should hammer at solving the conflict between holistic legislation for the valley and the local legislation to maintain coordination between overall interests and local interests so that all kinds of legislation can form an organic whole. The coordination agency also should make full collection of information on water environmental management and protection and research it to supply information support for the watershed organizations, government and related departments to make decisions. At the same time, the coordination agency need publicize information and provide consultation service about water resource and water environment information for residents.

### 25.3.3 Encourage the Public to Participate in the Management for the Three Gorges Reservoir Area

Usually there will be many relevant professional experts in the river basins administrative agencies of various countries, in the process of making significant decision, their suggestions will be widely listened to and adopted, what's more the suggestions will be used for scientific demonstrations. For example in Australia from 1994, any scheme about water resources in any river basin must make proper environmental assessment before it is passed so as to fully consider environmental value. Any relevant water policy must have detailed plans before determined, and these plans must be estimated by authoritative professional department and approved by general public before implemented, otherwise it is illegal. When passing any law about water allocation, people must take the most scientific and most extensive information analysis for the premise so as to maintain the ecological environment that water reply on and realize the ecological value and society value of water [5]. Moreover in view of river basin management involves various social interests, foreign river basin management also pays attention to the public's participation, and it absorb many residents and social circles in river basins administrative agencies as members who take up a big proportion, which are good for strengthening the democratization of watershed management, scientific and transparency so as to realize efficient utilization and sustainable development of the basin. These measures are good reference for the management of water resources in the three gorges reservoir area.

### 25.3.4 Perfect the Paid System for Water Resource

First we should clearly stipulates residents' fee for water in the legislation, and the water rates except for water costs and the reasonable profits must be used for the management and protection of water resources and to improve the quality of river body and drinking water in the three gorges reservoir area constantly; Second to make more specific provision to earmark sewage treatment for its specified purpose only and formulate the fee must be used exclusively for construction and maintenance of the sewage treatment, and make sure sewage treatment fee has nothing to do with related personnel's personal income; Third, the nature of the fee including sewage treatment fee should change from administrative charges to company charges gradually, which is also the inevitable requirement for water supply and sewage disposal to realize the marketization.

### 25.3.5 Perfect the Paid System for Pollution Discharge

The author thinks we should stipulate the relevant finance departments to establish independent expenditure projects for pollution discharge fees and strictly distinguish it with other funds to fully guarantee the fees are all used for protection and management of water environment. So we must complement or revise the terms of the related laws as soon as possible. In addition, we should not charge the sewage treatment plant and other pollution treatment unit, and the main reason is that these units' pollutants are rooted in the pollutants that they have handled, if we change them, it will certainly affect their efficiency and enthusiasm of work. Moreover, if even the collection objects can not be defined clearly, it shows that the system itself is not perfect, and we should improve it as soon as possible.

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# Part IV
# Innovative Education and Applications

# Chapter 26
# Research of Core Strength Training in Taekwondo Training

**Mingming Guo**

**Abstract** With the gradual physical training systems and scientific theories, core strength training more and more attention by many coaches. At present, the application of core strength training in Taekwondo significance only stays at the theoretical level is not related to the experimental study. This study used experimental method and mathematical statistics method, the Shenyang Sport University 16 Taekwondo two-stage athlete of core strength training experimental study. The results showed that their choices of eight items special physical quality index, through the core strength training have improved. Through the matching sample *t*-test, the seven indicators of high horizontal kick target, fast playing sandbags, continuous quick filed a knee, the continuous single leg rapid horizontal kick target, and continuous single leg foot split target special physical quality indexes are highly significant difference. The index of bilateral back spinning kick despite has a raise, but the difference is not significant. Hope this research for the future in the core system introduces taekwondo strength training is a reference.

**Keywords** Taekwondo · Core strength training · Experimental research

## 26.1 Introduction

Core strength is the core muscle to classify the strength from the aspect of anatomy, which is the strength to maintain the gravity, control body's balance and transfer the strength required during the motion, generated by shrinkage under the control of all

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muscles and ligaments. Core strength training is comprehensive, systematic, and scientific strength training for all muscles [1]. It is a kind of modern physical training, to improve athlete's core strength through varied training instruments and methods, which can be applied to many items [2, 3].

Taekwondo is a skill-ruling antagonistic group of combat, which requires comprehensive physical qualities. Strength, velocity, smart, and patience are leading ones. Velocity and explosive force are main factors. Athletes have to change their velocities and directions according to current situations. They have to change bodies' gestures to keep their balance [4]. Such training can firm spine and make pelvis to keep the correct motion, to improve the ability of controlling and enhance the energetic exports to improve the effects [5, 6].

## 26.2 Research Object and Method

### *26.2.1 Research Object*

This paper selects 16 male students as samplings, majoring in Taekwondo, in grade of 2008 and 2009 in Shenyang Institute of Physical Education, all of them are Grade-2 athletes. It focuses on the effect of core strength training on athlete's special physical qualities. There are eight people in the reference group, and others are in experiment group.

### *26.2.2 Research Method*

According to research requirements, they collect and arrange approximately 30 papers on core strength training from library of Shenyang Institute of Physical Education and CNKI, including journal, magazine, and Master Degree Thesis. Know about the research situation and relative theories of core strength training.

During August and October, 2011, we have been training 16 college students for 8 weeks, majoring in taekwondo in Shenyang Institute of Physical Education, who are classified into two groups randomly [7].

During August and October, 2011, we have been conducting training 8 students from experimental group for 8 weeks, four times a week, and 30 min a time.

Taekwondo gym in Shenyang Institute of Physical Education

According to the requirement, the training is divided into three stages, mainly trained by Swiss ball and slippers.

Conduct special test on 16 students, who are from both groups before and after the experiment. The test content is: high horizontal kick target for 20 s, fast playing sandbags for 20 s, continuous quickly filed a knee for 20 s, continuous single leg rapid horizontal kick target for 20 s, continuous single leg rapid down stress kick target for 20 s, and continuous spinning-back kick target for 20 s.

Conduct usual taekwondo training on eight students from reference group. Conduct core strength training on eight students from experimental group for 8 weeks, four times a week, and 30 min a time. There are three stages. The first stage is for 2 weeks. The main task is hand action on the mat, including flexible arm and stoop bridge (double arms single leg, single arm, and single leg), prone sides body extension, sitting leg rotary, supine bend cross contract leg, prone double legs rotary. The second stage is for 3 weeks. It mainly practices Swiss ball, including supine, hold and swing the ball with two legs, prone and swing two legs up and down, prone and support the ball to swing in single leg, supine and pull the ball to push hip, side-lying support holding ball in single elbow. The third stage is for 3 weeks. It is mainly exercised in slippers, including kneeling hold and stretching slipper in double hands, prone and hold Swiss ball in two legs and stretching slipper in two hands, supine, stamp and pull the hip, prone and stamp the slipper [8, 9].

To ensure the reliability, it is mainly controlled from following three aspects. First, while conducting the test, do not tell students they have been conducted the same tests, so as to decrease the probability of special training in their leisure times. Second, in the process of experiment, the time for static strength practice is 15–30 s for a group, dynamic strength practice is more than 20 times for a group, and the ratio of practice time and rest time is 1:2. Control the gestures rigidly, keep breathe with action, and stress the neutral system, to ensure the effects. Third, students do not take actions to improve their core strengths as possible as they could, and have to be enquired before the training, to ensure its science.

Using scientific statistical software SPSS13.0, comparing to sample *t*-test, deals with the data before and after the experiment.

## 26.3 Conclusion and Analysis

### *26.3.1 Effects of Core Strength Training on Athletes' Special Physical Qualities*

Core strength of Taekwondo athletes is the ability to stable body's core region, control the gravity center, and reduce the energetic loss, under the management of core muscles and neutral. Core strength in the competition is represented as rapid position shifting, hitting velocity in the attacking, and rapid gravity center regulating in the transformation. It requires the good earthquake resistance of internal organs, tactile enhancement, hurt feeling weakening, and high stability of vestibular analyzer. Maximum power is not the essence, but the rapid regulation is, under the pierce combat. Such performance depends on core strength level. In other words, the performance has to rely on core muscles. The test data are shown in Table 26.1, 26.2.

Table 26.1 analysis of special physical qualities data differences between reference group and experimental group before the experiment n = 16.

(a) High horizontal kick. (b) File a knee. (c) Left rapid horizontal kick. (d) Right rapid horizontal kick.

Table 26.2 analysis of special physical qualities data differences between reference group and experimental group before the experiment n = 16.

(e) Fast playing sandbags. (f) Left leg down stress kick. (g) Right leg down stress kick. (h) kick-turn.

Notice: A1 is the data from reference group before the experiment; B1 is the data from experimental group before the experiment; A2 is the data from the reference group after the experiment; B2 is the data from the experimental group after the experiment.

Table 26.1, 26.2 shows: before the experiment, the levels of 8-item special physical qualities are the same. All the P values are more than 0.05, without obvious differences. The initial qualities are the same.

After the 8-week training, we conduct the second test on reference group, to explore its effect. The result is shown as in Table 26.3, 26.4

Table 26.3 analysis of special physical qualities data differences for reference group before and after the experiment n = 8.

(a) High horizontal kick. (b) File a knee. (c) Left rapid horizontal kick. (d) Right rapid horizontal kick.

Table 26.4 analysis of special physical qualities data differences for reference group before and after the experiment n = 8.

(e) Fast playing sandbags. (f) Left leg down stress kick. (g) Right leg down stress kick. (h) Kick-turn.

As Table 26.3, 26.4 depicts the mean value of 8-item special physical qualities change little before and after the experiment for the reference group. The P values are more than 0.05, without obvious differences. It shows the common class training is only to keep the special quality level of student's.

After the 8-week core strength training, to research the specific effects, conduct second test on 8 students in experimental group. The result is shown as in Table 26.5, 26.6.

Table 26.5 analysis of special physical qualities data differences for experimental group before and after the experiment n = 8

(a) High horizontal kick. (b) File a knee. (c) Left rapid horizontal kick. (d) Right rapid horizontal kick.

**Table 26.1** Analysis of special physical qualities data

| (a) | (b) | | (c) | | | (d) | | |
|---|---|---|---|---|---|---|---|---|
| M SD | M SD | | M SD | | | M SD | | |
| A1 | 35.63 | 1.685 | 60.75 | 2.121 | 36.38 | 1.188 | 36.63 | 1.061 |
| B1 | 36.00 | 1.852 | 60.50 | 2.121 | 36.50 | 1.195 | 37.00 | 1.195 |
| P | 0.728 | | 0.875 | | 0.862 | | 0.285 | |

**Table 26.2** Analysis of special physical qualities data

| (e) | (f) | | (g) | | | (h) | | |
|---|---|---|---|---|---|---|---|---|
| M SD | M SD | | M SD | | | M SD | | |
| A1 | 71.88 | 2.416 | 28.00 | 1.309 | 27.88 | 1.126 | 14.00 | 1.069 |
| B1 | 73.00 | 2.507 | 28.63 | 0.916 | 28.38 | 0.916 | 15.13 | 0.641 |
| P | 0.434 | | 0.305 | | 0.170 | | 0.142 | |

**Table 26.3** Analysis of special physical qualities data

| (a) | (b) | | (c) | | | (d) | | |
|---|---|---|---|---|---|---|---|---|
| M SD | M SD | | M SD | | | M SD | | |
| A1 | 35.63 | 1.685 | 60.75 | 2.121 | 36.38 | 1.188 | 36.63 | 1.061 |
| A2 | 36.13 | 1.246 | 59.38 | 0.916 | 36.13 | 1.246 | 36.13 | 1.246 |
| P | 0.487 | | 0.156 | | 0.711 | | 0.487 | |

**Table 26.4** Analysis of special physical qualities data

| (e) | (f) | | (g) | | | (h) | | |
|---|---|---|---|---|---|---|---|---|
| M SD | M SD | | M SD | | | M SD | | |
| A1 | 71.88 | 2.416 | 28.00 | 1.309 | 27.88 | 1.126 | 14.00 | 1.069 |
| A2 | 71.50 | 1.773 | 27.50 | 1.195 | 28.63 | 0.744 | 14.25 | 0.707 |
| P | 0.598 | | 0.170 | | 0.080 | | 0.598 | |

**Table 26.5** Analysis of special physical qualities data

| (a) | (b) | | (c) | | | (d) | | |
|---|---|---|---|---|---|---|---|---|
| M SD | M SD | | M SD | | | M SD | | |
| B1 | 36.00 | 1.852 | 60.50 | 2.121 | 36.50 | 1.195 | 37.00 | 1.195 |
| B2 | 39.88 | 0.835 | 64.63 | 0.916 | 39.75 | 0.886 | 40.38 | 1.302 |
| P | 0.001 | | 0.000 | | 0.000 | | 0.003 | |

**Table 26.6** Analysis of special physical qualities data

| (e) | (f) | | (g) | | | (h) | | |
|---|---|---|---|---|---|---|---|---|
| M SD | M SD | | M SD | | | M SD | | |
| B1 | 73.00 | 2.507 | 28.63 | 0.916 | 28.38 | 0.916 | 15.13 | 0.641 |
| B2 | 78.88 | 2.416 | 31.38 | 0.916 | 31.13 | 1.126 | 15.50 | 0.926 |
| P | 0.000 | | 0.000 | | 0.000 | | 0.080 | |

Table 26.6 analysis of special physical qualities data differences for experimental group before and after the experiment n = 8

(e) Fast playing sandbags. (f) Left leg down stress kick. (g) Right leg down stress kick. (h) Kick-turn.

As Table 26.5, 26.6 shows, to the students in the experimental group, levels of 8-item special physical qualities are changed before and after the experiment. The results after matching sampling *t*-test are: the mean value of 20 s high horizontal kick target increases to 39.88 from 36.00, P = 0.001, with obvious difference. The mean value of 20 s fast playing sandbags increases to 78.88 from 73.00, P = 0.000, with obvious difference. The mean value of 20 s fast filed knee increases to 64.63 from 60.50, P = 0.000, with obvious difference. The mean value of left rapid horizontal kick target increases to 39.75 from 36.50, P = 0.0000, with obvious difference. The mean value of 20 s right rapid horizontal kick target increases to 40.38 from 37.00, P = 0.003, with obvious difference. The mean value of 20 s left leg down stress kick increases to 31.38 from 28.63, P = 0.000, with obvious difference. The mean value of 20 s right down stress kick increases to 31.13 from 28.38, P = 0.000, with obvious difference. The mean value of kick-turn increases to 15.50 from 15.13, P = 0.080, with unobvious difference.

The data above indicates, after 8-week training, the students' special qualities, such as 20 s high horizontal kick target, 20 s fast playing sandbags, 20 s rapid filed knee, 20 s continuous single leg rapid horizontal kick target and 20 s continuous single leg down stress kick, have presented obvious changes. Although some improvements in 20 s continuous turn kick, the matching sampling *t*-test differences are not obvious. The reason includes three aspects. First, the core strength training improves the core stability, reduces the energy required to control gravity center, so as to increase the velocity. Second, the improvement of core strength enhances the energy output and increases the velocity for an action. Third, it strengthens the muscle and ligaments, reduces the momentum loss in the transference, and increases the velocity of bottom of body. But to 20 s continuous turn kick, the improvement of magnitude has no obvious difference, due to its high requirements of technical skills. Only with the deeper enhancement of technology, it can be improved. Therefore, the effects will be unobvious only by core strength.

### *26.3.2 Effects of Core Strength Training on Athletes*

According to torque conservation theorem, when athlete's down body produces a forward rotary torque, an opposite rotary torque must be produced in other part of body, to keep the balance. The core muscles act as connection. It includes the training both deep stable muscle and surface stable muscle. In tradition, deep stable muscle training is often ignored.

By adding instable factor in the training process, the controlling ability of nerve is enhanced, propelling the body to adapt to the changes of conditions, with real-time regulation, so as to improve the self-feeling capabilities of neutral muscle system. Core strength training under the unstable state is an effective way to stimulate and raise core stable muscle. It can also improve the core stability. Training of stability, balance, flexibility, and compatibility of the core part to improve its power, can directly improve the stable function, so as to improve the controlling capabilities.

Core muscle is the key. When body generates power, the energy in the core muscles transmits from the center of body to motion section. The strong power can promise the firm support for body, improve the energy output from the core to body, and increases the efficiency. Not only promises the effective utilization but also decreases the energy loss, which makes the technical actions to be more correct, successful, economic, and effective.

In the hitting process, maximum power and velocity have to be achieved at the time for leg of leaving ground. It comes from the force of core strength muscles, effectively transferred by enclosure dynamic line, so as to increase the temporary power. In the starting stage, the athletes, with fine harmonious ability and strong core muscles can keep better balance, and keep their muscles relax, so as to avoid extra energy loss. But at the time of hitting, the strong core strength can reduce the momentum loss in the maximum scale, so as to promise maximum velocity.

Core strength training can increase the ability of deep small muscles, enhance the stability of spine and pelvis, and improve the stability of core part and patience of core muscles. With the improvements of stability of joints and ligaments, etc., the loads can be reduced effectively, so as to prevent from hurting effectively.

In the competition and training, all the sports have to be conducted with the ordinate forces of bodies. By enhancing the stability, stable supporting can be provided for other muscles; meanwhile it can also improve the qualities such as start, lag, acceleration, and changing direction, etc. When athlete has fast generating strength, strong muscles can ensure the correct positions in the action, and the stability of deep small muscles can prevent from the acute loss. Otherwise, the probability of hurt can be increased greatly, which have a direct effect on the performance.

## 26.4 Conclusion

The 16 Grade-2 athletes are grouped randomly. They have been tested before the experiment on 20 s high horizontal kick target, 20 s fast playing sandbags, 20 s fast filed knee, 20 s single leg fast horizontal kick target, 20 s single leg down kick target, 20 s turn-kick, the difference after matching sampling *t*-test is not obvious.

After the 8-week usual training, conduct second test on the special physical qualities on 8 students in the reference group on 20 s high horizontal kick target, 20 s fast playing sandbags, 20 s fast filed knee, 20 s single leg fast horizontal kick target, 20 s single leg down kick target, 20 s turn-kick, the difference after matching sampling *t*-test is not obvious.

After the 8-week core strength training, conduct second test on the special physical qualities on 8 students in the experimental group on 20 s high horizontal kick target, 20 s fast playing sandbags, 20 s fast filed knee, 20 s single leg fast horizontal kick target, 20 s single leg down kick target, 20 s turn-kick. Separately conduct matching sampling *t*-test with the results before the experiment, the result shows, the indexes of 20 s high horizontal kick target, 20 s fast playing sandbags, 20 s fast filed knee, 20 s single leg fast horizontal kick target, 20 s single leg down

kick target have obvious differences. The mean value of 20 s turn kick increases, but with unobvious difference.

Core strength training is of significance, mainly manifesting in three ways. First, it can improve the ability to control gravity center. Second, it can improve the efficiency of skills. Third, it can reduce the probability of hurting.

## 26.5 Advice

Limited in quantities, it is not comprehensive. The following study will consider increasing the sampling quantities and study the different genders. To expand the research field, add the test on biomechanical index and biophysical index, to improve the science.

The core strength training is important, which can be emphasized in the daily training. It can not only improve the efficiency of skills but also reduce the hurts effectively.

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# Chapter 27
# Experimental Study of Tai Chi Competitive Push Training of Sanda Players Combat Ability

**Hai Yu**

**Abstract** Sanda belongs to skill dominant category combat sports, the purpose of competition is to get the upper hand. With Sanda and the world combat sports practice, Sanda technology, the tactical level is higher and higher, competition against more intense, a heavy hit and quick throw is already the development trend, so in addition to skilled offensive and defensive technology, increase the player's active soon broke the technical level and the shockproof ability is also one of the elements of success. It mainly adopts experiment, measurement, and statistical analysis method, the use of twenty-four Style Taijiquan and Taiji competitive push aided training on improving Sanda Athletes throwing and falling and strength endurance level of actual combat ability and the role of research. By selecting the relevant index analysis, the conclusion is as follows: in Sanda training, the scientific use of twenty-four Style Taijiquan repertoire, and competitive Taiji Push-hand assistant training, help to improve Sanda Athletes' heart and lung function and nervous system response ability, but also can improve the perception ability and rapid response capabilities, on improving Sanda the wrestling athletes and anti-falling success rate has a very significant role. By twenty-four Style Taijiquan training can make a better understanding of the center of gravity of Sanda Athletes moving law of gravity, thereby enhancing control ability to improve the anti-shock ability goal. In addition, by means of twenty-four Style Taijiquan and competitive push training also enables Sanda Athletes in high strength and better regulating themselves improve strength endurance level. Hope the research can provide the traditional Wushu and Sanda training fusion and rich Sanda sport provides a theoretical basis for the effective training method.

**Keywords** Sanda · Tai Chi push hands · Auxiliary training · Practical ability

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## 27.1 Introduction

Sanda belongs to skill-oriented fighting confrontational projects, since 1979 the original National Sports Commission decided to carry out, in a short span of 30 years, it has developed into the World Wushu Championships and the Asian Games project. Sanda movement in the process of internationalization, with the world fighting operation against rules communication, after revision, realize the Sanda movement and world conform to combat sports, constantly improve the level of tactics in sanda. Sanda Athletes through the training and the competition has developed a fiercely competitive activity in the actual combat skill, and timely make quick response ability according to the movement of an opponent. Modern Sanda Athletes have intense confrontation, kicking fell comprehensive technology. The State General Administration of Sports Wushu management center the successful organization of Sanda and the United States, Japan Karate, South Korea Taekwondo Karate boxing, Muay Thai and free fight against Thailand after the game, the world of martial arts enthusiasts to further understanding of Chinese Sanda is a blend of kick, hit, throw in an antagonistic sports. At the same time also set off a worldwide learning Sanda Sports craze, in such form, foreign Sanda levels improve rapidly. Sanda Sports require athletes to have more comprehensive physical quality, strength, speed, agility runners, and endurance quality is the dominant sport quality of Sanda sports. In the numerous quality, especially the speed and quality of the explosive determines the leading factor of competitive ability of Sanda Athletes. Therefore, Sanda Sports training method is often obvious directivity characteristic [1]. On Athletes' body function requirements of visceral organs of good seismic performance, having strong adaptability and high stability of the vestibular analyzer, and also make the athlete's tactile strengthen, hypalgesia [2, 3]. Now, many domestic and foreign sanda competition, at individual level, have the good performance of the best foreign player [4, 5].

The Modern Sanda techniques are born out of traditional Chinese martial arts, how to learn from traditional Wushu technical elements, rich modern boxing, Sanda of Wushu to fully reflect the culture characteristic, are the bottleneck for the development of sanda. This paper aims to study the Sanda movement in the process of internationalization, how to use Tai Chi and competitive push training, improving Sanda Athletes throwing and falling technology effectiveness, so that the traditional Wushu and Sanda training integration, rich Sanda of the effective training method, for the traditional Wushu Sanda training provides the theory basis for the application, finally China Sanda has always been at the leading position service.

## 27.2 Object and Study Method

### *27.2.1 Study Object*

Taiji competitive push training of Sanda players combat capability influence. Shenyang Sport University School 80 Sanda Athletes as the research object.

## *27.2.2 Research Methods*

### 27.2.2.1 Literature Data Method

Consult the Taiji competitive push movement and Modern Sanda training books and related research literature, for the study of practice and experiment provides theoretical basis for design.

### 27.2.2.2 Expert Interview

Visited the well-known experts, Tai Chi Master and descendants of 15 people, through the Tai Chi training of Sanda players combat capability influence. And some Sanshou coaches, experts, selected to reflect the actual combat ability of Sanda Athletes test index. Finally on the foundation of expert interview, determines the Taiji competitive push training of Sanda Athletes throwing and falling, endurance level and actual combat ability is more important to study the influencing factors.

### 27.2.2.3 Experimental Research Method

Choosing 80 years similar martial arts, is close to the level of technology of Sanda Athletes as the research sample. In order to make the experimental object physical quality and technology can fully reflect the Sanda movement characteristic, choose the level of 60–75 kg, were randomly divided into two groups: the control group, the experimental group, each group of 40 people. In June–October 2011 test was performed between 5 months of experimental study. Experimental period, the two group's training session is same; the control group routine training; the experimental group twenty-four type shadowboxing Taiji competitive push and auxiliary training as a routine training on the basis of applying factor [6].

### 27.2.2.4 Sports Measurement Method

Test Time

June 10–October 13, 2011 the experiments carried out to test.

Test Index

At the end of the experiment on two groups of indicators testing, test indicators are as follows:

**Table 27.1** The test index and test method of statistics

| Test index | Test mothed |
|---|---|
| Index 1 | Two combat wrestling |
| Index 2 | Two combat wrestling |
| Index 3 | 10 m to hold people run |

After the experiment, comparative two grapes, index are as follows:

In Table 27.1 the index of 1 in two combat wrestling specific test methods: 3 min for each board, statistical accumulation of wrestling scoring index number; index two combat falling concrete testing method: each 3 min, statistics accumulated effective prevent the opponent from using wrestling scoring times, actual combat into three groups adjacent to the three level by sequentially Robin; index of 3 in 10 m to hold people run specific testing method for password command subjects starting, trunk through the 10 line is completed.

Test Tool

Stopwatch, gloves, protective gear, sparring arena.

#### 27.2.2.5 Statistics Method

Application of Spss 13.0 for Windows statistical package for the social science the data were analyzed statistically.

## 27.3 Results

This paper adopts the independent samples *t* test to the control group and experimental group performances for comparative studies, the results in Table 27.2.

## 27.4 Analysis

### *27.4.1 Control Group and Experimental Group Index Comparative Analysis*

#### 27.4.1.1 Control Group and Experimental Group Two Combat Wrestling Indicator of the Presence of Very Significant Difference

China Sanda to throw Kyo, in some international matches, wrestling athletes led them to victory is our important country magic weapon, the number fell by around

**Table 27.2** The control group and the experimental group performances test of difference

| Index | Group | Sample | $x$ | $s$ | $t$ | $p$ |
|---|---|---|---|---|---|---|
| Two combat wrestling | Control group | 40 | 5 | 0.87 | −8.59 | <0.01 |
| | Experimental group | 40 | 7 | 0.76 | | |
| Two combat falling | Control group | 40 | 5 | 0.93 | −6.37 | <0.01 |
| | Experimental group | 40 | 7 | 0.86 | | |
| 10 m hold people run | Control group | 40 | 13 | 0.67 | −2.25 | <0.05 |
| | Experimental group | 40 | 15 | 0.63 | | |

in the game also more. Tai Chi in the basic requirement is "dip even stick with", "killing with kindness". Dip even namely "be neither too familiar nor too distant, do not touch off", it make the other side to attack fails, wants to escape, so as to defeat the opponent. By twenty-four Style Taijiquan and competitive push training of Sanda Athletes in actual combat, can be very good to use the "dip even stick with", in the use of wrestling to play the other side penetration, to strain, moves with potential students, loop infinite, athletes improve his center of gravity control capacity and destroy each other's ability to focus, wrestling with the success rate is improved greatly, in the experiment showed that, after a competitive push athletes after training, catch wrestling fighters awareness enhancement, especially a small, often go on, the application of wrestling come very naturally, investigate its reason, basically be competitive push training improves the athletes' perception, style is often based on their contact with each other at point changes while leveraging hair action, make the impossible to guard against, surprise, reached "a boxing said no fist, it came, inadvertently is true realm".

#### 27.4.1.2 Control Group and Experimental Group Two Combat Falling Index Existence Extremely Remarkable Difference

Antifall training is the important part of Sanda training. Sanda against, wrestling is important, falling more important, effective prevention of fall not only can disrupt the enemy's effective attack, also can borrow situation back-drop to win. The statistical results show that by means of twenty-four Style Taijiquan and competitive push training on athletes improve shockproof ability very significant effect. Tai Chi training requirements are "the introduction of lost", four two dials thousand jins, "self-surrender", "to machine extracting potential", "with a home". The Tai Chi training of Sanda Athletes in actual combat, can do well in soft just made, rapid response, timely off each point, become passive to be active, borrow force to make force, anti-fall each other, practice shows that, by Tai Chi practice, develop center of gravity and timely changing habits, the other with the wrestling attack, to adjust the center of gravity, not for the other to control, through competitive Taiji athletes in their training, at a disadvantage when, can contact with each other point changes, timely adjustment center of gravity, and at the same time destroy each other, as he said "the introduction of lost", back-drop success.

#### 27.4.1.3 Control Group and Experiment Group10 m to Hold People Running Indicator of the Presence of Significant Difference

By twenty-four Style Taijiquan and competitive push training, which reflects the athlete strength endurance level of 10 m to hold people running results improved. Twenty-four form Tai Chi is aerobic exercise, long-term training to improve heart and lung function have a significant effect, at the same time can develop active relaxation in habits, and against, can make the body does not participate in the fight against muscle groups in a relaxed state, is conducive to maintaining physical strength, at the same time. Tai Chi exercises in brain in a relaxed state, make the brain nerve flexibility, improve the practical ability, push competitive two people in the resistance has been in limbo, prolonged exercise, can enhance the strength and endurance level. Therefore, through the twenty-four Style Taijiquan and competitive push training can improve the athletes' strength endurance and body coordination force, to improve athletes useful in fatigue condition play technology.

### *27.4.2 The Analysis of Taijiquan and Push Training in Application*

#### 27.4.2.1 Tai Chi Training in Sanda Training Application

Sanda development in recent years, intense fight, comprehensive technology is the current trend, the characteristics as fist of said, far leg near boxing wrestle body contact, these techniques skillfully is to go through special training, the training is undoubtedly a good method, by arranging reasonable routine exercise, makes the athlete body coordination, technical connection to natural reaction, on the basis of practical training, will achieve twice the result with half the effort, however, in the discovery in investigation, the current player and Sanda Athletes before early experience is different, most early Sanda Athletes after the traditional martial arts training, because the material in Sanda training, can reflect the consciousness of Wushu boxing the leg fell, combination of consciousness is strong, flash show maneuvers the body coordination, today's athletes in sports school training Sanda is often direct, without the traditional Wushu routine exercise, so in the sense is to fight and fight, martial arts culture due to the lack of Sanda style westernization, is also the present form "Sanda is boxing with legs" bias, which is currently the bottleneck of Sanda sports. In the visit and investigation, expert and coach generally agree that Sanda Athletes should arrange reasonable Wushu Exercises auxiliary, however, the specific practice; which Wushu as well, we did not agree, at last the principle of consensus selection routines reach an agreement.

Sanda Athletes of Wushu training, selection of Wushu routine arrangement principle: first choice with martial arts moves changes consistent with actual requirement, consistent with actual combat. Second, the selected routine is beneficial

for training athletes in actual combat factor and variable, homeopathic became actual combat consciousness. Third, the selected routine is beneficial to improve the physical fitness of athletes, and is beneficial to improve the athletes' corresponding quality. In fourth, the selected routine technology facilitates the positive transfer of Sanda techniques. In fifth, the selected routine should have cultural connotation of martial arts, so that the athletes in the long-term practice, understanding Chinese culture, form a national characteristics of Sanda techniques style.

Based on the above principles, in the experiment process, considering the short experimental period, choose the routine must be small, because the main use of boxing, Sanda leg, breaking technology, so on some emphasize grappling techniques such as praying mantis routine is excluded, finally considering the Taijiquan to personal wrestling, but also has a strong cultural heritage, has on the athletes' fitness rehabilitation of injury, choose twenty-four easy style Tai Chi. Practice has proved, twenty Tai Chi to increase the player's combat capability has a very good effect.

Through experiments, athletes were twenty-four Taijiquan training, to achieve the desired results, in training and general fitness training is different, the first stance and footwork training for athletes, chiefly the Taijiquan movement of the center of gravity of skills, practice has proved, this technique is precisely the athlete falling to maintain the balance of the key, in this foundation on the routine single practice, in a single practice emphasized when movements fighting meaning, and sometimes players were simulated feeding action, while emphasizing the body relax and energy conversion, on the basis of this, then the set of training, the practice proves that the training of athletes at the same time to develop the consciousness of actual combat, not to participate in the contact point muscles relax you, for athletes in actual combat in maintaining physical fitness, strength Cuikuai has very good effect. Generally after the warm-up after Tai Chi training, about 30 min, then the Sanda training, training before the end of Tai Chi exercise on both sides has reached the purpose of relaxation.

#### 27.4.2.2 Taijiquan Competitive Push Training in Sanda Training Application

In traditional Tai Chi treatise, often refers to know yourself as well as the enemy of Kung Fu, Tai Chi practice the confidant of Kung Fu, Tai Chi practice through, make oneself in the use of the imaginary play body to coordinate, move freely, because it is a slow practice, so athletes can be very good to realize the body each joint and muscle actions right, also to achieve "bosom friend", in Sanda combat often encountered problem is, in both personal, not to control the other points, therefore in the close after the two sides are often disorganized fighting, Tai Chi Chuan said "know your enemy" Kung Fu, refers to both personal, through the contact point of each other's feelings the change, first machine, from the control of each other, in Sanda personal rivalry, achieve more strokes are other competitors, to attack, I take this opportunity to fight back.

In traditional Tai Chi training, this is distinct from other martial training means, namely the pusher practice, is a specialized practice know kung fu means, but also to the ultimately combat the compulsory part. We visited the expert and coach, the traditional Tai Chi training methods to study, found that the traditional pusher having five schools, technical connotation is identical, because of restricted by historical conditions, although traditional pusher can effectively exercise know Kung Fu, but from our present Sanda combat requirements still have a great distance, due to periods of experimental conditions we decided to study, through application of Taiji competitive push for Sanda Athletes training measures, practice has proved that this method to improve the practical ability of Sanda athlete has very good effect.

Sanda sports field is fast and furious, athletes in the technology practice often focus on quick exercises, while ignoring the with each other to limbo mutual dynamic perceptual training, and Tai Chi is advantageous competitive push with exercise and other limbo mutual dynamic perception. Taiji competitive push requests both sides in close embrace, not allow punches, kicks hook, mix, tearing, in mutual perception condition through dynamic transformation, with the body and limbs of the contacting point out other issue, this forced players maximize perceive each other and timely change point, practice has proved, by Tai Chi training improving the athletes' competitive push, fall and fall proof ability, at the same time as the 3 min of stalemate against the state, strength, and endurance increased significantly.

In the experiment, we in order to better combat and free combination, the main highlight in stalemate to situation "top of practice", commonly used techniques of "mining", to capitalize on "collapse" and "practicing homeopathic lightning fall" exercises, in skilled hands, we let go of pusher rules, allowing instant cuddle the other disc for wrestling attack, this practice is effective in improving the athletes to capture fighters, change because of the enemy against the defensive to the offensive and continuous attack ability.

## 27.5 Conclusion

(1) Sanda training, the scientific use of twenty-four Style Taijiquan repertoire and competitive Taiji Push-hand assistant training, help to improve Sanda Athletes' heart and lung function and nervous system responsiveness.
(2) Twenty-four Style Taijiquan and competitive push training can improve the perception ability and rapid response capabilities, to improve the athletes' wrestling and anti-falling success rate has a very significant role.
(3) Twenty-four Style Taijiquan training enables Sanda Athletes experience center of gravity of the moving rule, and center of gravity control ability, to improve the anti-shock ability has a certain effect.

(4) Twenty-four Style Taijiquan, competitive push training enables Sanda Athletes in high strength against the regulation itself, thereby improving the strength and endurance level.

## 27.6 Suggestions

(1) Departments should organize relevant scientific research personnel of the traditional Wushu Sanda training in the application of research, form as soon as possible application in Sanda training of traditional Wushu training method and theory system.
(2) It should be in the Sanda technology training, recovery training, rehabilitation training to strengthen the application of traditional wushu.
(3) Different traditional martial arts in the Modern Sanda training with different auxiliary role in Sanda, initial training should increase the proportion of traditional Wushu training. Traditional Wushu is rich in content, coaches should differ according to the training objective of traditional Wushu assisted method selection, while paying attention to the content and intensity of rationality.

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# Chapter 28
# Study of Basic Qualities of Good Coaches

**Xiang Zhang**

**Abstract** The coaches' basic qualities including the ability of observing, controlling the overall situation, and strategic thinking are resurveyed from the perspective of management education. The coaches' in-service training in management, education, and psychology should be reinforced. The coaches should also be helped to improve their cognition about the function of management education through case analysis and introducing experts' experience.

**Keywords** Management · Education · Coach · Qualities · Ability

## 28.1 Introduction

As we all know, as the top arena of sports, the Olympic Games' influence is unsurpassed. Whether it is the summer or winter Olympic Games, countries and regions all over the world attach great importance to it, and even encourage its athletes to excel in the Olympic arena of athletic performance at the cost of huge incentives. And high-level coach is the prerequisite to ensure that athletes in the Olympic Games and even World Series achieve excellent results in the movement. Coaches directly determine the level of athletes. Because coaches are the main designers of the training process, the main organizers of the training activities, and important decision-makers of training management; they have the most saying on the development direction of training, the job contents in a period of time, and the

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specific object of the general task. Experts have pointed out the number of world champions a country can develop, is first of all determined by the number of the world-class coaches it has.

In recent years, many domestic and international researches on the coaches mainly focus on the coaches' training, developing and team building, competency and psychological characteristics, etc. Among them the following are associated with the coaches qualities: In the Sports Training, Fang Yan puts forward that coaches should have a strong sense of professionalism, dedication, high moral character, a solid foundation of expertise, a comprehensive theoretical knowledge, skilled special training operation and innovative capabilities, and the ability to adapt to the sports team' living environment [1]; Qin and Zhang propose in The Sports Management that coaches should have the basic qualities in ideology, knowledge, and capacity [2]; USA Track and Field Association points out in The USA Track and Field Guide that coaches should have knowledge in physiology, sports skills, psychology, biomechanics, and other disciplines [3]; Gao and Wang also believes that the best coaches must have a high degree of professional dedication, comprehensive basic knowledge, proficiency in special business, and should be adept at innovation and capable of implementing reasonable and strict management on athletes [4]. In addition, some scholars have borrowed Spanker's competency model, suggesting that among others, achievement motivation, personal influence, insight, relationships, leadership behaviors (such as powerful and non-powerful leadership), command, teamwork, self-control, and organizational commitment may become the core qualities of the excellent coach [5].

It can be seen from the above literature that, at present, the majority of the researches on the coaches' basic qualities are still confined to explorations from the perspective of choosing suitable materials and training. However, coaches are not only the organizers of sports training, but also the managers of sports training, and the important decision-makers of sports training management. The Coaches' management level also directly affects the level of the athletes and even the competitive level of a sports team, because management can produce effectiveness and productivity. To improve the coaches' level of scientific management education in the process of training in China, the author reexamines the coaches' basic qualities from the perspective of management education.

## 28.2 The Origin of the Coach Role

Sport is developed gradually in the process of human development with the appearance of human beings as its precondition, the improvement of the human beings and the development of their psychology as its condition, the development of the human society as its basis, and its development is closely related with human productive labor and life practice. The improvement of human physical, psychological development, and the formation of human society are the basic conditions for sport, the source of which is labor [6].

The formation of the competitive sports and the bringing up of the younger generation are closely linked with adults' practical social education practice, and also have a close relation with the basic areas of life. Therefore, the early competitive sports are closely related with religion, military, and productive activities. Later, with the development of human civilization, people's value orientation shifts from the simple survival needs to multiple needs, including entertainment, pleasure. It becomes more and more popular to participate in athletic activities for the purpose of physical fitness. Esthetic concept of competitive sports has gradually formed and the links of competitive sports with religion, military, and production activities have been remarkably weakened, and competitive sports have become a relatively more independent social phenomenon [7].

Competitive sports have played a more and more important role in human life, e.g. impelling the spirit of human self-motivation, meeting the esthetic enjoyment needs of social life, and promoting the rapid development of society and the economy, etc. With the growth of the individual significance and the social significance of competitive sports, the society has formed the specialized incentive system of sports performance, which includes coaches, the professionals who specialize in competitive sports training, to train athletes and guide them to participate in sports competitions for outstanding achievement. It can be seen from the emergence of the coach role that, in the process of training and guiding the athletes, the coaches' roles inevitably involves the management education for athletes.

## 28.3 The Coaches' Roles in Management Education to Athletes in Training

With the continuous development of scientific and socialized sports training, the level of sport skills is affected by multifaceted, multileveled factors, and the whole training process is, so to speak, a very complex controlling system.

Bert aplenty believes that the so-called system is "the interaction of complex multi-elements." In other words, if a set of objects can be distinguished at least among two objects, then all objects can be linked together by the identifiable unique ways, and this collection is called system [8]. Sports Training is a very complex controlling system, in which the elements like coaches, athletes, equipment, social, and geographical conditions are involved.

Figure 28.1 shows that the coach is the controlling section of controlling system in the process of training, and the dominant factor in determining the training level. All factors of relevant levels must ultimately be linked through the central part, the coach. Therefore, the coach plays a decisive role in the process of sport training.

In addition to the responsibilities for the selection of sports apparatus and training, the coach has another important responsibility, that is, the management education. The coach's role in management education is reflected in a large amount of external behaviors influence on the athletes' physical fitness and psychology

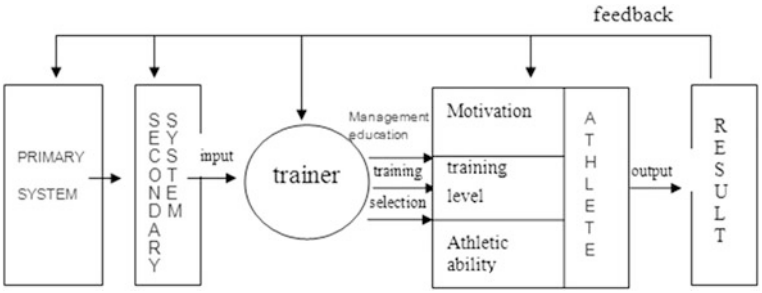


**Fig. 28.1** The complex controlling system of sport training (Quoted in Tian and Wu [11])

through organizing training, commanding competitions, and ideological work, which ultimately make the athletes achieve the peak level in competitive sports and grow from the natural individuals into social beings [9]. The coach is the commander in athletic competition, especially in team events, and the level of the coach determines whether the level of training can be reflected truly in the fierce competitions, or even plays extraordinary [10].

Thus it can be seen that the coach is the main part of sports training management; is the main supportive force in conducting scientific management and continuously improving the technical level of sports. The coaches' qualities, the qualities of management education in particular, have a direct relation with the realization of China's strategic goal in competitive sports, and determine whether our country can move on from a big sports nation to a sports power.

## 28.4 Good Coaches' Basic Qualities in Management Education

As for the meaning of quality, there are three explanations in Term Dictionary: the first one refers to a person's primary physiological characteristics; the second one means the inward nature of things; and the third one is known as the basic and necessary condition to complete an activity. In competitive sports, the qualities should be understood as the third definition. That is, coaches should have the capacities needed for taking up social training activities. Some experts believe that these capabilities include cognitive ability, planning ability, interpersonal ability, organizational ability, and teaching ability [11]; Xie and Wu believe that coaches should have the sociability and bearing capability in the games [12]. However, all these studies have one thing in common; they all neglect the coaches' role in management education in training. The present writer believes, from the perspective of management education, the coaches' basic qualities include observation ability, the overall controlling ability, and strategic thinking ability.

### 28.4.1 Observation Ability

Athletic training is a complex controlling system. To understand the system, the first thing is to make a systematic analysis of the compositions of the system, that is, to have a good knowledge of its constituent elements. As an element in the controlling system, athletes are the principal part of the training, and the final results of all training are reflected in their performance in sports. In addition, athletes are the main target of the management work in sport training. So the coaches must first understand the athletes; and it is required that the coaches should have the ability to observe. By observing the athletes' characteristics in biology, psychology, sociology and training, including age, gender, morphology, developmental status, the individual biological rhythms, temperament, personality, motivation for training, family status, living habits, literacy, training age, and load-bearing capacity, the coaches can adopt their methods to suit athletes best in the management education, and take specific measures in accordance with athletes individual differences. For individual projects, in the process of management education, coaches enforce influence on the athletes' physical and psychological aspects through a large number of external behaviors, such as organizing training, commanding competitions, and taking up ideological work; and ultimately help athletes achieve outstanding athletic performance. For team events, only on the basis of in-depth understanding of each athlete's personal characteristics can coaches handle the relationship between the team and the individuals in the training process; can the desired effects of training be achieved.

On the other hand, if coaches truly understand the athletes, and conduct the management education scientifically in sports training, a good master–apprentice relation will be established. Studies have shown that a good master-apprentice relation is a prerequisite for obtaining outstanding athletic performance. Because a good master–apprentice relation will certainly stimulate athletes' interest in training and promote them to complete training more actively, which will yield twice the result with half the effort.

### 28.4.2 The Overall Controlling Ability

The overall controlling ability, by definition, is the ability to grasp the whole situation. Whether for the individuals or for a sports team, the coaches' ability to control the overall situation is particularly important. For the individuals, the training is a complex long-term process. In the years of hard training, athletes not only have to bear enormous psychological and physical burden, not also have to be disturbed by a variety of factors form both the internal and external conditions, including injury, the temporary stagnation of competitive level, complacency on the achievements, constraints of bad interpersonal relationships, and various other

social, psychological, and biological problems. These problems will cause the player to feel confused, have less confidence, and lose interest, which would interfere with the overall training process. Thus, coaches should help athletes eliminate all these disturbing factors on the basis of in-depth understanding and observing the athletes, so as to conduct the training process according to the established plan and continuously improve the athlete's athletic ability. And all these require coaches should have the ability to control the overall situation.

For a sports team, in accordance with point of view of the system theory, a sports team is one entirety composed of multi-elements that depends, restricts, encourages, and complements mutually. The entirety is constituted by parts. The entirety controls the part and the part supports the entirety. The main focus of the system principle is to examine the integrity of the system. Therefore, it is a matter of fact for the coaches to spare every effort to increase cohesion and mobilize all positive factors in sports teams to promote the sports teams to bring the fighting force into full play, which also requires coaches must have the overall controlling capacity.

### *28.4.3 The Strategic Thinking Ability*

In addition to the observation ability and the overall controlling ability, good coaches must also have the ability to think strategically. The so-called strategic think ability refers to the rational thinking process of analyzing, comprehending, judging, and anticipating the overall, long-term, and fundamental relationship of major issues. The core of strategic thinking is the ability to grasp the trend of change and development of things. A well-devised plan ensures even the most far-flung victory. Although the change and development of things goes through twists and turns, but there exist the internal regularities. Only with a good knowledge of the objective laws of things and their development trend, can we and grasp the initiatives. So is the training process, a complex long-term process. Based on L. P. Marvel's division, sports training process can be divided into three periods, namely, basic training period, the maximum real competitive possibility period, and the athletic longevity period.

Among the three long periods, the training certainly has its own internal law of development. As for the coaches, they must grasp these laws; and make macro developmental planning for the athletes' training over years on the whole. When implementing the planning, they must try every possible means to eliminate the interference of many noncontrollable factors, and make the basic direction of training process at the original track and keep the stability of the overall plan for athletes through adjustments and amendments to some of the measures. Only after years of scientific and systematic training, can it be possible to bring out high-level athletes, to reach the peak of world sports and keep athletes in the best competitive state for as long as possible.

In addition, to make a well-devised plan requires of the coaches the strong ability to think strategically. In today's competitive sports, especially on the competitive arena of team events, the coaches' strategic thinking ability often determines the future and destiny of a sports team. Currently, the team events often adopt the group round robin system. Thus, in order to achieve the best athletic performance, coaches are required to choose from the global perspective different strategies and tactics in the games, to treat different opponents according to their own and the opponent's strength, rather than distribute the force equally without particular emphasis, which will result in irreversible defeat.

## 28.5 The Cultivation of Good Coaches' Qualities in Management Education in China

The good coaches' qualities in management education, including the observation ability of the overall controlling ability and the strategic thinking ability, etc. have great effects on whether athletes can reach the peak of the world's competitive sports. So in the training of the coaches, we should take the initiative to add contents in this aspect.

In the training, in addition to the knowledge on training, we should take the initiative to strengthen the coaches' knowledge in management, education, and psychology. At the same time, we should help to improve their cognition about the important function of management education through case-analysis and experts' experience introducing so as to prompt them to learn knowledge in this field actively in the training process and improve the qualities in this field. We should also help them learn to conduct truly scientific management education for athletes training in the future. The relationship between athletes and coaches is not only the relationship between master and apprentice, but is, to certain degree, the relationship between leaders and subordinates.

It is well known that just like the relationship between teachers and students, the relationship between coaches and athletes is also very delicate and special. If information processing between the coach and athletes can be done well, the internal contradictions will be split up and the relationship between the two can be adjusted to the best state, which will stimulate players to participate in sports training actively and greatly improve the efficiency of training; otherwise, it will be counterproductive, resulting in a lose-lose ending. Across the world's sports circle, many examples can be taken for the good relationship between the coach and athletes, but the broken relationship between the coach and athletes is also very common. The relationship between the coach and athletes to a large extent depends on whether the coaches have abilities in management education. Studies have shown that our coaches' abilities in management education have a big gap with outstanding foreign coaches.

## 28.6 Conclusion

According to Marx's political economics, man is the decisive factor in productivity. Similarly, in the process of sports training, the coach is the decisive factor determining the level of athletic ability. Among others, the coaches' qualities in management education, including the observation ability, the overall controlling ability, and the strategic thinking ability, have great influence on whether the athletes can reach the peak of the world's competitive sports. Therefore, it is required that the coaches should focus on carrying out scientific management education in future training, thereby increasing the level of scientific training and promoting China's shift from a big sports nation to a sports power.

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# Chapter 29
# Research on College Sports Dance Lesson Teaching

**Xuekai Liu**

**Abstract** In order to reflect the important role of sport dance in college physical education, teaching dance classes for College Sports, presented to classroom teaching research, and create a good climate for innovation, and establish a knowledge and innovation, health teaching concepts, and specifically from teaching content, teaching methods, the image of teachers, students self-issued learning were discussed. Practice has proved effective, a deliberate attempt to explore the College Sports Dance Teaching Reform.

**Keywords** College · Dance sport · Courses · Teaching reform

## 29.1 Introduction

Dance Sport is also known as "international standard ballroom dancing," is the competitions of the men and women as partners of a pedestrian pas de due [1]. Divided into two entry groups, ten dance. Ballroom event group contains Waltz, Viennese Waltz, Tango, Foxtrot, and Quickstep, Latin dance groups, including the rumba, cha–cha, samba, cowboy, and Paso double. Each dance has its own dance, dance and style. Dance music and movement requirements, the group compiled their own sets of action. Standard ballroom dancing originated in the ancient folk dance; experience the evolution of the dance, circle dance, line dance, group dance, and a widely held social dance.

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After the 1820s, the British Royal Dance Teachers Association specification finishing the original “dance”, “dance”, “dance” to develop the game method, before the formation of international standard ballroom dancing, and in 1947 held in Berlin, Germany next world standard ballroom dance championship. Has developed into a high artistic skills and strong athletics program [2].

Dance Sport is an international epidemic, health and beauty, in close connection with the sport and the arts in one of the sport, a combination of sports and dance a new dance genre exercise, athletic, and esthetic effects, but also a sports a strong dance [3]. Ice ballet, water dance, rhythmic gymnastics, large-scale song and dance ensemble gymnastics, and Tingyi Quant of the Chinese traditional Wu Qin Xi, wielding, sword, etc. fall into this category. Sports dance and other art of dance reflect the life and people’s thoughts and feelings, but it focuses on the fitness of the performance of people, brave up vibrant spirit.

In recent years, Dance Sport has become a popular college physical education course [4]. Attract students to the rich content, a variety of forms, graceful movements, the unique value of exercise and entertainment, civilized and elegant style. Physical Dance Course in colleges and universities can better achieve the purpose of college physical education, physical exercise capacity, esthetic ability, and social skills capacity training students so that students develop lifelong exercise habits, to further stimulate students to exercise the friendly exchanges between the students and the emotional connection between the enthusiasm and active classroom atmosphere so that students entertain the classroom atmosphere for learning, stimulate students’ interest in learning to enhance teacher–student, but also trained a student’s rhythm sense of rhythm and esthetic sense, refine their sentiment, the injection of fresh blood to change the traditional teaching content and teaching mode, and opened a new way to develop lifetime sports consciousness.

## 29.2 Dance Sport Teaching the Concept of Reform

### *29.2.1 Classroom Teaching and Research, to Create a Favorable Climate for Innovation*

Good learning depends largely on the learning environment; the formation of a good learning atmosphere in turn depends on the teaching mode, the reasonable application of the method. Educational theory: teachings plays on the practice behavior of students’ learning organization, control, inspire, guide, model, description, summarize, compare, analyze, and evaluate the role; learning rule plays the main purpose, feedback, development and so on. The two are mutually contact and interaction. The teacher should first of classroom teaching and research. Design and adopt innovative teaching means and methods, the creation of the relaxed, harmonious, and pleasant environment of innovation and education.

Teachers play a leading role in the teaching process, but the embodiment of the teachers is not the truth and the absolute authority [5]. Only by establishing a new equal relationship between teachers and students, in order to improve students' learning product, the initiative to enhance creativity can play, teaching may be relative. Second, it is good at creating an atmosphere conducive to individuation. No personality, no innovation. Not only do we have to acknowledge the students' character, but also to help students develop their personality, without prejudice to others the development of the premise, as far as possible the full development of their personality. Again, to create resources optimization configuration atmosphere. In modern society, the teaching conditions are maturing, we want to make full use of modern teaching equipment, teaching films to watch TV to learn the technical movements of the outstanding players, camera documentary shoot students' movements are reasonable arrangement of movement problems in student's intuitive feeling of understanding. Take flexible and diverse forms of assessment, comprehensive assessment of student learning.

### *29.2.2 To Establish the Concept of Knowledge Innovation, Health First Teaching*

Compared to quality education and the traditional exam-oriented education has the following characteristics [6]:

(1) Subjectivity: it is to carry forward the human subject, focusing on the potential of development of human wisdom, focus on training of the human spirit.
(2) Of all sexual: it is for all students, so that each student can be developed within the scope of his talent allowed to oppose the "egalitarian" and "one size fits all".
(3) Comprehensive: it requires both students morally, intellectually, and physically, so that the students' physical, psychological-round development, so as to improve the overall quality of students.
(4) Basic: it is not elite education, but for the life of the preparation for civic education.
(5) Developmental: It emphasizes the students' intellectual development, overall development, and personality development, so that students learn how to learn, to train students for lifelong learning ability and information processing capabilities.

According to the above-mentioned characteristics, combined with the promotion of quality education, sports dance lessons should be innovative, not only to teach the basic techniques of dance, skills, knowledge, but also to guide and nurture students' creative spirit and practical ability, in the classroom through the idea of quality education and lifelong sports to promote healthy, beautiful body, cultivate sentiments teaching purposes.

## 29.3 Dance Sport Teaching Reform Content

### *29.3.1 Selection of Teaching Content*

Dance Sport teaching content and physical education, health education, education in the future the combination. The Dance Sport not only the combination of its own characteristics, but also with a wealth of traditional national sports content. In addition to the contents of the gesture, physical (health-related physical fitness and motor skills, physical fitness), music, gymnastics, dance, but also practical, innovative ability, course content, so as to fitness, heart health, training in emotion, will, personality factors such as integration of students' lifelong awareness, innovative spirit and practical ability.

According to the above teaching ideas, sports, dance lesson must follow to enhance students' health, which will help the future development of society to promote the principle of development of the curriculum itself. Traditional teaching, the teaching of sports dance lessons, mainly teachers will be several dance compilation for some routine combination, students through classroom learning, and assessment, students in later life, cannot be learned in the action reasonable use, it will only copy from, you cannot live it. Innovative teaching requires not only teaches the basic stance, basic footwork, various combinations of the basic music and related theory to enhance the content of physical health, and still teaching, the use of heuristic teaching method to guide students to active learning, positive thinking, so that students can learn and use, giving top priority to truly achieve the purpose of the study.

### *29.3.2 Selection of Teaching Methods*

Sports the traditional teaching of the dance classes, teachers in accordance with the Lecture-Demonstration-Practice-to correct errors-consolidating and improving the "process will instill in students the teaching content". Students to master the basic movements of dance of sports, the difficulty of complete sets of actions, co-productions such as proficiency, music, and movement to evaluate the effect of Dance Sport teaching, but ignore the process and the ability of students to learn. Innovative teaching heuristic teaching, not only to teach basic techniques, skills, theory and, more importantly, the initiative and enthusiasm to mobilize students to learn in the classroom to stimulate students' positive thinking, to develop students' intelligence, and develop students' practical capacity and innovative teaching purposes. The key to cultivating students' innovative ability is the implementation of the reform of teaching methods. Sports teaching methodology, including the teachings, the study of law to create law, the examination method. Teachings, the study of law is the basis of the teaching methods, the creation of law is the goal of

teaching, the examination method is the inspection of teaching effectiveness. Implementation of heuristic teaching and exploration of teaching is an important aspect of reform of physical education teaching methods.

### *29.3.3 Teacher Image of the Set*

Efforts to enhance and improve the image of teachers, sports dance teachers should have the youthful vigor and healthy appearance, beautiful language, decent clothing, the harmonization of the action, lively, cheerful personality and humble attitude of tolerance, a good image of the teacher, students the mind and feelings have a significant impact, helping to cultivate the students' ideological character and the sublimation of the soul, to enable students to produce a heartfelt love of dance, the change from passive learning to active learning. In fact, a good teacher-student relations of cooperation, but also a science teaching methods.

### *29.3.4 Students to Exercise Self-Learning Awareness*

Students' ability to exercise themselves is an important symbol to test the effect of teachers' teaching, but also a direct impact on the students' lifelong exercise an important factor. The examination of sports dance class sports by students to learn and master each dance a single dance movement for self join, through the student's ability, the arrangement of the ability to design routines and the ability of exercise training to improve students' esthetic ability the overall quality of expression, skills, and psychological qualities. Specifically, the fitness effect of Dance Sport following three aspects:

(1) to form a good body shape: Dance Sport training, ask participants to keep your head up, chest, abdomen, vertical, waist, Chen Jean, knees relaxed, thighs, and buttocks clamping mention the entire body was stretched, tall, and straight, elegant, generous gesture; movement, a lot of energy, reduction of excess body fat, maintaining proper weight, creating a beautiful shape to lay a solid foundation.
(2) to improve their physique: long-term adherence Dance Sport exercise, in terms of body balance, flexibility, strength or agility, reaction speed, can be effectively improved and enhanced.
(3) maintain a healthy psychological: it allows people to exchange ideas with people in a relaxed environment to express feelings to strengthen cooperation and the elimination of tension, depressed, and a sense of loss.

## 29.4 Summary of Practical Effects

Proved by years of teaching practice, sports dance teaching by college students like the teaching content, teaching test (the first 2 years teaching is basically a combination of action teaching dances less; added after the dance content and require students to conduct self increasing combination) content, and constantly with difficult requirements, but Dance Sport Elective increased year by year (number of each class size compared to other elective course, is the lesson of all the options, the largest number of single shift), students basic to class rate reached 100 %, and radiate a clear upward trend of the students 'passing rate, good rates, excellent rates, especially when equipped with male and female teachers at the same time after class, demonstration and practice of the effect of significantly improved students' learning enthusiasm has improved significantly. We also dress when the students' examination requirements, the effect is very good, usually do not pay attention to the attitude of students, when their clothing is not sportswear but dance installed also focus on the attitude display, so that students clearly know what kind of code of conduct, and in what situations should further enhance and exercise the overall quality of students. Practice has fully proved the students' interest in learning tendencies and recognized Dance Sport teaching programs, teaching methods, and management systems.

The group dance practice in the physical dance course, the action lively and cheerful, the students of unity and cooperation, all sentiment, mental, and physical pleasure. The group dance practice, to promote friendship and exchanges between students; group dance with the action inter-related, and enhance students 'sense of responsibility, and more conducive to students' personality self-control and regulation. The Dance Sport self combination of exam performance, to improve the psychological quality of students' individual to overcome the timid and shy psychological, while enhancing the confidence and team spirit. According to the survey showed that 84 % of the students of the physical dance feel to improve sleep quality, especially good mood, quality of life improved significantly.

Dance Sport is one of the most popular sports. It combines sport and art in one, with its unique artistic charm to attract the masses. The Dance Sport regulatory competition, it makes the body of the participants to get exercise, spiritual purification, so that the participants and viewers to enjoy the beauty. It is the organic combination of sports and art, the esthetic experience to bring people to a more profound level, so that people gain the power of sports and arts, is beneficial for the physical and mental health, is beneficial for the all-round development.

## 29.5 Conclusion

Variety of physical dance course, not only students' physical and mental pleasure, the students a good psychological quality and the overall quality and culture, to learn good sports art of the dance, it is necessary to improve the cultivation of

music, literature, art, learn, and understand the Dance Sport art features, in order to constantly enrich their own imagination to make their dance more beautiful dance level increase faster. To improve student learning and the quality of life, thereby strengthening the enthusiasm and initiative of the students after school to practice and opened a new way to cultivate the sense of lifelong physical.

The study is mainly through the implementation of the main teaching, first class as inspire students respected innovation, the pursuit of innovative awareness of important positions; fully affirmed the students in the study and design of the buildings to explore their views and achievements, and outstanding, innovative Compiling of students introduced to the students, exchange the opportunity to show as much as possible for the students, encouraging innovation, affirming our achievements, and enhance confidence in learning. Second, to enable students to support, encourage and constantly enhance self-confidence, develop their own inheritance from knowledge to knowledge innovation boasts more. Expand student performance, personal space and to facilitate the students through the design of a single action, the combination of clusters of group performances, sets and action compose, organize small self dance sport, or allow students to attend the evening performances, class get-together, cheerleaders of the Games, etc. form, so that students both in the classroom or after school can showcase their talent, in order to constantly learn, practice, demonstrate successful experience. The promotion of the achievements of the teaching, can give full play to the students' interest and expertise, and motivation to learn has practical significance for improving the quality of teaching and training students for life-long exercise habits.

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# Chapter 30
# Study on Olympic Thinking of Physical Education of College Students

**Xuekai Liu**

**Abstract** Students are the most active young people, the most creative group, and the Olympic movement is mainstream and core of the contemporary world of sports, sports and culture, it advocated the combination of education and to institutions of higher learning to develop a comprehensive development talent provides a wealth of educational resources. Digging through the "Beijing Olympics" spread the Olympic spirit and give full play to the educational function of sport, to enable students to become moral, intellectual, and physical development of talent.

**Keywords** Olympic spirit · Students · Physical education

## 30.1 Introduction

This is a great opportunity for Olympic Education, responsible for the educational mission of colleges and universities pay attention to and strengthen the Olympic Education more important task that cannot be ignored, the 2008 Olympic Games in Beijing, China successfully held [1, 2]. Especially in the contemporary college students in a more complex international and domestic environment, vulnerable to a variety of complex objective factors and the impact of social thought, and their values just at the critical period from the volatile to the stereotypes, so through the "Beijing Olympics" contemporary college students to create a very rare oppor-

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tunity for values education, and very vivid way, and favorable conditions for the Olympic spirit in the physical education provide the best platform.

In today's world of political vicissitudes, the increasingly fierce international competition, the rapid development of science and technology [3]. Worldwide economic competition, the competition of comprehensive national strength, is essentially the science and technology, competition and the national quality competition. We want to continue to develop in the future international competition to grow their own, and turned China into a socialist modern power, it must rely on education. The long-term goal based on education. The fundamental task of education is to comprehensively improve the quality of the nation, and the final analysis, should be implemented to improve the quality of the young students improve the quality of the nation. In this situation, China's education sector, the primary and secondary school the full implementation of the slogan of implementation of quality education, school sport as part of basic education, which itself contains a very rich educational factors on students' physical, psychological, moral, social, and cultural development has an important educational role.

## 30.2 Penetrate into the Media of the Olympic Spirit

To dig the Olympic Games on the tremendous educational value, our country has always been a strong aspiration for national self-esteem and self-confidence expressed in the Olympic Games. In the just-concluded 29th Olympic Games, Chinese sports delegation, defying strong opponents, tenacious, and achieved 51 gold medals, 21 silver, and 28 bronze medals, honors, among the gold medal championship, our athletes to participate in the Olympic Games, since the historic breakthrough [4]. The arena of the Beijing Olympic Games, Chinese sports delegation has always insisted on carrying forward the Olympic spirit, the Chinese sports spirit, tenacious, humble in victory and defeat, to show the world the Chinese nation and self-improvement, and enthusiastic mental outlook for the motherland and the people won a great honor. Also a great encouragement to and inspire the enthusiasm of contemporary college students to participate in sports, and inspire their patriotism, education, and nurture their spiritual qualities. The successful staging of the Beijing Olympics and the media are inseparable, so we need to take full advantage of the Beijing Olympics this opportunity, the specific ways by today's society, newspapers, radio, television, and other media widely publicized, highlighting "Green Olympics, humanities Olympics, Hi-tech Olympics" theme, and actively guide the majority of college students to establish a Sports environmental protection, humanities and sports science and technology awareness. Courses for students interested in elective; related to the Olympic lectures to introduce students to the knowledge of all aspects of the Olympic history and development, can also be in the form of a variety of reading materials

to the student recommended to guide the students to consciously increase the Olympic understanding [5]. Regularly carry out Olympic-related sports activities in school, to convene to participate in and experience the Olympic sport charm, and to release or put up posters in a relaxed, understanding of Olympic joy.

## 30.3 Olympic Spirit Penetrate into Sports Teaching

At present, the Chinese Middle School Students Sports Foundation poor, combined with the sports facilities construction lags behind, leading to the college students interest in participating physical exercise is generally not high, especially in the case of poor quality of basic skills, learning itself is a passive, teaching content in college sports should be to reduce or cancel the viability of the culture has nothing to do little to pure athletic events, such as shot put, Roxbury Flop, gymnastics equipment projects, the content is technically demanding, teaching difficulty, with a certain degree of risk, lack of student self-confidence, there is no interest in learning, easy to dampen the enthusiasm of the students to learn and practice [6]. Therefore choose interesting, entertaining larger, and the viability of the culture-related content, such as martial arts, sports, etc., these elements have a large entertainment and fun, swimming, although the degree of difficulty but related to the viability of the culture. Sports students' interest in learning, help to promote the students to develop habits of physical exercise; physical education teaching physical education should be run through the guiding ideology, "Beijing Olympics" It is to our physical education provides a vivid stage of the Olympic spirit throughout the physical education, contribute to improving the quality of students' sports culture under the guidance of the Olympic spirit, to help students to form the correct values of sports, which can generate real interest in sports; And science, the practice of sports technology, students imperceptible by the influence of the spirit of sport. Many college students to the sport as they grow up the ladder, to explore their own bodies and intelligence potential through sport, to show their competence in movement skills, while learning and completion of other work more self-confidence and excellent, so that physical education is indispensable to students' mentor.

Three of the Olympic spirit penetrates into the contest

Olympic Games, the Chinese delegation has always adhered to States, the regional delegation to learn, strengthen friendly exchanges, enhance friendship; to achieve the Olympic family and the understanding, friendship, unity and the spirit of the contemporary college students self-awareness is very strong, the hearts of others, collective, self-centered values [7]. This requires our extensive variety of sports, the popularity of Olympic education, and vigorously carry out extra-curricular athletic activities in the form of the Olympic Movement is a sports competition, and many sports collective project is to educate students to

understand the success of the game cannot be separated from his teammates cooperation and guidance of coaches and behind-the-scenes support, which will be conducive to the concept of collectivism and teamwork training students in various forms sports practice activities, enable students indomitable sporting events, understand the interaction between the individual and collective interdependence, the same time, the contest with their rivals in the contest, which will deepen mutual understanding, friendship, mutual learning from each other, and seek common progress.

Olympic President Jacques Rogge presented the Olympic Games should be more pure, more united, more humane "strict rules of the game and the referee just law enforcement, and encourage people to develop the moral consciousness of the law abiding and fair competition". Young people in sport have to regulate their own behavior, to obey the referee, to observe the rules and learn to live in harmony with others, to grasp the normal relationships, the completion of the work and do other things necessary quality. Contemporary society because of the benefits-driven, a lot of people trampling on the law, ignore the rules, unscrupulous, and serious breaches of the principle of fair competition, but also to the many college students have a negative impact, making the fraud, bad faith, advocating the utilitarian, the formation of a distorted value orientation

The Olympic Movement "higher, faster, stronger" motto on college students to overcome difficulties, to overcome the self, courage to meet the challenges of the future life with a strong appeal, and in the organization and practices of a variety of competitive sports, subtle infection and nurtured by the Olympic spirit. This is to foster a sporting spirit, has even more of this spirit to the whole ethos of its relentless pursuit of the ideal of life. A new generation of students, many the highlight of the material improvement of living standards and the value of knowledge-based highly family spoiled, pampered, and cannot endure hardship, weak, became a "greenhouse" growth generation, can never grow up to become useful. Olympic medals in every one, especially the Olympic gold medal, have condensed the numerous sweat and hardships of the athletes and other personnel, as they courage to struggle and hard work results.

Participation is the first principle of the Olympic spirit, As Pierre de Coubertin said "The Olympics is not the triumph, but to take part; the nature of life is not obtained but they struggle". Mining and spreading the Olympic spirit to correct the students the idea of some money worship. With the deepening of China's reform and opening up, while raising the level of people's material, the material desires of many people over-expansion, materialism, and consumerism became their highest pursuit, do anything for money, and become a social moth. Those who did not medal in the Olympic Games, in the game, they did not give up, eventually crossing the finish line, they never give up the spirit of the Olympic spirit.

## 30.4 Conclusions and Recommendations

### *30.4.1 Carry Out a Variety of Sports*

The college is the most important period of time; the campus culture has an important role in the formation of the Olympic spirit of students. Strengthen the construction of campus culture; the growth of college students is the perfect personality and wisdom of great benefit. Campus culture, not only the Olympic Movement is in the campus to develop and implement to create conditions for, and college students physical and mental effects will be more lasting and profound. Take full advantage of a relatively thick atmosphere of culture on college campuses, campus and cultural networks, such as campus radio, billboards, magazines, newspapers, quiz competitions, lectures, theoretical Sharon, discussions, organized by the Olympic Cultural Festival, the creation of Olympic College Students camp. Olympic education as the students will have a positive effect. Schools can encourage students to organize a variety of sports clubs, sports associations, and other associations, to fully mobilize their enthusiasm. Consciously organize various forms of competitions under the guidance of the teachers to meet the fitness of college students actually technology, the different needs of the entertainment, to further improve the quality of comprehensive sports.

### *30.4.2 Sports and Culture, Education and the Combination*

This is the fundamental way to implement the Olympics. Selection and specification of the teaching organization and preparation, teaching content, and strengthen the Olympic education subject matter and purpose. Meanwhile, the teachers through lectures, discussions, and the organization to watch the video and so on to teaching and to enhance external exchanges and cooperation, and meet the desire and practice of contemporary college students to the Olympic movement in the form.

### *30.4.3 To Improve the Education of Physical Education Teachers*

Teachers' knowledge, cultural attainments, is the coach of the teachers. Therefore, the PE teachers put physical education teaching activities as real education activities, the student body and soul are nurtured. Physical education teachers to continue to strengthen the Olympic cultural enrichment, familiar with the Olympic knowledge, the most profound understanding of the Olympic spirit, freely use physical education teaching, better achieve the goal of the Olympic education.

### 30.4.4 Improve the Awareness of Students' Sports and Promote Habits of Lifelong Sports

Students understand the process and the rule of sports, recognize the true value of sports in order to form a positive emotional experience in sports, the formation of interest in sports and the desire to participate in physical exercise, and thus the formation of sports will develop the habit of lifelong physical exercise. "Beijing Olympics" is to strengthen students 'knowledge of the sport, students and sports emotion and sports will improve a living textbook for students' sports consciousness.

### 30.4.5 Reform School Sports Training Objectives

Today with the "examination-oriented education" to "quality education" process of transition, school sports to adapt to society, to adapt to the students, must also be in transition, changing a single phenomenon of the past school sports goals, quality of school physical education.

In the examination-oriented education, one-sided pursuit of enrollment rate, with most of the time and effort on the examination subjects of the study, sport in the rightful place in the discipline, and even in some places even physical education is also occupied, let alone education people, resulting in the formation of the abnormal situation of the student body and mind, today, with the full implementation of quality education, school sports should be for all students, both school sports and the fundamental direction of the basic requirements of quality education for all students is to make a different sports based on each and every student learn and earn and learn something. So that each student have been successful physical education, the success of emotional experience, to develop their own interest in learning, to enhance the learning self-confidence, and then to train themselves to become future winners of the cause of the comprehensive development of physical and mental health. Quality education for school sports looks forward to, "China Education Reform and Development Program said:" revitalizing the nation's hope in teacher education, the revitalization of education. How to make physical education to adapt to the development of quality education, which put forward new requirements for the majority of PE teachers, one of the characteristics of quality education for internalization, internalization is the main initiative, carrying out teaching reform should take into account students' own development needs, in order to help develop students' sports interest and expertise, personality development, awareness and social responsibility to improve their participation in physical exercise, and establish the idea of lifelong sports.

### *30.4.6 Comprehensive Evaluation of School Sport Target*

Assessment of school sports, school sports goal, the establishment of a scientific evaluation system, the system of information collection and qualitative and quantitative analysis. With the quality of school sports, scientific and rational evaluation system should be established, it should have an integrated feature in the evaluation of physical education teaching and learning quality, the establishment of a comprehensive set of quality indicators, not just their physical, morphological and function changes, not just its general technology, skill formation to master, should the formation and development of personality psychology in school sports high school students, sports interest, emotion, habit formation, and students to participate in the exercise of penetration to a comprehensive assessment.

In short, the reform of school physical education is the deepening of development, according to quality education in school PE target system to assess the education, the quality of teaching.

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# Chapter 31
# Study on Ball Serving Techniques of Young Tennis Players

**Chengguo Wang**

**Abstract** To improve the ball serving techniques of young tennis players in Shandong province, all aspects of the service techniques of more than ten young tennis players are analyzed and studied from the perspective of kinematics through literature consultation, image parsing ways, etc. Results show that the young tennis players in Shandong province have a great difference from the world's excellent athletes and the national athletes in serve velocity, horizontal distances of ball-toss and ball-stroking, the hip angle at the lowest gravity center of serve, the average angular velocity of pedaling and stretching of knee joint in the "scratching back" action, the height in ball stroking, etc. However, the height of ball toss is reasonable. Also, the technique improvement measures with a clear purpose and the suggestions for the future trainings are proposed.

**Keywords** Shandong province · Tennis · Serving a ball · Kinematics

## 31.1 Introduction

Although China's female tennis players have achieved gratifying records on the international women's tennis games, the competitive techniques of China's tennis players still have a great difference from Ping-pong and badminton competitive techniques at international games. In this paper, the techniques of professional young tennis players are comparatively analyzed and diagnosed by starting from the techniques of ten young tennis players for the purpose of finding out the problems and shortcomings, and also some improvement suggestions are proposed [1, 2].

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## 31.2 Research Objects and Methods

### *31.2.1 Research Objects*

12 young tennis players (five men and five women) in Shandong province are selected as research objects in this paper.

### *31.2.2 Research Design*

Field shooting method is applied in the study. Finally, the players' techniques and quality of serving a ball are comparatively analyzed and integrated, finding the common technique problems in powerful serve of China's young tennis players as well as the corresponding solutions. Thus, the reasonable entry point for improving the quality of serving a ball is acquired.

### *31.2.3 Research Methods*

Research methods include literature consultation, interviewing, observation, and high-speed shooting, image parsing, and mathematical statistics. The indexes of 12 young tennis players in powerful serve are comprehensively tested by using two Japanese JVCGR-DVL9800SH high-speed digital cameras and the three-dimensionally fixed shooting method; the speed of shooting is 200 frames per second, and the angle between two cameras is 75°.

## 31.3 Results and Analysis

### *31.3.1 Analysis of Serve Velocity*

In Table 31.1, the average serve velocities of the young male and female tennis players in Shandong province were 170.51 km/h and 112.94 km/h, respectively. According to the velocities, it can be seen that the serve techniques of China's tennis players and especially female players were far behind the international level [3, 4].

**Table 31.1** The fastest serve velocity (km/h)

| | The World's excellent athletes | | China's national team player | | Young tennis players in Shandong province | |
|---|---|---|---|---|---|---|
| | Female | Male | Female | Male | Female | Male |
| AVG | 194.1 | 224.56 | 165.14 | 183.82 | 112.94 | 170.51 |
| Standard velocity | 5.38 | 7.54 | 5.18 | 19.69 | 12.46 | 11.73 |
| The slowest | 188 | 219 | 160 | 144.68 | 97.67 | 150.31 |
| The Fastest | 205 | 244.6 | 173 | 206.53 | 123.27 | 187.60 |

### *31.3.2 Horizontal Distance of Ball-Toss and Ball-Stroking*

Whether the motion track of the thrown ball is reasonable in the air or not will affect the accuracy of the ball-stroking of players. If the thrown ball is in a vertically upward projectile motion, the players only need to make a judgment on the position of the ball from one direction in the ball-stroking; if the motion track of the thrown ball is unreasonable in the air, the players need to make a judgment on the position of the ball from at least two directions. Thus, the accuracy of ball-stroking is down. In fact, a reasonable ball-toss should turn to the front of body, because human body will have certain motion inertia in the upward swinging and also horizontally displaces along with racket. Therefore, the ball stroking point can be ensured to be right above player's body if the ball is slightly thrown forward [5].

From Table 31.2, it can be seen that the average of the horizontal distance between the front and back of ball-toss point and ball-stroking point of the young male tennis players in Shandong province was 0.46 m and its ratio with stature was 0.23, but the average of the young female tennis players was 0.23 m and its ratio with stature was 0.13. In contrast to the ball-toss parameters of China national team players, the absolutes of the ball-toss horizontal distance of both male and female players and their ratios with stature were (0.83 m, 0.45) and (0.52 m, 0.31), respectively; both absolutes and relative values of young tennis players in Shandong province were obviously less than those of China national team players. This shows that the ball-toss of the young players is closer to vertically upward projectile motion, and has no obvious upward projectile motion [6].

### *31.3.3 Ball-Toss Height*

From Table 31.3, it can be seen that the ball-toss fall of the young male tennis players in Shandong province was 0.46 m, less than 0.64 m of China national team male players, and closer to the statistical standard (0.50 m). Therefore, it can be thought that the ball-toss height of the young male tennis players in Shandong province was reasonable and had no big or small problems, but the ball-toss fall of

**Table 31.2** Horizontal distance between the front and back of ball-toss point and ball-stroking point (unit: m)

| Statistics | China national team players | | Young players in Shandong province | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| AVG | 0.52 | 0.83 | 0.23 | 0.46 |
| Ratio with stature | 0.31 | 0.45 | 0.13 | 0.23 |
| Standard deviation | 0.20 | 0.30 | 0.06 | 0.12 |
| The slowest | 0.11 | 0.43 | 0.12 | 0.31 |
| The fastest | 0.79 | 1.35 | 0.26 | 0.67 |

the young female tennis players was 0.84 m, less than 0.87 m of China national team female players, but obviously larger than 0.64 m of China national team male players and the statistical standard (0.50 m). Therefore, considering the ball-toss fall of China's female tennis players was concluded by Botao Yan to be 0.87 m, it can be thought that the young female tennis players in Shandong province obviously have a too-high ball-toss problem.

### *31.3.4 The Hip Angle at the Lowest Gravity Center of Serve*

Table 31.4 shows an analysis on the hip angle of the young male tennis players in Shandong province at the lowest moment of squat body (i.e. at the lowest gravity center of serve): the hip angle of the young female tennis players was 166.61°, significantly greater than 138.80° of the young male tennis players. This suggests that the hip action of the female was not as good as that of the male in bending knees. Full hip action is a guarantee of keeping body balance. In combination with the results obtained from filed observation, it was found that the forward moving of the female bodies was not obvious, which was reflected from the squat in the original place. Therefore, this could not ensure the large angle of inclination (high to low) of shoulder, and also went against fully stretching hip. However, it is necessary to keep a reasonable toss posture, providing a physical basis for the follow-up power. According to the field observation, the forward moving of the male bodies was obvious after toss ball and so was the hip action and a reasonable

**Table 31.3** The fall between the ball-toss highest point and the ball-stroking point (unit: m)

| Statistics | China national team players | | Young players in Shandong province | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| AVG | 0.87 | 0.64 | 0.84 | 0.47 |
| Ratio with stature | 0.52 | 0.35 | 0.48 | 0.26 |
| Standard deviation | 0.21 | 0.25 | 0.14 | 0.15 |
| The slowest | 0.49 | 0.20 | 0.64 | 0.28 |
| The fastest | 1.12 | 1.08 | 0.99 | 0.65 |

**Table 31.4** Hip angle at the lowest gravity center (unit: 0)

| Statistics | Hip angle at the lowest gravity center | |
|---|---|---|
| | Male | Female |
| AVG | 138.80 | 166.61 |
| Standard deviation | 11.07 | 8.7 |
| The slowest | 121.45 | 155.72 |
| The fastest | 147.44 | 176.69 |

posture (high to low) of shoulder was kept. This provides a good physical basis for the follow-up power in ball serving.

### *31.3.5 The Average Angular Velocity of Pedaling and Stretching of Knee Joints in the "Scratching Back" Action*

As body squats down to the lowest, knee joints reserve enough flexible energy for fast pedaling and stretching. The fast pedaling and stretching of knee joints are the beginning of the "scratching back" action, but also the first step of the whipped actions of the entire human body's joint chain system. Its direct effect is making body speed up upward and also generating a "beyond" over the racket and the arm holding it, and thus a "back bow" posture appears and the "scratching back" action is formed. At the stage of the "scratching back" action, as pedaling and stretching of knee joints are fast, racket declines because of inertia relatively to the back of players. Thus, the agonistic muscle in swinging racket and stroking ball should be stretched to improve the pre-tension of muscle and increase the muscle contraction force in the process of swinging racket and stroking ball. Therefore, the "beyond" generated by the pedaling and stretching of knee joints over racket can not only increase the distance of the "work" of swinging racket, but also can play an important role in improving the muscle contraction force of the arm holding racket in the process of stroking ball. From Table 31.5, it can be seen that Shandong young female tennis players' average angular velocity of pedaling and stretching of knee joints in the "scratching back" action was 105.77°/s. However, relevant data shows that the average of Chinese outstanding female players was 195.21°/s. Therefore, there is a great difference between two sides. Thus, it can be concluded that insufficient angular velocity of pedaling and stretching of knee joints is one of main reasons for affecting the low serve velocity of Shandong young female tennis players, and the serve velocity will be greatly increased if the angular velocity of pedaling and stretching can be improved.

**Table 31.5** The average angular velocity of pedaling and stretching of knee joint in the "scratching back" action (unit: 0/s)

| Statistics | The average angular velocity of pedaling and stretching of knee joint | |
|---|---|---|
| | Male | Female |
| AVG | 163.65 | 105.77 |
| Standard deviation | 30.50 | 17.16 |
| The slowest | 121.19 | 94.57 |
| The fastest | 202.69 | 137.51 |

### *31.3.6 Height of Ball-Stroking Point*

Research shows that one of the main differences between professional players and middle-level players is the different ball-stroking point. The average ball-stroking point heights of the young male and female tennis players in Shandong province were 2.71 and 2.40 m respectively and their ratios with stature were 1.47 and 1.43 respectively (see Table 31.6); the ratio between average ball-stroking point heights and statures of China national team players was 1.51 and 1.45 for men and women respectively. The relative value of ball-stroking heights of the young tennis players in Shandong province is still different from that of China national team players, which can be reflected from the low height of ball-stroking point. After analyzing reasons, this has a close tie with the insufficient pedaling and stretching strength of the lower limbs of China young tennis players. This is because that for powerful serve, striving for a higher ball-stroking point is not only an important technique measure for ensuring successful ball stroking, but also an embodiment of fully playing the pedaling and stretching strength of body. Without a good lower limb strength, there will be no a higher ball-stroking point. In addition, when the body is in a naturally relaxed and fully extended state, the ball-stroking point will be naturally higher. Technically, lower limbs of a player are required to be fully forward and pedal and stretch upward, and also body should be extended as much as possible; when the gravity center of the body rising high in the air goes up to the highest point and the body is extended vertically to the maximum, ball can be hit. Thus, higher ball stroking is based on reasonable ball stroking actions.

## 31.4 Conclusion and Suggestions

First, the young tennis players in Shandong province is far behind the world's advanced level in serve velocity. This is not conducive to training reserve personnel for China's tennis sport and further improving China's tennis sport.

Second, the horizontal distances of the young tennis players in Shandong province in toss ball forward are less than those of China national team players as a whole. Smaller horizontal distance in toss ball forward can help appropriately increase the stability of ball stroking, but goes against the powerful serve. Up-front

**Table 31.6** Height of ball-stroking point (unit: m)

| Statistics | Height of ball-stroking point | | | |
|---|---|---|---|---|
| | China national team players | | Young players in Shandong province | |
| | Female | Male | Female | Male |
| AVG | 2.43 | 2.76 | 2.40 | 2.71 |
| Ratio with stature | 1.45 | 1.51 | 1.43 | 1.47 |
| Standard deviation | 0.06 | 0.05 | 0.05 | 0.05 |
| The slowest | 2.30 | 2.66 | 2.34 | 2.66 |
| The fastest | 2.49 | 2.82 | 2.45 | 2.76 |

ball toss is more conducive to increasing racket swinging distance and ball stroking power, and suitable for the flat stroking with powerful serve.

Third, the ball tosses of the young female tennis players in Shandong province are too high, making the "scratching back" action pause and ball fall or the "scratching back" action slow down. This not only damages the continuity of the serve actions, but also reduces the swing speed of racket and goes against the contraction of the stretched muscle, giving rise to unharmonious strength in swinging racket and hitting ball.

Fourth, insufficient limb power strength is the main reason for affecting the low pedaling and stretching speed of knee joints in the "scratching back" action, and also the main reason for the low serve velocity. In future training, it is necessary to pay attention to strengthening the exercises of limb power strength.

Fifth, the ball stroking points of China young tennis players are low, affecting serve velocity and success rate. This is caused by the poor ability of the players in controlling ball stroking time, and also most players like to stroke when body gravities drop.

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# Chapter 32
# Management Model of High-Level Athletes in General Colleges and Universities

**Yikun Xu and Juhua Song**

**Abstract** In the twenty-first century, how to realize the sustainable development of competitive sports of Jiangsu province by relying on general colleges and universities resources and constructing high-level sports teams has been very important. From the perspectives of reviewing history and looking into future, the management model of high-level athletes in general colleges and universities of Jiangsu province is systemically analyzed, attempting to provide some suggestions for the construction of the management model of high-level athletes in general colleges and universities of Jiangsu province.

**Keywords** General colleges and universities of Jiangsu Province · High-level athletes · Management model

## 32.1 Introduction

The "combination of sports with education" for establishing high-level sports teams in general colleges and universities of Jiangsu province has a history of nearly 20 years. Many athletes have made a figure in the national university games and the world university games. In the mean time, a small number of Chinese athletes have attained gold and silver medals in the Olympic Games, and thus helped win honors for the country. However, there are still a great number of

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problems in student enrollment and training objectives, etc. In this paper, the current situation and characteristics of the high-level sports teams in general colleges and universities of Jiangsu province are analyzed, and also the strategies for the construction of the high-level sports teams in general colleges and universities are explored [1].

## 32.2 Cultural Education Model for Athletes

### *32.2.1 Location on the Objective of Cultural Education for Athletes*

The basic objective of the cultural education for sports teams in the new period should be located at "training new generation of people with lofty ideals, moral integrity, good education and a strong sense of discipline", which can help athletes not only improve sport techniques and levels but also really become useful talented personnel adapting to and serving for society after retirement [2].

Because of the specific characteristics of athlete identity and training objective, the location on the objective of cultural education for athletes is different from that for common students, but is necessary to give a reflection to the specific characteristics of education in competitive sports. Therefore, the cultural education for athletes should be with clear objective and powerful operability [3].

### *32.2.2 Main Model of Cultural Education Currently for Athletes in Jiangsu Province*

Currently, the mainstream model of the cultural education for athletes in Jiangsu province is still oriented at "everything is monopolized under the guidance of the physical educational system". A coordinated educational system with record of formal schooling from primary school and middle school (secondary school) to junior college has been formed within the physical educational system.

In the education of the sports system, because of the orientation of the gold medal strategy, the phenomenon that winning medals is highly valued but educating talented personnel is lightly thought is universally in existence. One of the consequences of the educational system with a poor quality is that there are more and more scarce talents reserved for sports games in the future. This has become a "bottleneck", which restricts the development of competitive sports in China [4].

## 32.3 Current Situation of In-Service Excellent Athletes Studying in General Colleges and Universities of Jiangsu Province

This investigation shows that there are increasingly more excellent athletes to study in the general colleges and universities of Jiangsu province. The investigation on the employment intension of athletes after retirement shows that only 10 % of them chose to work as a coach in the sports industry, 48 % chose to work in other industries related to sports, and 42 % chose to do a job that has nothing to do with sports.

According to the investigation on the coaches and administrative personnel in sports departments, it can be known that management personnel in the sports system hold a positive and supportive attitude toward the studying of the in-service athletes in the general colleges and universities of Jiangsu province, and also make great efforts to allowing excellent athletes to receive higher education in colleges and universities. Also, the investigation shows that the majorities of parents greatly give supports to athletes to study in the general colleges and universities of Jiangsu province.

At present, the vast majority of athletes are qualified to study in the general colleges and universities of Jiangsu province after attending the national college entrance examination according to the enrollment scores.

At present, the credit system is generally implemented in the general colleges and universities of Jiangsu province. Because of the special characteristics of college athlete students, they are allowed to attain less credit than common college students, and also the fixed number of learning years can be relaxed according to the actual conditions of athlete trainings and games as well as the actual achievement of credits.

With the purpose of encouraging the athletes to be active in participating in games on behalf of colleges and universities, all colleges and universities basically make relevant regulations and provide incentives for the athletes achieving good results. Because of relevant incentives strategies, the majorities of the athletes hold a highly positive attitude toward participating in games on behalf of the schools where they are studying.

According to the investigation, the actual learning effect of the athletes was far from being satisfactory; only 18 % of the athletes thought the learning effect was good, 60 % reflected the learning effect was ordinary, and 22 % felt unsatisfactory with the learning effect.

### 32.3.1 Problems in Current Management Model for the Studying of Athletes

First, there have been no relevant supporting or local policies and regulations that adapt to the actual conditions and the regional characteristics to be formed yet. Second, there have been no matching systems and mechanisms yet. Also, all kinds of resources have not been scientifically and rationally applied and developed. Third, the communication between education and sports system is poor, and the real and the most effective promoting joint force has not been formed. Fourth, resources are not integrated well, and also a long-term effective promoting mechanism is not established. Fifth, the contradiction between learning and training has not been really eliminated. Sixth, there are a small number of choices for the athletes. For various reasons, the opportunities for the excellent athletes from part of sport items to study in the general colleges and universities of Jiangsu province are scare. Seventh, the management mechanism that is suitable for athletes to study has not been perfected yet, and also the teaching cost of athlete students is higher than that of common students. In addition to the above analysis, some problems, which are brought by the athletes who have employed formally by the state's institutions but still study at the full-time colleges and universities with common college students together, are necessary to be highly thought.

## 32.4 Preliminary Conception on the Management Model for the Studying of Excellent Athletes in the General Colleges and Universities

### 32.4.1 Innovating Management Model

The management model for the studying of excellent athletes, in which top priority is given to educational departments, the initiative participation of sports departments and the close cooperation of colleges and universities with sports teams, should be established. In the mean time, it is necessary for such a model to meet the training laws of modern sports and education.

### 32.4.2 Main Intensions of Innovating Management Model

#### 32.4.2.1 Operational Platform Linking Unity and Operability

Further Unifying and Defining Training Goal

To promote the studying of excellent athletes in the general college and universities to be better, it is necessary for colleges and universities to take the improvement of

the cultural and comprehensive qualities and the training of excellent sports talented personnel with a comprehensive development of morality, intelligence and physical condition as the training goal, and simultaneously ensure the realization of the goal.

Issuing Detailed Implementation Rules for the Local Governments

It is necessary for educational, administrative, and sports management departments to jointly issue relevant detailed rules according to the goal, idea, and implementation measures of educating personnel jointly by colleges and universities and sports teams, standardize the management mechanism and system for the college athlete students, and encourage colleges and universities and sports teams to make in-depth cooperation.

Establishing Relevant Institution and Implementing a Uniform Management

It is necessary for educational and sports administrative departments to jointly establish a management office, and carry out a macro management on all kinds of problems related to college athlete students and control them from policies.

Establishing a Communication Network

In essence, sports and education systems jointly undertake the task of training the athletes if they take exercises in sports teams and also study in the general colleges and universities of Jiangsu province. This certainly involves the exchange and communication between the two systems.

Attaching Importance to Easing the Contradiction between "Learning and Training"

The contradiction between "learning and training" is an inherent contradiction in China's competitive sports training system, and therefore it is difficult to be solved, but can be eased through some methods.

#### 32.4.2.2 Teaching Management System Integrating Normalization and Flexibility

It is necessary to standardize the teaching management systems of all colleges and universities. Based on keeping the unique characteristics of all colleges and universities, the teaching management systems of all colleges and universities should be uniform for meeting the needs of college athlete students.

### Clearly Defining the Management System

Colleges and universities should pay much attention to the management of this part of students, and the methods for managing high-level sports teams in schools can be compared. Under the leadership of a vice principal, the department of sports can be responsible for comprehensively managing and coordinating all aspects of athletes studying in colleges and universities, including student registration.

### Moderately Expanding the Selection of Programs

Excellent athletes have their own characteristics, advantages, and planning for the future, and therefore they hope there are more programs available for them to select.

### Adopting a Flexible Educational System

The graduation time limit of four years can be further broken and sufficient time can be provided for college athlete students to finish assignments with high quality and learn more.

### Uniformly Grouping Classes and Reasonably Arranging Teaching Contents

It is necessary to reasonably set up teaching courses and contents. That is, teaching courses can be arranged with targets according to the cultural foundation and actual conditions of the college athlete students, to ensure the quality of teaching.

### Adopting Flexible Teaching Plans

The traditional way that teaching plan is made only once each semester can be considered to break. After a full communication with sports teams, teaching plans can be arranged, for avoiding the athletes' outside trainings and games and making full use of their time out of training and games, including the time at night. At the same time, it is necessary to set up a perfect system for making up missed lessons, vacancies and exams, and maintain the teaching schedule as much as possible.

### Applying Advanced Teaching Methods

With the arrival of the information age, many advanced teaching methods can be utilized at present. According to the frequent outside trainings and games of the athletes, special distance network teaching can be provided for the athletes.

#### 32.4.2.3 Security System Integrating Merging Integrity and Complementation

Integrating Teaching Resources of All Colleges and Universities

Credits of public courses can be shared. In the teaching of undergraduate courses, unified requirements are proposed on the public courses such as English, politics and computers, and basically kept consistent. For all these public courses, all colleges and universities involved in a certain training base can be combined as a joint teaching group and carry out uniform teaching by arranging the college athlete students of relevant grades, and thus credits can be shared.

Sports System Can Reasonably Share Teaching and Implement a Fund Allowance

Consideration can be specifically given by sports administrative departments to making a certain fund budget for these college athlete students, so as to provide subsidies for colleges and universities in the extra expenses on the management and teaching of college athlete students, etc.

## 32.5 Conclusion and Suggestions

First, it is necessary to make the studying management model of college athlete students innovative, and set up a system and mechanism that meets the laws of in-service athletes studying in the general college and universities of Jiangsu province. Therefore, the goal of winning medals and educating talented personnel can be fundamentally ensured. Second, it is necessary to build up an operational platform linking unity and operability. Also, it is necessary to issue detailed implementation rules for local governments, and set up corresponding institutions and form a communication network, and carry out a uniform management, so as to be beneficial to the standardized administration and cooperation between educational and sports departments and the operation and coordination between sports teams and colleges. Third, it is necessary to establish a teaching management system combining standards and flexibility, standardize the teaching management systems of all colleges and universities, apply flexible and various educational systems and learning models, and use the teaching requirements meeting the characteristics of athlete students, so as to ensure the actual learning effect of the athletes studying in the general colleges and universities to be improved. Fourth, it is necessary to establish a security system merging integrity and complementation. Fifth, it is necessary to give full play to the important role of physical education colleges in training college athlete students with the combination of sports with education.

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# Chapter 33
# Study on College Sport Curriculum Evaluation Based on Network System

**Feng Zeng**

**Abstract** The new evaluation system is based on multi-intelligence theory, evaluation, and control of the interior. It emphasizes the whole system and evaluates students' learning efficiency. It reflects not the only increase the number and quality of change in the understanding of students, and student's non-intelligence development. The new evaluation system research results can be reflected in a period of research, to help students find the problem in the process of learning, improve the students' learning method, note if students has reached the expected teaching target, it can evaluate students' learning courses, method, and emotional reactions. Only in this way it can be beneficial to emotional maturity and personal development. The new evaluation system based on the evaluation content, including sports participation, sports skills, health, mental health, and social adaptation ability. It embodies the 3 d health value, movement, and characteristics the development trend of the international course.

**Keywords** Sports curriculum · Curriculum evaluation · College

## 33.1 Introduction

With the fast development of combining the modern education technology, multimedia technology and network technology, multimedia network course based on the Internet will become major resources of future education. Network course is to point to the teaching contents and teaching activity of subject behaviors in the

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network. It not only helps to improve the students' initiative and ability, to realize the personalized teaching and learning, emphasizes the importance of learner-focused method, combining the classroom teaching and learning although network, course extensions classroom teaching, help to solve the problems existing in the current classroom teaching mode. Multimedia integration cooperative learning environment from the network course is not only likely to be theoretical teaching and practical skills cooperated very well, but also help learners' learning efficiency high [1]. Since the 1990s, the comprehensive quality education has carried out in China. Further education reforms the development, quality, and qualification of the university the talents cultivated education has changed greatly. "Promoting

Comprehensive, harmonious development improves the overall quality of students "has become the common value orientation of China to the teaching purpose. Colleges and universities", as cradle of training high-level, high-qualification talents, should also take it as a goal, make the student of high quality talents internal discipline. The formation of new Chinese school education and sports requirement also can generate new challenges and opportunities of the sports reform. In the physical education curriculum reform, learning evaluation is one of the most important parts in the school education. The learning evaluation of university physical education curriculum relying too much on the means of the check and irrational in the content and the test method: emphasis on the conclusion of the evaluation process evaluation and ignore. Overall the university learning behind evaluation model has become a bottleneck; limit the Physical education teaching reform. Physical education learning evaluation is the necessary reform. Therefore, how to construct a scientific, rational, and feasible learning evaluation system has become a real problem, is also one of the themes of study, need to pay high attention to the current college sports reform [2].

The traditional physical education is evaluation highly conclusion attaching importance to evaluation. However, the angle of the change to new learning ability, has generated new development trend of the conclusion of the integration process evaluation and assessment conclusion evaluation. Sports the content of the evaluation also have a significant change, mainly includes the following four aspects, a worry, intention, and attitude; B: thinking and judgment; C: skills and performance; D: knowledge and understanding. The primary task of the evaluation is to pay attention to the intention and attitude. A lot of evaluation is to encourage students to learn and adjust the teaching process. This evaluation is not involved in grade and comments and physical evaluation, this ruled out the specific content of the evaluation, just as the reference for the students to understand the development of physics. Subject of evaluation is concerned, it accepts the teacher evaluation, the students each other's assessment and evaluation. About methods, diagnosis evaluation, evaluation form, conclusion evaluation, evaluation and development performance evaluations are taken into account. About the form of evaluation, oral evaluation, observation, measuring, check the and so on all is adopted.

## 33.2 PSTNRS

For a relatively sound and effective system is to ensure the successful launch of higher education in the national assessment practice. The physical education learning evaluation of the guiding ideology in the modern university emphasizes more process function; it is different from the past. Through the practice of learning evaluation, people have come to realize the characteristics of process evaluation is to improve the students' learning efficiency shows the existing problems and the related information back to feed.

And foreign reform, the reform of college physical education curriculum in the home is a relatively late and research it is lagging. But recent years have seen the study of the rapid development of PE curriculum reform in university at home. In China's search web journals from 2001 to 2008, there were 4313 articles on reform in university found that EP. Therefore, in the study of physical education curriculum reform of university is rich, one of the most influential people is the inspiration of the sports education curriculum reform in basic education course reform from university physical education curriculum in Chinese written by professor JiLiu; Development of the concept of Chinese sports education and reform written by professor Zonghu music; Explore the scientific of the sports curriculum written by professor MAO Zhenming; Study related problem in China sports education reform ZhangKai wrote value "health" and "people-oriented" in modern sports wrote XuWu; Reflection on the status of sport in China university and the country's future development measures of written by professor ChenXiaoRong and so on. In physical education curriculum reform is in the home, more and more attention of the construction of the physical education learning evaluation system. Liu jian et al. pointed out in this paper the relationship between the transfer of key learning evaluation and implementation of quality education in the sports teaching the focus of the university students' physical education learning evaluation should be below to integrated assessment conclusion only conclusion assessment and evaluation process. That same year, you TianWenHua had some problems such as all in sports in university study out of the evaluation of the current research of Shaanxi province in college physical education learning evaluation of Shaanxi. Many other scholars is in the home also the concrete research learning evaluation of sports.

Objective conclusion evaluation is to introduce some qualification judgment was evaluated. Therefore, in general, people have the education activities serious evaluation results. While acknowledging the irreplaceable conclusion of the evaluation function in the process of education management, American scholars worth more this process function evaluation. This has become a recognized trend of the development of higher education of the circle. At the same time, it has become the development trend of the study of physical education learning evaluation in the university. Personalized sports teaching network resources system (PSTNRS) is shown in Fig. 33.1

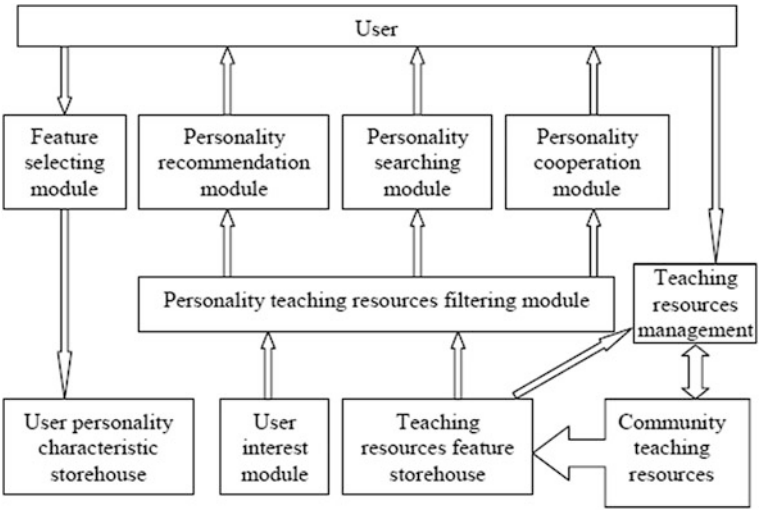


**Fig. 33.1** Personalized sports teaching network resources system (PSTNRS)

PSTNRS's main function is to help users find sports teaching resources of the network to quickly and accurately according to their interests. Function selection module select users interested in sports teaching resources of the network information according to browse and feedback of sports teaching network resources. Then, the information stored in the personality characteristics of users is tracking and warehouse, update. The personality characteristics are of library users to save the user personality information (such as name, age, occupation, buying interest, hobbies, etc). It tracks a user Interest. The key word users dynamic characteristic of choice method and records; it can also provide the user for the construction of a module user features in the module of model. The user's interest from the user's choice model keywords individuality characteristic library and tectonic user interests model of sports personality. Filter module teaching network resources filter according to user model of teaching resources.

Personality recommend module and recommended the realization of automatic request advice. Request advice is called the management module implements teaching resources and the teaching resources filter modules. Individual character search module accepts user requests. Individual character search results through the filter modules. Personality cooperation module allows the user to get help, accurately problem of learning. The working process of the model is as follows: first, the user's interest of physical teaching characteristic information network resources to select feature selection module. The information stored in the personality characteristics of library users. The personality characteristics of warehouse are tracking and update. Then, the user's interest is through the user's personality model characteristic information. In addition, the sports teaching resources of the network are the filter modules of the filter sports teaching network resources according to user model. Finally, individual character search service,

individual character and personality recommended service cooperation services, realized by the personality of the search, individual character module recommended and individual character cooperation, according to filter the results.

## 33.3 Realization of Key Technologies

### *33.3.1 Establishing and Updating User Interest Model*

Build user interest in the process of process model of knowledge acquisition. There are two ways to obtain knowledge, such as user clear feedback and user hidden feedback [3]. In order to make full use of the advantages of the two methods, build user interest initial model according to user registration information and user interests model is according to the latest web server logs. A web server log records user IP address, access time, visit the page, access method, request document URL, HTTP version, return to code transmission bytes, agreement, the error code and so on. The user first interest model, the paper put forward according to user registration information. User registration information submitted to the server system although Web input. When the user registration is Web may allow the user to answer some questions, such as research orientation, interest, etc. Different people answer it formed a different personalized interest vector expression users. Because the user's interest is variable, the user's interest update user model of behavior through the observation in web server logs. When web sites have visited a, log database to increase its record, these records is the access time arrangement. Mining the log file may find users browse and how long the user view pages.

### *33.3.2 Filtering Module for Sports Teaching Network Resources*

Adaptive filtering algorithm for sport teaching resources based on vector space model is composed of three steps such as training, adaptive filtering and modifying thresholds adaptively.

Step 1: training phase. According to assigned training texts, initial filtering profiles and thresholds are generated [4].

Step 2: adaptive filtering phase. For each text in teaching resources, we judge whether it is related with initial filtering profiles or not.

Step 3: modifying thresholds adaptively. Users' feedback is utilized to modify the profiles and thresholds adaptively.

**Table 33.1** The experiment results

| System | Average Precision | Average Recall | $F_\beta$ |
|---|---|---|---|
| PSTNRS | 0.29 | 0.25 | 0.26 |
| Contrast system | 0.13 | 0.11 | 0.12 |

## 33.4 Conclusion

Based on the above research, we development project of personalized teaching resources of the network system movement. The authors construct a system of the web site, providing personalized course. In order to obtain the contrast experiment results, feature selection module, the user's interest module, personalized teaching resources is PSTNRS filter modules, and the contrast in the formation of the system. Evaluation metrics as follows [5]

$$\text{Recall} = \frac{\text{number if information correctly filtered}}{\text{number of information}} \tag{33.1}$$

$$\text{Precision} = \frac{\text{number if information correctly filtered}}{\text{number of information filtered}} \tag{33.2}$$

$$F_\beta = \frac{\left(\beta^2 + 1\right) \times \text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}} \tag{33.3}$$

There are 105 people register in this system. 100 personality characteristics storehouse are established. The interest group is 23; there are 286 texts in teaching resources. 8 texts that have the biggest correlation in teaching resources are provided to the corresponding user. Through the experiment, Table 33.1 shows the results:

From the Table 33.1, we discover that the filtering average precision of PSTNRS is higher than the contrast system. In summary, the model of personalized sports teaching network resources system (PSTNRS) is proposed. The result manifests that PSTNRS can support sports teaching better. I wish that this article's work could give references to certain people.

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# Chapter 34
# Research on Agricola Leisure Sports Under Business Ecosystem

**Tiexiong Zhang and Hongmei Wen**

**Abstract** Agricola leisure sports are a newly developed industry in recent years. Based on the modern people's motivation of consumption, it is an industrial collection to meets the growing demands of recreational sports with the characteristic of business ecosystem. Thus an intricate value-net is formed. This article is aimed at putting forward the competition strategies under the business ecosystem for the industry of agricola leisure sports, from the system aspect as well as the corporate level. Some new paths for the development of agricola leisure sports is offered.

**Keywords** Agricola leisure sports · Business ecosystem · Strategy research

## 34.1 Introduction

In 1993, Moore firstly put forward the concept of business ecosystem. Later, systematically, he made further discussion on this business ecosystem theory [1, 2]. According to the definition given by the modern scholars, it is a kind of objective existence, and resulting from human economic activities, it is also a social biological system with a future of ecology of. It contains all kinds of economic individuals and groups-the suppliers, producers, the circulator, the consumer, competitors, and others related to industries and enterprises, government agencies, industry and social organization and so on, which compete and cooperate with each

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other and form an entirety with specific economical function [3]. Different from the food chain in natural ecological system, which has always been regarded as a relationship of eating or being eaten between links, the value chain is more like the symbiotic relationship of exchange on interests and values. In other words, it is a business ecosystem value-net composed by multiple symbiotic relationships [4]. The leisure sports industry we discussed in this article is also not limited to one or a few specific industries. It is an integrated industry which is from the perspective of leisure sports consumption but the traditional perspective of "supply". In the specific form of farm tourism, it strips out all kinds industries from the traditional industry framework, which can satisfy people's need for leisure sports and provide leisure sports products as the core. This essay puts forward the competition strategies under the business ecosystem for the industry of agricola leisure sports, from the system aspect as well as the corporate level. Some new paths for the development of agricola leisure sports is given.

## 34.2 The Value Chain Structure and Value of the Network of Agricola Leisure Sports Ecosystem

Agricola leisure sport is a relatively new type of tourism. Based on the definition of commercial ecological system, we can see that the leisure sports industry farm also has the characteristics of commercial ecological system, and its commercial ecological system is complex with different levels. Each component is dependent and mutual information-transferred. Agricola Leisure sports industry is launched at people's consumption motivation rather than the traditional agricultural industry, the former categorize the sports-related activity which involves a various social sector.

Fund projects: Key funding research project of The Education Department of Hunan Province (Numbers: B41003) such as education, transportation, commercial, travel, arts, and culture. All these are presented in the form of the entertainment industry of agricola leisure, health entertainment industry, sports competition demonstration industry, sporting cultural leisure industry, sports tourism, farm tourism activities and so on. Through these leisure sports products, the consumers feel unlimited joy and happy both physically and mentally. Thus, the ultimate goal is obtained when both consumer and enterprise achieve their value. The same as natural ecological system, it plays a very important role in the normal operation of leisure sports activities [5].

The value chain of Agricola leisure sports ecological system. Agricola leisure sports are a specific operating environment. In this circumstance, it shows different levels. First of all, it is the subsystem of the higher level system. That is, it is a subsystem in the social system. Secondly, leisure sports industry of ecological system itself is a complex system, which contains multi-levels subsystems. The main participants in Leisure sports industry value chain constitute the core levels,

including organic leisure sports facilities, equipment manufacturers, the leisure sports service provider, leisure sports products and services sales channel, additional products and services, and the customer of core products. Its benign operation ensures that core value chain of leisure sports industry can be implemented. On one aspect, the extended level, constituted by the core level of the upstream suppliers and the indirect customers, together with the core value chain compose the expansion value chain of leisure sports industry. On the other aspect, as the competitors of leisure sports industry, the financial chain, policy chain, complementary products and services and other leisure industry form an internal environment of ecology system. As we all know, financial chain can provide important support in financing, customer base, marketing channels and other aspects for the suppliers of leisure sports industry, and industry associations also plays an increasing important role in development of healthy leisure sports industry ecological system, whose effects can be found in many aspects–the formulation of standards, norms behavior, trust-building, providing consulting and so on. As a competitor, other leisure industry has a positive or negative influence on the leisure sports industry from aspects of the industrial policy, the industrial structure, operating mode and so on. In addition, politics, economy, laws, culture, and technological conditions make up the outside environment, which has indirect influence to the developmental model and path of the leisure sports industry ecosystem [6].

The value network of agricola leisure sports industry ecosystem. In the business ecosystem life stages, there is only one order parameter that controls the cooperation between enterprises, that is value which reflects the essence of dominate commercial ecosystem process operation. In the leisure sports industry ecosystem, the cooperation between the core value chain and the extended value chain, financial chain and politic chain, leisure sports industry and service industry, and other related organizations provides valuable service and products to customers, then perplexing value chains are formed, and then the formation of a value network. There is a dependence relationship in the operators and participants of agricola leisure sports industry and the various species and environment. A virtuous Circle of ecosphere between the material flow and energy transmission is proceeding among the value chain. Similar to the natural ecological system where every living things' growth depends on the material circulation, energy flow, information delivery and the mutual influence, interdependence, forming a complex with distinct features of self-adaptability, self-regulation, and self-organization. With the aid of the logistics, capital flow, and information, the leisure sports industry ecosystem form a complex value network and produce valuable services.

## 34.3 The Competitive Decision Strategy of Agricola Leisure Sports Industry of Ecological System

Competitive strategy of System level. A healthy ecological system is stable and sustainable which maintains its organizational structure and internal system regulation's adjustment in time and space. The most important healthy index of ecosystem evaluation is the ecological system's integrity, adaptability, and efficiency. Agricola leisure sports activities must based on the ecological theory, and modern ecological agriculture environment and entertainment as its approach. Through balancing the agriculture and environment, ecological, and economic, the agricola leisure sports will achieve the ultimate objectives that it has a sustainable development and speed up the process of integration of urban and rural, and the agricultural moves towards modernization and ecologicalization. Therefore, from the following three aspects, the macro competitive strategy of agricola leisure sports industry ecological system can start with.

From the point of view of value for strategic choice. The reason why customers choose leisure sports but other leisure sports is that it can satisfy the needs while others cannot. Through the series of activities-go to the farmer's house, do farmers work, live in farmer's room, enjoy agricola leisure sports. And it renews people's contact with nature, with a feature of simpleness convenience and economy. People can get exercise, make social intercourse and entertain themselves while sightseeing. This kind of satisfaction cannot be obtained through other leisure activities. Leisure sports should keep the integrity of the ecological system and promote the material circulation, realizing benign interaction. In order to promote the health development of commercial ecosystem, it should create new products and cultivate the market demands constantly to meet the needs of customers, and improve the value recognition of customers.

From the point of view of common development for strategies choice. In an increasingly unstable environment with fierce competition, it is hard to survive without establishing close relationship with other development elements. Like a biological ecological system, each member of business ecosystem relies on each other and develops together. We can say that it is difficult for agricola leisure sports to provide customers with all of the service value ability, they must establish a stable strategic partnership with other participants, build mutual trust mechanism, reduce the value of the whole system dissipation, and thus realize the common development of the overall effect, which is the necessary choice for the leisure sports. Leisure sports activities will develop the members of its system to enjoy the same rights, the leisure sports industry farm funds, investors, Banks, insurance companies and leisure sports facilities, equipment manufacturing and government department of industrial policy, and in this process, catering, retail, traffic and transportation, such as cultural industry and complementary industry, the tourism industry and other leisure industry constitute the leisure sports tourism form ecological system. Therefore, organic leisure sports and other members of the

value network provide customers with valuable services, achieving the purpose of common development.

Selecting strategies from the point of view of niche market. In the ecological system, each species has a most suitable space and time position for long-term survival competition. The members of leisure sports industry ecological system should also look for their right space, and that is the Aperture market strategy (niche strate-gy, also called the niche strategy). It is through focusing on their own unique ability and using the significant assets in ecological system provided by the other parts that emphasize differentiation. In the current economic system, the farm leisure sports industry is a kind of emerging industry whose organization is not perfect. The market growth is not mature, the products are too simple and the service differentiation is in a low level. The main operating means of farm leisure sports industry are pricing strategy and advertising strategies. Compared with other industries there are not substantial differences which has a great impact on its economic effects and leads to discontentment with products and services from consumers. Therefore, there is much to do to improve in the ecological system. In order to get living space from the ecosystem of the farm leisure sports industry, providers of products and service need to break the old and traditional niche market according to the ability and professional knowledge conditions which belong to themselves or can be obtained. Then they can create a new niche market to produce valuable services as soon as possible which serve to different niche market. And then the core competitive power and different business model can be formed. For example, by providing professional service for some customers (such as white-collar female), they can improve commerciality of the entertainment products to strengthen their professional knowledge in some gap and establish the authority in this niche market. The competition strategy choice from the enterprise level. At present, our country's organic leisure sports industry still exists various problems. There are not enough plans for developing organic leisure sports tours; The equipments, conditions, and other resources still have not been effectively integrated; The sports leisure tourism resources and protecting the ecological environment and history culture failed to combine together; There is not an overall plan for Agricola leisure tourism and the development of related industry; Overall management is not standard; The government pays less attention to promote good atmosphere for developing the Organic sports leisure tourism. With the continuous improvement of our country's market and legal system, the sports leisure farm industry must find an effective way to develop itself. It should also avoid the scene that because of its small difference with other production, companies hold down costs to lower the price, or depend on the strong force to exploit and crush small businesses to get more profit. This may lead to same kind of bad competition. From the perspective of business ecosystem, we can converse competition strategic thought of leisure sports industry to promote the upgrading of the industrial structure and even the healthy development the entire economy.

## 34.4 Conclusions

The development of sports career is bound up with the social economic standard. Agricola, as a new rural industry, will bring many benefits to local farmers by blending leisure sports activities. And it adapts to the economic and ecological development of rural places, which has the characteristics of business ecosystem. It not only breaks the barriers in politics and policies from the traditional agricultural framework, but also makes people to re-examine the relationship of members in sports leisure under the commercial ecosystem. Turning ferocious competition into common development, it will have a positive impact to the construction of new country and the development of rural sports career in China.

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# Chapter 35
# Research of University PE Cultivation of Innovative Talents

**Shengmin Cao**

**Abstract** The review and analysis of the effect of college sports teaching goals that sports an innovative personnel training not only in skills, physical fitness, talent alone cannot constitute a College Physical Education the goal, they are unlikely to reflect the goal of pursuit of human development. College Physical Education, in the face of basic adult college students about to enter the era of knowledge economy in general fully rely on knowledge and knowledge application only from a global human needs, the implementation of life to serve the students, helping students to enhance quality of life directly to obtain and maintain health, beauty, happy for the goal, really reflects the objectives and requirements of the new era of human development and the vital interests of the students' individual needs, and thus have the potential to radically stimulate the mobilization of students to learn the proactive sports to enhance and expand the effectiveness of College Physical Education.

**Keywords** Teaching of college sports · Students · Life · Capacity · Innovation

## 35.1 The Goal of University Physical Education Teaching

Review college sports teaching practice, the target problem has undergone skills, physical fitness, the evolution of talent development process, indicating that the university physical education workers in the theoretical study on the deepening of development played an important positive role in the promotion of university sports career. But the decades passed, the University of Physical Education Teaching Practice has proved that the implementation of these goals do not have satisfactory

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results [1]. Stresses the implementation of sports teaching the students to the pursuit of sports knowledge and skills to teach and to master, even to a certain degree of technical levels as the goal for the majority of the students not to use sport as a career, apparently is not required; also the majority of students to learn the cultural and scientific knowledge, develop intelligence-based, cannot do the time and effort. Neither necessary nor possible to conclude that the students it is impossible for the resulting action to meet the needs of the motivation and achieve their goals [2]. And therefore cannot learn well, or even tired of learning. Typical witness than by 16–19 years of school education and university teachers are reflected in the sports technical skills to master level is very general. And in real life, almost no one from elementary school to the University have studied the high jump, long jump, push the shot put, and other sports skills to adhere to exercise, this is excellent evidence to the contrary [3].

Stressed that the fundamental goal of the College Physical Education in order to enhance the physical fitness of students, seems to have caught the students hope that the good physique psychological characteristics, like which motivate students actively involved in sports learning. However, due to people's physical strength, not all acquired, nor can be reached by relying on a factor in the day after tomorrow. It is least affected by genetic, living environment, labor conditions, the law of life, leisure and entertainment, and physical exercise and other factors. To constitution, must rely on the comprehensive management of the above factors, physical activity is clearly only one factor, and only equivalent in other factors that enhance the physical role of physical exercise of reasonable circumstances, be possible to effectively occur. And other factors, by no means the school, school sports, and even physical education teachers are able to be guarantee to be done or can be controlled. Obviously the target in order to enhance the physical, exaggerated the role of sports, is a typical subjective conjecture, from objective reality. In fact, the students of the two large-scale physical test, revealing the vast majority of students not robust physique, body symmetry; 3 years ago, an authoritative information, the intellectuals of China's universities and research institutes, 60 % of people suffering from various diseases, the average age at death was 58 years old, below the national average life expectancy of 10–12 years old; a tracking survey of the key universities: university graduates, only 68.7 % maintained a good level of health, 72.5 % had no sports interest and sports skills, expertise, and adhere to exercise only 9.5 %; Qu Zong Lake, Yang Wenxuan 65 School Sports Teaching reveal: preferences of physical exercise of ordinary professional students fewer than 60 % in general accounted for 40 %; made about 1096 students in the school survey shows that: a week to adhere to the 3–4 times body exercise, accounted for 12.6 % of boys and girls 7.43 %. Are no doubt the physical 0 goal of the feasibility of a question, reflect the College Physical Education neither bodybuilding physique culture, enhance physical fitness, health promotion, nor does it help students develop sports skills, expertise, training sports interest to help students develop adherence to the exercise habit.

Emphasis on physical education teaching personnel training school education objectives and requirements, the sport as part of the education, which should be for the personnel training services, which is justifiable, on the whole it is consistent with.

But a closer inspection it is not difficult to find: sports, whether as a discipline, or a unilateral commitment to the task of training personnel, and clearly cannot be completed. And even if the purpose of sports personnel training, only one aspect in the school education, the needs of the community school, educating people. On the other hand, standing by the target of education: the student's position, the talent is not that they learn the objectives of the sports. Leizhi stove as early as five school sports fitness music goal of a text reveals: the results of the survey made by the college students of 2380 (including 561 girls), 93.25 % of the students believe that target them to learn the sport far more than tempered the body and contribute to physical enhancement, while the need for more opportunity to participate in sports activities, gain fitness, entertainment, beauty, communication and fun, and to enrich their campus life. Motor skill learning, 98 and 45 % of students believe that schools should provide more learning content and opportunities, but the vast majority of content and secondary repeat in the future is useless; physical problems, 100 %. The school cannot be guaranteed, the key is its own conservation. They think the school life for the person's life is important, and all aspects of playing some basis. However, in order to adapt to social life and the pursuit of quality of life, regardless of learning ability, or physical exercise means, must be with the age, growth, and social living conditions, the main objective factors change continuously adaptive changes; in school learning is not so much talent, as it is more precise in order to live, that is, individual needs, education, life. It also shows that there is some difference between education and the educated in the target problem. And this difference in the educational practice in the past precisely neglected, so that enthusiasm is an important reason not to mobilize students to learn fundamental. In real life, universal enrollment with the University, the difficult problem of graduate employment is more and more prominent, some studies poor professional obsolete graduates, even if they have good health, apparent loss of competitiveness in the job market, leading to work without place coming from the objective facts of life, so that they know better how the school learning process but in reality is a process of preparing their future life, completion of school studies only can mean the beginning of the future independent living. For them, the high quality of life is by learning basic needs. This also reflects each family parents, the elderly people of every social reason why the younger generation, education, and training of the basic state of mind and human reproduction, social progress and development is bound to pursue, should become an important basis to re-examine the teaching goals of college sports.

## 35.2 University of Physical Education Should be Student Life to Serve as the Goal

Throughout human society from the agricultural economy, industrial economy era, the era of knowledge economy, the evolution of the development process, from simply focus on economic construction to socially sustainable development,

forward direction is always aligned one goal: to improve the quality of life for all people. Expressed in the administrative program by the World Summit held in Copenhagen in 1995: the ultimate goal of social development is to improve and enhance the quality of life for all people. United Nations Programme in its Human Development Report also reveals that: human development is a process to improve people's chances of survival, generally speaking, the health and longevity, to accept the well-educated and living happy is a basic indicator of human development. This global trend has caused the Chinese government which attaches great importance to the 16th CPC National Congress report made it clear: to build a moderately prosperous society, and comprehensively improve the quality of life. Although China is still in to continue to address local poverty, gradually increase the level of moderate prosperity and affluence of the stage, but the comprehensive construction of an economy is more developed, improve democracy, advance science and education, enrich culture, foster social harmony and upgrade the texture of life for the people of well-off society, aimed at improving the standard of living and quality of the people across the country, this is certain. The will of the state is so clear to point to the lives of ordinary people, the sport as an important component of human social life, education should be an unprecedented situation close to the lives of ordinary people, this simple truth is clearly not required to prove. In short, building a moderately prosperous society in an overall improvement and to improve the quality of life for all people, naturally must also include the growth of human quality of life for present and its future. State-run schools, implemented for students of physical education, life to serve the students, help students to increase access to quality life skills, it is a matter of course. In fact, the reform and opening up more than 20 years, China's GNP mostly maintained a growth rate of over 7 %, has made great achievements in economic development, people's living standards will be improved. With the rapid increase in living standards of the National People's concerned about the physical and mental health, enjoy life, to enhance the quality of life has become a widespread value orientation, natural college students are no exception. Accordingly not difficult to understand national development in order to improve and enhance the quality of life for all people, need to cultivate a large number of able to serve the community, service life, with the talent to create a better life skills; personal development in order to obtain the high quality of life as the goal, you need to learn to understand life, the ability to create and enjoy high quality of life. College Physical Education only to serve the student life, to help students acquire the ability of the high quality of life and truly reflect the objective needs of the era of development and the immediate interests of individual students. Fundamental and thus be possible to mobilize college students learning sports proactive, effectively enhance the physical effectiveness of teaching.

## 35.3 Sports Teaching Innovation Goal is the Pursuit of Health, Beauty, Happy

As mentioned earlier, the College Physical Education should be to serve the student life, students would be able to get the high quality of life must be competency-based training and improvement of these capabilities, obviously must rely on common school education, including subjects teaching to achieve, not unilaterally by the Physical Education Teaching can afford. Sports both the role of the people, and the role of society, but is ultimately a role in the human. With the evolution and development of human society to the era of knowledge economy, human labor in the production process of economic development investment in a corresponding change in input from the entire body, some physical inputs, mental input. In science and technology are primary productive forces, economic growth depends on the present era of knowledge and information, the brain gradually dominate in the economic and social development. This change reveals a strong body through sport, build up their strength, acting directly in the production, improve production efficiency, and increase social wealth, is clearly unlikely. Result in physical functional role of desalination in productive labor, will be replaced by a hunger for their own muscle activity patterns of the human body as a whole out of the field of production and labor, compensation function. Sports for the role of people, from the satisfaction of input material production requires a strong body of the soul turned to people on the pursuit of healthy living. Throughout the history of sports practice, people engaged in sports activities is neither intended to improve the technical skills, nor is it simply in order to enhance physical fitness, but not unilateral taught through sport, will serve as an integral part of the overall social development, in order to improve and improve people's quality of life services. Examine real life people put into sports activities, or in order to health or to the United States, or for the music. Thus health, the United States, music has become to improve and enhance the pursuit of their own quality of life of ordinary people through sport. "Health" includes fitness, heart health, and healthy lifestyles, "health" to summarize. The sports person's "health" as early as confirmed by the history of sports practice, this need not repeat them here. "Beauty," the thing itself an objective reflection of a certain nature. Beautiful shape, body, Beau, beauty, beautifying action, to beautify the soul, "America" to summarize. Heart of beauty in everyone. "People's" pursuit of beauty, create beauty accordance with requirements to promote change and development of the wider world of all things; the inner world of people through the United States balance with the external environment of conflict, relying on the United States to enrich the life support. America the ever-present, ubiquitous. Sports in the United States include the beauty of human body and movement America. The human body both in the human sciences, social arts, and culture have been recognized as the highest form of expression in America, is the lofty goal of human beings to pursue, but also the material basis for a better life of mankind. Sports are the effective direct means to achieve this great goal. It goes without saying that the

starting point for both sports, the sport is bound to pursue the results achieved. The "music" often refers to the happy, joy, happiness, and the like can be used "happy" to none, according to. "Happy" does not refer only to happy, recreation, sightseeing, tourism, "happy" meaning happy, excited, satisfied, full, quiet, comfort, freedom, creativity, success, giving vent to all the "happy" performance. Industrialization and modernization, social, industrial production, and development of market economy, people put the cart before the horse. Pursuit of the value of the material, to the neglect of the people themselves; output, output value, profits rise, human frustration, tension, loneliness, fear, etc. more and more pressure. Capable mortal have been hard to become happy together; pursuit of "happy" has become a modern way of life orientation. This not only makes the sport to become a real social/entertainment career provides a broad market, to meet people "happy" the needs of sports can be generated in the form of development, becoming an integral part of the family, school, and society. Also shows that sports are only rooted in the human "happy", will show new vitality. Thus, opportunities and achievements of the athletes in the new period, should be based on all sports happily pay very much love to get more happy life. This point can be seen, health, music reflects the people's physiological, psychological, and social needs is a human symbol of the pursuit of a better life, nor everywhere and sports closely, thus it is a sport should the pursuit of goals; health, beauty, music, sports is directly targeted, in line with the vital interests of the everyone in the whole society of different genders, different ages, different social strata, both longing for the future, but also practical needs, and thus it can be fundamentally mobilize everyone to participate in the initiative and enthusiasm of sports practice, to make the sport truly become the lifelong needs of people's lives. An integral part of university sports, education, is a typical stage sports, its stage, the most prominent educational. College Physical Education, in the face of basic adult young students, the implementation is directly targeted to health, beauty, music, more in line with contemporary young people to pursue a better life, physiological, psychological, and social needs, embodies the sport for students interest, incentive, reality and life, and thus is feasible.

## 35.4 Conclusions

With the evolution and development of human society, the construction of well-off society in China and comprehensively promote, improve and enhance people's quality of life goals are more clear, and sport as a universal cause, should be to improve and improve the quality of life for all people. In order to meet the needs of the construction of well-off society, the state schools need to develop the service to the community, service life, with the innovative talents to create a better life skills quality; students to study access to and enjoy the high quality of life, you need to lay the all aspects of creating a better life the ability of the basis. College sports is a typical stage sports, education and teaching process in the macro objectives of the

service life of students, focusing on capacity-building to enhance student access to quality of life, and its direct target of the students' health, beauty, music, sports truly become the practical needs of students and lifelong needs. To this end, the current college sports teaching practice, the following recommendations: (1) change their concepts, advancing with the times; (2) from the goal, the selection of teaching content; (3) full use of the teaching factors to improve the overall effect.

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# Chapter 36
# Study of the Fitness Status of Teachers in Higher Vocational Colleges

**Wankai Fu**

**Abstract** This paper has made investigations and study on the characteristics of fitness awareness, the behavioral characteristics, and the influencing factors of teachers in higher vocational colleges. It has put forward some specific countermeasures for constructing the teachers' fitness incentive system and establishing the permanent offers for teachers' fitness service centers. It is the hope of the author that this paper would provide some references and basis for the relevant administrative departments to carry out some sports fitness activities.

**Keywords** Teachers in higher vocational colleges · Fitness · Investigation · Countermeasures

## 36.1 Introduction

The State Council has emphasized in the "Outline of the Nationwide Body-building Plan" that "positively create sports fitness conditions for intellectuals, advocate and promote the sports fitness methods that are appropriate to their work characteristics, pay attention to the fitness screening, and physical determination work of the medium and senior intellectuals." Regarding the sports fitness requirements that are put forward in the "Outline of the Nationwide Body-building Plan", how do the higher vocational colleges carry out the nationwide body-building plan and what are the circumstances? It is quite necessary and urgent to

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make an investigation and also make an analysis of body-building activities of the teachers in higher vocational colleges [1, 2].

## 36.2 Research Objects and Research Methods

### *36.2.1 Research Objects*

In this study, some of the teachers from Liaoning Provincial College of Communications would be taken as the research objects.

### *36.2.2 Research Methods*

#### 36.2.2.1 Literature Material Methods

This research takes the literatures and books concerning the teachers' fitness and fitness aspects. The data from the literature and the books are collected from the library.

#### 36.2.2.2 Questionnaire Investigation Methods

This study makes a reference on the existing research results and designs "A questionnaire of the body fitness and body-building status of the teachers". In addition, it makes the validity and reliability test of the questionnaire [3].

#### 36.2.2.3 Mathematical Statistics Methods

In terms of the data collected, spss11.5 statistical software is applied to make the qualitative and quantitative research and analysis.

#### 36.2.2.4 Interview Methods

The author has paid a visit to sports statistics experts, sports experts, fitness instructors, and other relevant personnel.

## 36.3 The Survey Results and Analysis of the Physical Body-Building Activities of Teachers in Higher Vocational Colleges

### *36.3.1 The Characteristics of Fitness Awareness of Teachers*

#### 36.3.1.1 The Attitude of Teachers Toward Physical Exercise

The survey shows that 79.1 % of the teachers think that fitness exercise is important and very important. 74.6 % of them are willing to participate in physical exercise while 25.4 % of them are quite unwilling to participate in physical exercise [4].

#### 36.3.1.2 Mastery Degree of Fitness Knowledge and Skills

Statistics show that only 10.7 % of teachers have a very good knowledge on the physical fitness and they have skills to master the body-building activities. 80.7 % of teachers have some knowledge on the physical fitness and they do not have a lot of skills to master the body-building activities. 8.6 % of teachers basically have no knowledge on the physical fitness and they do not have any skills to master the body-building activities [5].

#### 36.3.1.3 Teachers' Understanding of the Nationwide Body-Building Plan

It can be found from the analysis of the survey that 45.6 % of the people know but are not clear of the specific content. 29.2 % of the people have merely heard of the plan and 7.9 % of the people know and understand the contents of the Nationwide Body-building Plan. Those who have never heard of the Nationwide Body-building Plan have accounted for 17.3 %.

#### 36.3.1.4 Understanding of the Sports Body-Building Function

The top ten in the statistics of the understanding of the sports fitness function are shown as the followings: enhance the physical fitness and improve fitness; entertainment ease the tension of living and the working pressure; prevent and cure diseases and restore the body functions; strengthen interpersonal relationships; regulate mood; promote sleep; remain and shape the body fitness; iron will; cultivate sentiments.

The selected ratio of each option has been more than 50 %.

#### 36.3.1.5 Awareness to Maintain or Improve Their Own Fitness

Statistics show that the top four are to improve their diet and nutrition, to maintain adequate sleep, to live a regular life, and to carry out the physical fitness activities. There are only 15.1 % of the interviewed people who try to keep fitness through the physical exercise.

#### 36.3.1.6 Teachers' Motivations to Participate in Sports Fitness

It can be seen from the titles of statistical results that are the teachers who rank high take the prevention and cure of diseases and enhancement of physical fitness as their major motivation. Also, the teachers who rank vice position in colleges have relatively even distribution of the motivation of fitness activities. The teachers who rank intermediate position put the recreational hobby as a primary motivation for the purpose of fitness activities and the teaching assistants take the participation in social interaction as the main motivation. The differences are quite significant [6].

### *36.3.2 The Characteristics of Teachers' Fitness Exercise Behaviors*

#### 36.3.2.1 Teachers' Participation in Physical Exercise

It can be seen from the statistical results that the number of men who participate in physical fitness activities accounts 72.1 % for the male sample. 27.9 % of men do not participate. The number of women who participate in physical fitness activities accounts 51.5 % for the female sample. 48.5 % of females do not participate in physical fitness activities. There are significant differences between men and women in their participation in the exercise.

#### 36.3.2.2 The Exercise Time for Teachers to Choose

The statistics found that men and women teachers show no significant differences in the choice of exercise time. The workout time is mainly in the evening (26.0 %) and at noon (16.1 %). Those teachers who do not have a fixed time for exercise account for 19.9 %.

#### 36.3.2.3 Teachers' Sports Demographic Characteristics

The teachers who take up sports account for 20.0 % (the sports population for male teachers is 21.7 % and for female teachers is 16.9 %). The figure is

significantly lower than the population of the nationwide scientific researchers and teachers, with the percentage of 34.3 %.

#### 36.3.2.4 The Forms of Participating Fitness Activities for Teachers

Overall, teachers who choose to "work out with colleagues and friends" account for 37.7 %. Teachers who choose to "work out with their family" account for 14.2 %. Teachers who have no fixed way of exercise account for 25.3 %, ranking the second place.

#### 36.3.2.5 Teachers' Choice of Exercise Projects

From the overall trend point of view, the choice of fitness program for the teachers is more dispersed. They pay more attention to the fitness, fitness and entertainment projects. In particular, they are more willing to participate in popular fitness programs that are not restricted to the places and requirements and that require not strong technologies.

#### 36.3.2.6 Teachers' Choice of the Fitness Areas

The first major place for teachers to participate in sports activities is schools, with male and female teachers accounting for 38.3 and 35.1 %, respectively. Respectively there are 15.5 and 12.9 % of male and female teachers who select toll venues. There are certain male and female teachers who selected the community, with male and female teachers accounting for 14.0 and 20.8 % respectively. This is consistent with the basic actual living conditions that most teachers are living in the district.

#### 36.3.2.7 Teachers' Arrangements of Leisure Time

In terms of the survey on how to organize leisure time, it shows that 52.1 % of the teachers spend on lesson preparation and research, with the leisure time spending on simple rest (37 %). There are many teachers who regard the leisure time in the Internet and watching television (34.3 and 33.3 % each). The participation in physical fitness activities only ranks the sixth place.

### *36.3.3 The Reasons that Influence Teachers to Participate in Physical Fitness Activities*

#### 36.3.3.1 Comprehensive Reasons that Influence Teachers to Participate in Physical Fitness Activities

In terms of the subjective factors, the main factors that teachers do not participate in the exercise are that they lack of interest, lack of diligence, lack of willpower, and no exercise habits and no fellows. In terms of the objective factors, the main factors that teachers do not participate in the exercise are that lack of leisure time, the workload is heavy, very tired physically and mentally, no venues and facilities, lack of organization and guidance, and they do not know the exercise methods.

From a gender perspective, female teachers show no interest in the physical exercise and they are lazy, lack of willpower and the workload is heavy and very tired physically and mentally. This proportion is much higher than male teachers, which should be given attention.

#### 36.3.3.2 Teachers' Fitness Exercise Importance Extent of the Government and the Society

From the investigation result, 63.5 % of the teachers in higher vocational schools believe that the current government and society do not pay enough attention to the physical training of teachers; 83.3 % of teachers are not satisfied with the society and school organizations on the aspect of staff daily fitness activities.

#### 36.3.3.3 The Teachers' Satisfaction on the Organization Process of the School Fitness Training

Through the exercise organization process satisfaction survey for teachers: dissatisfied (needs to be improved and relatively poor) accounted for 50 % held a positive attitude toward teachers (50 %), indicating that half of the teachers in the school of physical exercises organizational effectiveness satisfaction than the low.

#### 36.3.3.4 Investigations of Teachers' Demand of the Schools

In the questionnaire concerning "Any demand for Schools in strengthening the organization and management of sports activities of teachers", 18.2 % of the staff think that sports organizations and institutions should be improved to ensure the rights of teachers to participate in sports activities; 25.6 % of staff select to set up a staff fitness service center. 35.0 % of the staff chooses to strengthen the science and fitness guidance. 40 % of the teachers ask for an increase in the number of fitness

facilities and the quality. 15.1 % of the teachers require participating in various forms of competition. Those who think that it does not matter account only 6.7 %.

The findings of the survey actually reflect the fitness needs of teachers are increasingly urgent.

## 36.4 Conclusion

### *36.4.1 On Fitness Awareness*

Teachers of all ages have the right fitness exercise attitude. They have comprehensive understanding of the fitness function and the motivation to participate in physical exercise is clear. But the teachers have not well enough mastery on fitness knowledge and skills. They do not have enough understanding of the "fitness plan".

### *36.4.2 The Characteristics of Teachers' Fitness Exercise Behaviors*

Vocational School Teachers have low sports population (20 %). Female teachers to participate in physical training are less than male teachers and there are significant differences.

Participation in sports activities is mostly concentrated in the evening and at noon. The sports and fitness activities are spontaneous: work out with friends and colleagues and with their families and personal exercise account the majority while work out in school group activities and in social activities is less (10 %).

Teachers have gender characteristics and age differences in the choice of the fitness programs.

In the handling of leisure time, 52.1 % of teachers spend it on preparing lessons and research, showing that teachers' workload is very heavy. But most of the teachers is not scientific enough on leisure time. The leisure time is for simple rest (37 %). Those who participate in physical fitness activities only rank in the sixth place. Fitness is not of very great importance.

### *36.4.3 The Key Factors Influencing the Vocational Colleges in Our Province to Take Part in the Physical Fitness Activities*

In terms of the subjective factors, the main factors that teachers do not participate in the exercise are that they lack of interest, lack of diligence, lack of willpower,

and no exercise habits and no fellows. In terms of the objective factors, the main factors that teachers do not participate in the exercise are that lack of leisure time, the workload is heavy, very tired physically and mentally, no venues and facilities, lack of organization and guidance, and they do not know the exercise methods. But the economic strength is not the main influential factor.

## 36.5 Suggestion

### *36.5.1 Governments Should Pay More Attention to the Teachers' Fitness Exercise*

Strengthen the "Sports Law" and "National Fitness Program" and vigorously promote the concept of fitness and promote fitness' green to help teachers establish a correct concept of fitness, and enhance awareness of fitness. Promote the implementation of the activities of the teacher's fitness.

### *36.5.2 Schools Can Set Up a Comprehensive Teacher Fitness Service Organizations (with the Functions of Management and Services)*

Integrate trade unions (including grass-roots trade unions), the Sports Ministry and school fitness department and establish the teachers' fitness service organization centers. Teacher's medical centers, physical monitoring centre for teachers and special club can be led by trade unions with the coordination of other sectors. They may hire part-time staff. (See Fig. 36.1, 36.2)

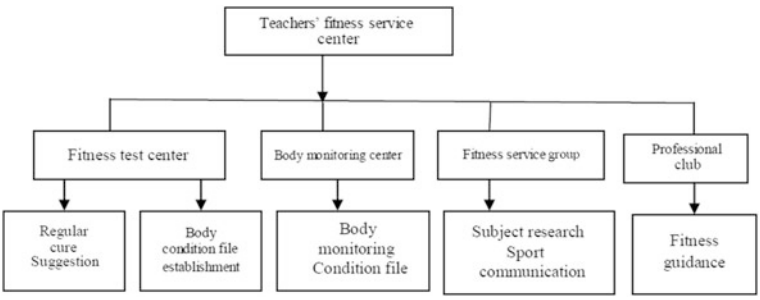


**Fig. 36.1** Teachers' health service constitution

### 36.5.3 *Teachers Should Properly Handle the Dialectical Relationship Between Fitness and Work, Reasonably Arrange the Daily Schedule, and Develop Good Fitness Habits*

See Fig. 36.2.

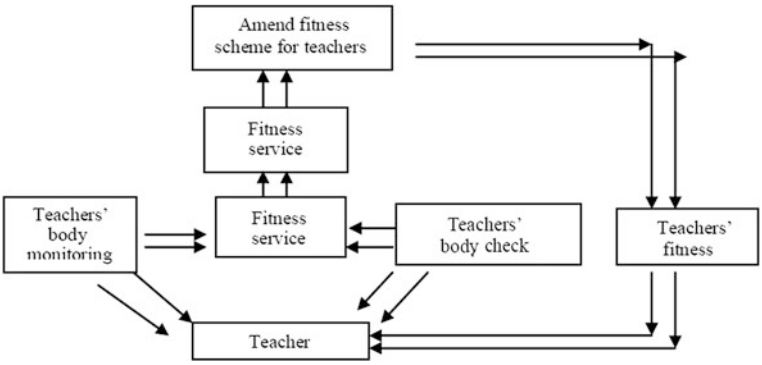


**Fig. 36.2** Work process

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# Chapter 37
# Research of Analytical Framework of the Effect on the Athletes by Complex Social Network

**Qian Huang and Xiaoli Zhang**

**Abstract** The athletes have special social network and social support due to the special training system of sports in our country. It is of great theoretical and practical value to research our athletes' social network and the rules of their social support. This thesis which is referencing a large number of domestic and foreign research results, combining the practical background of our country, starting from athletes' individual factors, social support network, employment network, sports and achievement network, builds an analytical framework of the effect on the athletes by complex social network.

**Keywords** Social network · Professional athletes · Analytical framework

## 37.1 Background

Social network means a unique set of links between a group of specific individuals or the social contact that formed formal and informal between an individual and others, including the direct social relations among people and the indirect relations that formed through the sharing of physical environment and culture. Since the 1960s, social network analysis became a new field of sociology [1]. Earlier studies of social network mainly for small groups, and then extended to community studies, and applied in many areas of sociology at present, such as study on social stratification, study on social mobility, urban sociology, political sociology and some other marginal subjects as mental hygienics, gerontics, and social work.

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Study on social networks including studying on whole network, studying on personal network and its effect [2]. Study on whole network is concentrated on studying on the internal relationship between small groups, and study on personal network and its effect is to define social network from the perspective of individuals, concerned about how individual behavior under the influence of all of its social network members, as well as how individuals become community groups through network. Wide field of studying social network such as the influence of social networks on the spread of information, invention promotion (Rogers 1995), the relationship between social network and job mobility and social resources (Granovetter 1973), the characteristics of social support network (including emotional support, practical support, and social interaction support), content and the relationship between social support and social relation. Social discussion network (also known as interpersonal association network), its effect on the behavior of individual consciousness, and how to affect other individuals through network [3].

Study on Chinese social network is still at the early stage, in which, study of urban residents and rural residents, study on the effect of social network in the process of occupational mobility of urban residents, study on the source of social capital and its effect on access to economic and social status; study on the social support network of urban and rural residents and the elderly; study on urban residents' social discussion network. Rural population and its demographic impact attracted wide attention scholars at home and abroad as with the influx of rural surplus labor into city, the analysis and perspectives of social network are introduced for the rural population studies [4].

Chinese athletes became a special groups because of the different social and sports institutions. It has been caused widespread concern in the community slowly as their special role and status. On the other hand, the interaction between athletes and society will be closer than ever along with China's rapid economic development, deepening of the reform, the effect of its complex social networks and its social support on groups of athletes is growing. The network is of great significance of athletes' daily exercise and life, improving performance, and their retired life [5].

Since 1949, a kind of athletes training system of "Thought is as logical as a chess, organization is as coherent as a dragon, training is consistent" is formed under the Government's led, a lot of athletes are cultivated, large quantity of remarkable results are obtained, the status of world-leading sporting nation is established [6]. We call this system as the national sports system; nationwide system means effectively unified, centralized state power to make some aspects of the rapid development of sports development mechanism and the corresponding set of organizations and other within a certain period. Nationwide system can provide some financial resources for sports development in China, which allows China's sports can be provided with the necessary financial and capital protection and accepted the Government's guidance and supervision on the use of funds in the context of whole economic underdevelopment [7]. Nationwide system can also provide some policy resources for sports development in China, make full use of national policies to address the physical work, especially some practical problems and difficulties of competitive sports encountered in the development process [8].

Under such a system, training of professional athletes in China is mainly Government-oriented athletes training system, that Government-funded start-up sports schools and administrative intervention at all levels. Governments all over the athletes representatives participating, excellent professional sports teams, rushed to the province, and then by selecting and entering the national team. This is typical of three-level training system under the guidance of planned economy, that the national team for the first level, provincial professional team for the second level, city and county-level amateur sports school for third-level. This is also the difference between Chinese training and foreign club training system. Professional athletes in the lower position than on other sectors in our country, because they are living and practicing in a relatively independent environment, so the complementarity of the lack of interpersonal interaction of dimensions, emotional return and position. Essentially, a complex social network is formed by relationships and social interaction among athletes, and a unique social support networks are also formed.

Social network is defined as "a unique set of links between a group of specific individuals" or the social contact that formed formal and informal between an individual and others, including the direct social relations among people and the indirect relations that formed through the sharing of physical environment and culture. Research on social networks becomes a new field of study in sociology since 1980s. Earlier studies of social network mainly for small groups, and then extended to community studies, and applied in many areas of sociology at present.

Complex social network refers to relatively stable relationship that formed because of the interaction between individual of society including professional athletes. Complex social network concentrates on interaction and contacts. Social interaction is conducted in a certain circumstances, different ways of interaction appear under different circumstances. We can analyze the interaction depth from four aspects—the interest association, the emotional investment, the extension time of interaction, the complexity of interactive specification. It is not difficult to see that professional athletes are lack of interaction with others except their families, coaches, and teammates, their social network is not stable. The interactive breadth reflects the scope of social interaction and the areas of interaction, in the three-level training system, athletes are limited to a small circle of daily life, people they communicate with are all staff who is engaged in the sport, which caused the small communication range, fields narrow.

## 37.2 Theoretical Basis

### *37.2.1 Factors of Social Network*

We can divide the relationship between individual and organization into strong relationship and weak relationship depending on the frequency of interaction, strength of emotional, degree of intimate, and mutual exchange. The strong

relationship develops in the individuals that at same economic level of ages, gender, education, occupation, and income, however, the weak relationship develops in the individual at different economic level (Granovetter 1973). Some scholars define the strong relationship as consanguinity and "field-relation", on the contrary they define the weak relationship as "occupation-relation" and friendship according to the characteristics of rural population. According to the studies, Social network may influence attitudes and behavior. Therefore, comparing with strong relationship, can weak relationship play a greater role to influence one's attitudes and behaviors.

### *37.2.2 Factors of Social Supporting*

The theory of social support developed and improved gradually after 1970s by hardworking of psychologist, psychiatrist, physicians, social science researchers, and social science workers. Initial research focus on the relationship between social support network and individual health, as the research depth later, the focus turns to social support network itself, including structure, contents, characteristic and the relationship between social organizations relation, and contents of social support.

Study on social networks including studying on whole network, studying on personal network and its effect. Study on whole network is concentrated on studying the internal relationship between small groups, and study on personal network and its effect is to define social network from the perspective of individuals, concerned about how individual behavior under the influence of all of its social network members, as well as how individuals become community groups through network. Social support networks are an important part of social network, which is the relationship between people and others under individual social network. We should get a good knowledge of the structure characteristics and internal rules to study athletes' social network structure the characteristics of social support network (including emotional support, practical support, and social interaction support), content and the relationship between social support and social relation, Social discussion network (also known as interpersonal association network), its effect on the behavior of individual consciousness, and how to affect other individuals through network.

## 37.3 Establishment of Analytical Framework

### *37.3.1 Questionnaire*

It is vividly depicted in the Fig. 37.1, the design and finish of this questionnaire go through such stages as collection and reduction of the materials, design of the

questionnaire framework, preliminary design of the questionnaire, test-investigation, and questionnaire for timely modification.

Main contents

(1) To protocol the frame of questionnaire's contents according to the target and plane of the research, referring to research achievement about social network and athletes home and abroad. For the content of the survey, two athletes who are selected from Zhangba training ground of Shaanxi province are interviewed in November 2011 to get knowledge of their social network, occupation, salary, team management, and marriage attitude, at last, the questionnaire's frame should be adjusted and improved.
(2) To improving validity of questionnaire, authors refine the information of individual, injuries, salary, team management, and marriage attitude and athletes' social network (including social support network, occupation network, achievement network) not only on the basis of summing up the results of "Social Support Networks of Rural–Urban Migrants" and "Questionnaire of National Outstanding Athlete", but also combining with athletes' training situation and daily life.

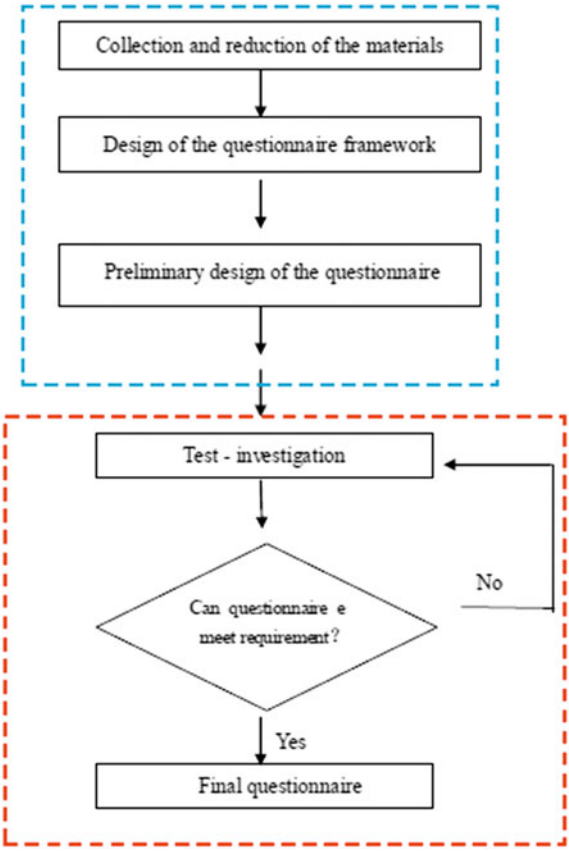


**Fig. 37.1** Questionnaire

### *37.3.2 Analysis Contents of Frame and Structure*

There are two aspects in questionnaire of athletes factors of individual and society (including information of individual, injuries, salary, team management, and marriage attitude), social network (including social support network, occupation network, achievement network). Social network can be divided into individual-center network and group-gather whole network.

There are two points included in factors of individual and society

(1) Individual factor: this factor mainly means to collect the information of interviewee for later research, including gender, age, educated, sport event, injuries, and marriage attitude. These information is of great value of research. For example, the events that athletes take part in are keys to the research; different events may bring different influences on athletes. So events should be listed as important information of interviewee.
(2) Society factors: it mainly includes athletes' understanding of organization and management of the training team, investigation of players' salary and their attitudes toward their salary.

Social network is made up of three subnetworks: social support network, occupation network, and achievement network. This thesis references the existing results of social network and the research on migrant workers' social network of Institute of population and development Xian Jiaotong University. Different methods are applied to make sure the edge of individual-center network and whole network in investigation for adapting the requiring of this research.

Individual-center network

In this survey, individual-center network including two aspects following:

A. Social support network: three questions are included in this part; questions are in accordance with Vanderpoel's standard style, mean to start from athletes' requirements to investigate athletes' emotional support network, practical support network, and social interaction support network. Each subnetwork needs a question to describe to help one to get help and interpersonal relation.
B. Occupation network: this is the most important in this survey, six questions are included. First, we need to get knowledge of interpersonal network structure which can offer help to re-employment of retired athletes. For example, we can ask "who can help you with your re-employment after retirement and how many people may offer help?" or we may make a further investigation of them who will offer help including their names, gender, occupation, position, or the relationship between them. We can even ask interviewee to sort by possibility. But there may be a gap between possibility and willingness of employment, as interviewee have not been employed yet when they are interviewed, so more detailed information should be offered such as "what job may you get by their help" or "what is your most desired careers in the future".

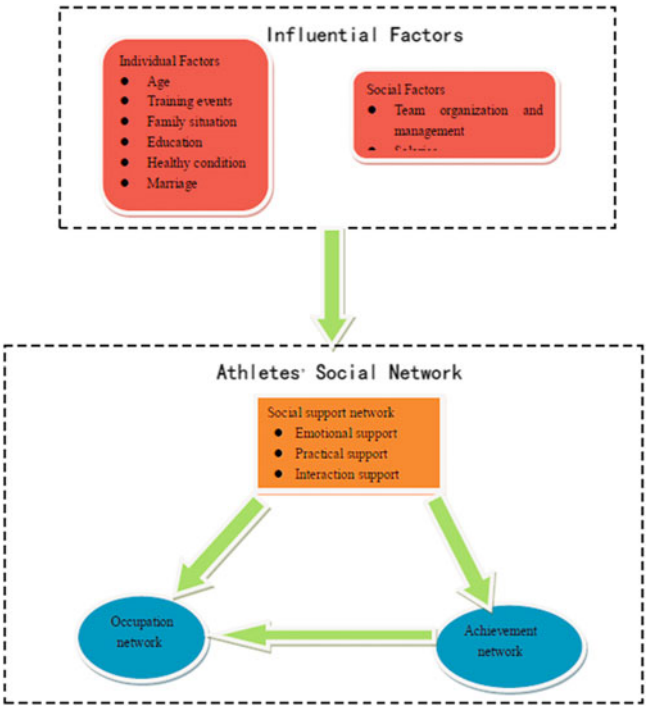


**Fig. 37.2** Analytical framework of the influence of complex social network on athletes

C. Achievement network: four questions are included. Performance is an important evaluation of horizontal standard of athletes. This part starts with athletes' best performance and understands the social support network behind this performance, and then gets more information about how athletes seek help.

Whole network: group-gather whole network is made up of a specific group of individuals and their relationships but in the survey, whole network is made up of every interviewee. Author encodes all members in the complex to form a whole network boundary, asks every member to make sure who are related to them in the network and answer whether their mates may offer emotional support, practical support, and social interaction support or not, knows their degree of intimacy, time of understanding, and frequency of contact. Author can get such information by the following chart.

### *37.3.3 Establishment of Analytical Framework*

First, we investigate the influence of athletes' network by considering individual factors and social factors as independent variable.

Then, on the basis of the first one, we should concentrate on dependent variable-occupation network and achievement network to explore the influence of social support network on these two networks and how will they influence each other.

So it is vividly showed how to establish analytical framework of the influence of complex social network on athletes as Fig. 37.2.

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# Part V
# Sustainable Education Management

# Chapter 38
# Study of Stick Figures Teaching Skills for English Major Students

**Wei Min**

**Abstract** In this paper, I discuss on the standing role and challenges offering Stick Figures teaching skill to Teaching English major students, it can be a reference on whether we should offer the course, which I believe is beneficial to future teacher's own professional development. This thesis includes four parts: in the first part I simply discuss the definition, the Stick Figures' own attributes and features. The second part talks about the necessity and significance of offering Stick Figures teaching application skills, which includes current survey on the majority teaching education courses, and the significance, in third part, it talks about the challenges of offering Stick Figures teaching skills. I demonstrate my opinions from the following aspects: challenges from both of rural and urban students; challenges from the teachers aspects and from the university support; and the challenges from the application in English teaching. In the last part, I stress the possible problems, for instants, students' participation, teachers' evaluation, materials, teaching methods, teachers' training.

**Keywords** Stick Figures · Teaching · Challenges · Teaching skills · Improvement

## 38.1 Introduction

Stick Figures are widely accepted by many teachers, which are widely used in many subjects, such as writing, oral English, integrated English, and grammar. Stick Figures meet the demands of the English reform, for it adds fun, interest, and new technique to teaching methods, making an enjoyable and stimulating

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classroom. Especially, in recent years, with the development of quality education, Stick Figures have been brought into teaching attention [1].

Numerous educators think high of Stick Figures and hold optimistic attitude toward the use of Stick Figures in real teaching. So they usually attached their attention to the application of Stick Figures in classrooms and a lot of research work has succeeded.

Our research found that there were about 56 papers related to the use of Stick Figures in classroom, most of which focus on how to apply Stick Figures to teaching and 10 of which discuss the importance of Stick Figures in English teaching. We also found that about 10 papers talked about the importance of teaching Stick Figures for students majoring in education, one of which was about the necessity of teaching Stick Figures for English majors, and none of which talked about the difficulties and challenges in teaching Stick Figures for English majors at colleges.

This thesis, based on a brand-new view, discusses the challenges in offering Stick Pictures courses to English majors specialized in English education. The aim is to make the educators realize there are difficulties from students, teachers, colleges when offering this course, advocating to solve all the potential problems and improve the learning conditions, which encourage learners to pick up Stick Pictures teaching skills and use it guide English teaching in future. Also, it advocate Stick Pictures to gain more space to grow and then better serve future teachers' own professional development.

## 38.2 Stick Figures' Own Attributes and Features

Stick Figures, also called simple drawing, used the stick-like lines to form the image, expressing characters, etc. All the pictures have been simplified, and these pictures vivid animals, still life or landscape in the form of pictures. In teaching, Stick Figures is different from general painting, in contrast, without complicated preparation and steps, Stick Figures may give all kind of images with the help of simple lines and simple structures. The simple way of drawing makes it easy to learn and to practice. Rich information and concepts will be well expressed in the Stick Figures, the simplest drawing. Hence, in primary and secondary school, Stick Figures are applicable to all stages, and almost all aspect of classroom teaching.

The Stick Figures has its own unique features for the used tools. The features are intuitive, iconicity, and funny. Flexible using of Stick Pictures in teaching is not only conducive to the students' understanding and memorizing, but also can add fun and imagination to the classroom teaching, so that students can learn English in the pleasant atmosphere. Stick Pictures teaching offers vivid explanation to children without vocal explanation, but with the strong sense of art, improving their memory and imagination. It also allows learners to learn in different ways in accordance with their needs and interests. Consequently, both their sense of achievement and motivation are greatly promoted. The classroom is filled

with fun, imagination, and creativity, encouraging students to understand and apply what they have learnt to practice with pressure.

## 38.3 The Necessity and Significance of Offering Stick Figures Teaching Skills

### *38.3.1 Current Survey of the Stick Figures Teaching at Colleges*

For a teacher, with extensive condition knowledge, full set of education and teaching skills, and having the knowledge on laws of modern education, are not only the requirements in a new era, but also the special requirements of education target.

It is clear well known that the typical characteristic of high-quality teachers is the excellent educational performance, teaching skills structure as key component of teachers' quality, played a key role in successful teaching.

In primary and secondary schools, many English teachers have taken the Stick Figures into the classroom. And in some universities, Stick Figures teaching skills course is set up for English Teaching major students, but do not receive expected results. At the same time, there are many education researches on Stick Figures, and many research thesis concerning Stick Figures have been published, most of them mentioned about the applications of Stick Figures in English teaching, some talk about how to learn Stick Figures, some call for offering Stick Figures teaching skills for English Teaching major students, etc. All the views and suggestions, which shows more and more educators are realize the importance of Stick Figures, are good for teachers' professional growth. But the question is most of the researches are not used in practical teaching.

### *38.3.2 The Necessity and Significance of Offering Stick Figures Teaching Skills*

Firstly, Stick Figures give free rein to teachers' creation, and encourage students to participate and practice active, to bring about a great advance in teachers' quality improvement. Stick Figures apply to different teaching technique. Students have experiences on four major aspects in learning: To accept the knowledge, form skills, acquire amenities, and then master methods. In essence, for students learning knowledge is actually a series of information to absorbing, the absorption process experiences perception–understanding–transformation–consolidation processes. Stick Figures is a helpful teaching aids that enable the complex content to be easier, organized, and combine is the old and new concept perfectly. When

considering Stick Figures Skills as teaching tool, teachers will effectively attract students' attention while promoting their owe teaching quality.

Second, the Stick Figures proposed different learning needs for obviously diverse people with different learning needs. In the classroom, students receive knowledge and information through two major channels: auditory and visual.

Stick Figures optimize classroom teaching which reduces the burden on students, is the key action to improve education and teaching quality comprehensively. Students who are with different cognitive structure and different ability levels can improve their learning through stratified guidance. Stick Figures concentrate on Students' development as basic work, pay attention to joint students' all-round development and personality differences in unity.

Third, Stick Figures promoting interest and hindering the restrain.

Stick Figures skills play an important role in promoting interest and hindering the restrain. Learning can achieve its expecting aim based on Stick Figures. Interest is the driving force behind study; efficiency is closely related to interest, but students are easy to lose interests to learning and often feel tired in class. Stick Figures focus on changing teaching methods to create relaxed and cheerful class atmosphere so as to stimulate and foster the students' interest in learning, and get them to learn happily instead of dully. On the contrary, if the students lost their interest, learning will become a heavy burden.

Fourth, Stick Figures foster the idea of quality education.

The Stick Figures proposed different treatments for obviously diverse people with different learning needs. At the same time, Stick Figures seemed to foster the idea of quality education. Quality education pays high attention to cultivate learners' attitude, ability, with vivid, lively, active development as basic characteristics of education. Student-centered is the requirements of quality education, which advocates students to be active development. While teachers aim at having live and scenarios classroom, Stick Figures can be taken into consideration, and that will do create an approximate authentic environment which enable students to have strong interest and passion to study and take the initiative to discover and create.

## 38.4 The Challenges in Offering Stick Figures Teaching Skills

As offering Stick Figures Teaching Skills, we will meet a lot of possible challenges from many aspects, including from the students, teachers, colleges, etc.

### *38.4.1 The Challenges from Students*

Because students come from different places, they have different culture background, value style, as well as experiences, that will greatly affect their attitude and reflection

when learning Stick Pictures: At first, they will show different levels in acquiring Stick Pictures knowledge's, and ask for the teacher equipped with high or low drawing, teaching abilities; second, different art basic skills will make students perform in different learning abilities, and students will active or passive participate to Stick Pictures teaching class; at last, different students need different teaching model according to learning needs and abilities. All of the students factors are challenge, which will make the Stick Pictures teaching course can only adapt to parts of students, do not meet the needs of other students.

#### 38.4.1.1 Students from the Rural Areas

When it comes to Stick Figures teaching skills, students from rural places will show three kinds of attitude, including positive, negative, and neutral.

Those who hold positive attitude to offering Stick Figures teaching will actively participate in the classes and they will have strong interest, because in rural area, it is most practical to apply multi-media in English teaching with the reason of lack of equipment and found, what they have learned in the Stick Figures teaching class will effectively help their teaching in the future. Stick Figures is not limited by material condition, it is very helpful especially in rural area where electric teaching-media has shortage. On the one place, in learning, they will take initiative to plan and organize their own learning, have a clear sense of purpose and learning aim, and have an active mild to identify and explore problems, which lead to solid knowledge acquisition and creative use of knowledge. Definitely, they will participate to the class actively; complete the learning tasks with positive thinking in time. They are enthusiastic to take Stick Pictures teaching skills. Meanwhile, on their spare time, they will spend more time to create and practice, do research and try great effort to form their learning method with the sense to combine Stick Pictures with English teaching. On the second place, they hold a view that learning Stick Figures teaching skills is meaningful and are of great value for future teaching. When encountering difficulties, resistance or frustration in learning, they will show perseverance and active attitude to cope with them. Consequently, these Stick Pictures lovers students will be active learners, take initiate to participate to the practice and combine Stick Pictures to real English teaching, and will make great program.

Some students will hold negative opinion and attitude toward Stick Figures teaching skills: learning Stick Figures teaching skills are hard task: they lack of basic painting skills, and they do not believe they can learn it well, or even it will waste their valuable time. They need more time and more practice after class time, the growth and learning experience make them become the habited of dislike art education. What is more, although learning is no problem, how to apply it to real teaching is another task.

#### 38.4.1.2 Students from the Urban Places

Urban students will act with likes or dislikes to Stick Figures teaching skills. Students who like Stick Figures teaching skills have their own reasons. To begin with, they have some basic painting skills, maybe when they were primary or middle school students, teachers laid stress on basic painting training, so they have gained and trained with basic painting skills. What is more, Stick Figures are very simple drawing which are formed with some simple lines and geometric figures, it is easy to learn. At last, the growth experience and environment make them accept newly emerging things, which is included Stick Figures teaching skills. They have a strong sense of all round development, and it is hard to say that Stick Figures will one day help teaching in future. It is a little bill to pay and not bad to gain another teaching skill, so they love to learn.

Urban students who dislike Stick Figures teaching skills will lose interest in the classes and believe that they have no grounds for learning. Nowadays, with the social development and progress of science and technology, computer, multi-media, and other modern educational technology is increasingly being applied to the field of teaching, and that will affect teaching methods and strategy choosing, as a consequent, professional teacher have a close relationship with modern educational technology. For learning, teaching media is the teaching resource who has directly, most obviously effect on learning process and result. Teaching efficiency increases as the development of modern teaching technique, and Teaching English major students receive computer science and technique education, in the future they will not only simply use mix-media, some can even produce audio-visual materials, teaching will not use chalk, why they learn Stick Figures? It is useless. As a consequence they have no interest in it and have no reason to participate.

Urban students have more strong character, they have opposed attitudes in learning Stick Figures teaching skills, which will result in an unharmonious phenomenon: they will show opposing extremes. The ones who consider Stick Figures teaching skills are worth learning will have high passion to learn and will get excellence achievement: The ones who dislike it will absent from class and get nothing.

### *38.4.2 Challenges from Teachers*

#### 38.4.2.1 Most Teachers have Not System Received Stick Figures Art Education

As most teachers did not systematically learn the Stick Figures art, and it is hard for them to use Stick Figures for teaching, or have the concept and awareness to use Stick Figures. In addition to the following factors: there are too much class so teachers are busy with daily teaching work; in the real teaching complete teaching

tasks is the first job, and the time is not allowed to use Stick Figures, the heavy teaching tasks take all the class time. As a result, teachers have no practice and of course they have no Stick Figures teaching skills.

#### 38.4.2.2 Teachers have Not Formed the Stick Figures Concepts and Awareness

To begin with, teachers are always busy with daily teaching work, and in the real teaching activities the teaching task is very heavy, these are some of the reasons that they have no time to learn and practice Stick Figures teaching skills, so they will not shape the awareness. Moreover, it is very difficult for teachers to do education research. Comparing with other disciplines, educational research work is a long-term activity which have to pay a lot of time, energy, and intelligent. To carry out educational research, it requires the teacher to go in for teaching activities under the guidance of educational theory, so that teachers need to put pressure on themselves. It is a heavy work that teachers need to study education and related disciplines theory, accumulate system, and collect information.

#### 38.4.2.3 There is No System Stick Figures Teaching Methods

In the teaching, teachers can not form the Stick Figures teaching skills concept, and accordingly teachers cannot accumulate the experience.

Teaching is the practical activity that has a definite purpose, teachers need to take a series of measures to complete teaching task, and achieve teaching aim. For learning, teaching method is the teaching resource which has directly, most obviously effect on learning process and result.

Teaching method is one of the external conditions that can affect learning quality. Teaching method refers to basic method, specific method, and teaching style, it includes two aspects: Teaching method and learning method. It is no doubt that teaching methods have unique function and significant impact on teaching development, it is the key factor which decide whether teachers can complete teaching task, achieve teaching aim, improve teaching quality In teaching, when teaching aim, task and content are decoded, choosing appropriate teaching methods can be the first mission. The teaching methods are not only having impact on students' learning knowledge and skills, but also the development of intelligence and personality. If the teaching methods are not scientific, students will lay behind. Students' learning depends on teachers' teaching methods, so teaching methods have great impact on students' learning, so teaching methods should be practical and operational. Stick Figures Teaching Skills is a new course, we have no written system scientific teaching methods. Therefore, we do not know the above approaches are scientific or not.

### *38.4.3 Challenges from College Support*

#### 38.4.3.1 There are Neither Stick Figures Teaching Sills Teaching Outline Nor Specific Stick Figures Teaching Skills Course

By the survey of majority of Teaching English major students' courses and education, it is found that: the existing system of Teaching English major teaching outlines covering writing, listening, speaking, reading, etc. but not including drawing skills. And the education courses which includes teaching skills are not contained Stick Figures Skills course, but with a heavy emphasis on lesson planning, curriculum, and objectives. Future teachers' imperfect skills system is will directly have impact on the cultivation of emotional education, the same to the improvement of education capabilities. As a result, it is difficult to set the Stick Figures Teaching Skills study level, not to speak to train students how to use Stick Figures Teaching Skills in teaching, and without doubt most students do not have such teaching skills.

#### 38.4.3.2 There are No Special Stick Figures Materials

For teaching, materials are the main fundamental media, and the knowledge carrier that can help teacher a lot. The so-called teaching materials include textbook, supplementary material, teacher's guide, and curriculum packages. To a great extent, the textbook decides teaching task that would be the key resource for teacher's teaching and students' learning. Teacher's guide is the helpful teaching tool for teachers, teacher development as curriculum development. Teaching materials are the media which is for students to communicate and integrate. Through teaching activities, good material which is effective used of it will greatly make students have development.

Teaching materials are an important factor in education. In lesson planning teachers need to correctly understand, research material. Moreover, in performing teaching, teachers have to master, flexibility use material.

For other subjects, there are several authorities teaching materials both for teacher and student. On the one hand, students are provided with excellent materials and resources; on the other hand, teacher have already researched and understood what students' material acceptability is. But for Stick Figures teaching, there is no authority course book, teachers have no scientific theory to guide them to consider how the material might be used in class, and it will also sequence the activities. So that, teacher dose not know how to use and analysis, that is a great challenge.

#### 38.4.3.3 The Colleges Do Not Attach Importance to Stick Figures Teaching Skills

Colleges lack of related Stick Figures teaching research institution, and do not provide related education research conditions, lead teachers to engage in education research. The growth of many outstanding teachers shows that the teachers who active involve in teaching and research work benefit a lot through the exploration, they equip with well-established teaching methods, corresponding experience, enhance teaching effectiveness greatly, and even created new teaching concept and methods. The new curriculum education research need teachers explore by themselves. As a result, teaching standards will stand in the original place, and make no program without the support from college.

## 38.5 Conclusion

Teacher education is the starting point of teachers' professional development, as well as the initialization phase that future teachers acquire professional knowledge and skills. We can attach high importance to Stick Figures teaching skills learning in that English Teaching major students will benefit in their future teaching and professional growth, it is expatiated to encourage future English teachers to conduct teaching, and effectively guide teaching, and as a result they can improve the adaptability and know how to deal with practical issues when teaching as we as to promote students all-round development. Training students equip of multi-skill, qualified, and special skills, is completely in-line with education policy.

It is necessary and important to offer Stick Figures teaching skills for English Teaching major students. However, it is a new course, as we can conclude from the above factors that if we offer Stick Figures teaching skills, we will also meet a lot of challenges from many aspects. For example, we have challenges from different levels of students who come from rural place and urban; lack of professional teachers, excellent course theory, teaching skills training; most importantly, we can not get attentions and supports from the colleges, etc. We should consider all the disadvantages and problems and make a scientific evaluation on whether it is worth offering Stick Figures teaching course. After there are ways of solving all the possible problems, and all the conditions are improved, Stick Figures teaching skills has scientific research, scientific theory guide; and related teaching model, management are built, then we can offering Stick Figures teaching course to Teaching English major students, let it better serve students.

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# Chapter 39
# Reform of College Advertising Teaching

**Ying Guo**

**Abstract** The advertising industry has been one of China's most important industries for decades. Advertising higher education has offered a strong supporting on the development of the Chinese advertising industry through providing the qualified workforce needs. Through reviewing and analysis the brief history and current major changes of China's college advertising teaching, the research indicated that the China's college advertising teaching has. Reformed and developed responding to social and economic development needs; on the other hand, the relationship between college advertising teaching and advertising industry is interactive.

**Keywords** College advertising teaching · Reform · Curriculum

## 39.1 Introduction

The advertising industry, which is currently one of the most globalized industries in terms of production, distribution, and consumption, has played important role in the development of economy and society in China for decades [1]. The college advertising teaching, born in early 1980s, has laid a solid foundation for China's advertising manufacturing industry [2].

During the past two decades, China's college advertising teaching has experienced significant transformations to accommodate the development of society and economy [3]. In a new century, the fast increasing of higher education, the

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application of high technology and China's increasing participation in global economy has speeded up the development of advertising industry and education of advertising majors in China [4]. However, the challenges of new society and problems of employability have been critical. Some of the problems have been predicted and identified by many researchers [5].

New challenges and problems have urged the further reform in college advertising teaching. One purpose of this paper is to analyze the current changes in college advertising teaching during the past two decades [6]. Another purpose is to identify the new challenges and problems met in terms of globalization, mass higher education, and higher technological revolution, and to explore the areas emergent to reform. The paper was organized into the following three themes with regard to China's T&C higher education: brief history, reform and development, new challenges and further reform needed [7].

## 39.2 Reform and Development

Since the implementation of nationwide reform of higher education in late 1990s, the college advertising teaching has made significant development.

### *39.2.1 Advertising Specialty Adjustment*

To solve problems existed in former higher education such as meticulous division of majors and extremely narrowed specialty ranges, the new round of reservation of undergraduate specialty catalogue has taken charge by the Ministry of Education, began in 1997, completed and issued in July of 1998, with the total number of specialties reduced from 504 to 249 [8]. In accordance to the adjustment of specialty adjustment, fashion/advertising design was transferred from a single structural specialty to a specialty orientation of the art design specialty, with clear guiding ideal to strengthen basic, dilute the professional, expand knowledge, and to train personnel with integrated high quality. The current advertising related programs, according to 1998 undergraduate discipline catalogue, are listed in Table 39.1. From Table 39.1, there are three advertising related area, which belong to three specialty, in current college advertising teaching system: fashion/advertising design and engineering, a specialty within category of light industry, awarded with bachelor degree of engineering or literature; fashion/advertising design, a specialty orientation of art design specialty, within category of arts; fashion performing and design/marketing, a specialty orientation of art design specialty, within category of arts.

**Table 39.1** Current undergraduate specialties catalogues of advertising programs in china

| Discipline categories | Categories | Specialties/orientation |
|---|---|---|
| Engineering science | Light industry | Advertising design and engineering (note: bachelor degree of engineering or literature can be awarded) |
| Literature | Arts | Art design (Fashion design); Art design (Fashion show fashion design) |

### *39.2.2 Reform of Teaching Contents and Curriculum in Advertising Programs*

During the period of 1980s and 1990s, that is, the early stage of development of college advertising teaching, as an emerging specialty, advertising programs have had problems of low qualification teachers, school education and industrial development out of line, irrational course structure, outdated teaching contents, and so on. At that time, students major in advertising design, who usually focused on creative design but neglected product design, were highly skilled in fashion drawing but quite weak in advertising technology; on the other hand, students major in advertising design and engineering, who usually focused on theoretical learning but neglected practice, were poor at practical ability, hardly to adapt to clothing industry rapidly. In response to these problems, higher education institutes with advertising programs launched reform of teaching in succession, and the situation was significantly changed.

First, through in-service training, offering in-service degree education, selecting teachers to go aboard for advanced studies and carrying out cooperative research, the knowledge structure of teachers has been adjusted. Many young teachers with Ph.D. and masters awarded by institution abroad or at home, have been replenished, and the degree structure of teachers has been improved.

Second, in the light of diversity training objectives, a new curriculum structure of "platform + module" have been adopted (see Fig. 39.1). The platform curriculum, which is designed in the light of discipline feature and common development needs of students, consists of public basic courses (namely general education courses), basic courses of curriculum consists of a set of module courses

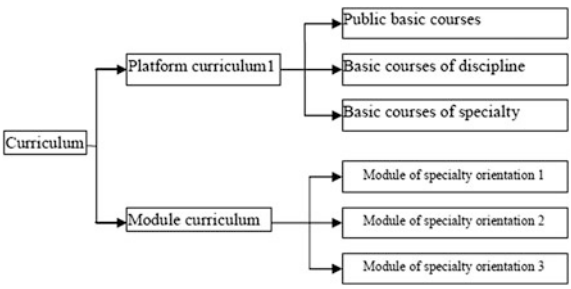


**Fig. 39.1** Curriculum structure of "platform + module"

of specialty orientation, which is designed in the light of occupational characteristics and individual requirements of personnel training. For instance, according to 2010 curriculum at Zhejiang SCI-TECH University, four modules of specialty orientation, including men's wear design, shoe and bag design, knit wear design, and high fashion design, are involved in art design (fashion design) specialty; on the other hand, three modules of specialty orientation, including advertising technology and management, fashion merchandizing, and advertising international trade, are involved in advertising design and engineering specialty.

Third, through integrating new technology and new knowledge into curriculum, the relatively advanced teaching contents have been shaped. With rapid progress in information technology, the computer skills have been required for qualified personnel, and new courses concerned with computer aided design. Manufacturing management has been involved in curriculum of advertising program. In recent years, China garment industry has shifted from traditional production-based to brand-based, which requires graduates to have some sense of the market and brand awareness. Adapting to this, fashion marketing and merchandizing courses were introduced to teaching area of advertising. By boosting combination of engineering, art design, economy and management, advertising program becomes multi-interdisciplinary.

### *39.2.3 Development of International Cooperation and Exchanges*

Since the accession to the WTO, China's increasing participation in global economy and world affairs has speeded up the globalization of clothing industry, which impact on the strong demand of local clothing professionals with international competitiveness for clothing industry, pushing the international cooperation and exchanges of advertising higher education to become more and more active in China. Various forms of international cooperation and exchanges emerge, including: Educational institutions of international cooperation, for instance, Raffles design institute, Shanghai, which is an international design institute cooperated by Donghua University and Raffles design cooperation of Singapore; Educational projects of international cooperation, for instance, Donghua University and Bunka Fashion College of Japan in cooperation with the fashion design project for undergraduate education, Zhejiang SCI-TECH University and New York State University Fashion Institute of Technology in cooperation with the fashion design project/advertising design and engineering project for undergraduate education. Other forms, such as one-year or two-year exchange project, international exchange course regularly taught by foreign professors, Overseas visits and exchanges, etc.

In recent years, China's fashion institute and department, focusing on training excellent local talent with international version, have learned and introduced international advanced education concepts and methods through international cooperation and exchanges, prompting the internationalization and development of college advertising teaching.

## 39.3 Current Challenge and Further Reform Needed

In response to the emergency of mass higher education, the influence of globalization, the advance of economic and clothing industry, there are current challenges and problems that the restructured and transformed Chinese clothing higher education are striving to meet or overcome, which will be discussed below.

### *39.3.1 Challenges of Globalization*

The process of globalization is making higher education more important than ever before, and the neglect of this sector seriously threatens development. Globalization exerts new pressures on college advertising teaching, making reform essential [9]. In the era of globalization, the college advertising teaching system should be adjusted to satisfy both the requirements of the global labor market and domestic social and economic needs. With globalization, the industry has more considerable impact on the global economy. Accordingly, advertising education should encourage comprehensive understanding of the global market as a site for production, sourcing, marketing, and consumption.

In a global environment and knowledge-based society, today's world requires problem-solving skills and flexibility to match the fast-changing world. College advertising teaching institutions must teach their students not only what is known now, but also how to keep their knowledge up to date. Accordingly, the creativity education accompanying with lifelong learning ideals should be focused instead of rote learning supported by memory.

Globalization makes opportunity for people to burrow out of the confines of their own institutions and link up with others to solve problems, through cross-institutional and cross-border networks. College advertising teaching systems should grab hold of the opportunities offered by global integration through further international cooperation and exchanges.

### *39.3.2 Challenges of Employability*

The second major challenge comes from the development of mass higher education in China. Since 1999, China has expanded its higher education at a remarkable speed, the college enrollment of new students and number of students at school is more doubled than those in previous years. The same thing has happened in the sector of advertising majors, resulting in poorer levels of education among the students admitted. Increased numbers of students, a shortage of well-fitted professional teachers, the lack of teaching resources, and inadequate instruction in larger classes are likely to bring about poor results, consequently affecting the competitiveness of graduates in the job market.

Since rapid progress in China advertising industry, the scale of advertising industry, including number of employees, output value and foreign exchange earned through export has been increased quickly resulting in strong demand of well-trained professional talent. However the employability problem, which is attributed to a lack of labor market intelligence and knowledge gaps between higher education institutions/graduates and regional employers, has been a critical challenge for current advertising higher education. In terms of the problem of labor market matching, the advertising educator should keep in mind the mission of producing graduates who have the right skills and competencies to match employer needs and improve education quality through further comprehensive reform challenge of information technology revolution.

The third major challenge comes from the development of information technology. In recent years, since the advertising industry is being revolutionized by information technology. The use of this technology exists in all phases of the soft goods chain-from design through production to distribution and retailing. Accordingly, colleges' education future advertising talents must prepare their graduates to work not only in a creative capacity, but also in a technologically sophisticated workplace.

Current computer use in advertising program in higher education is increasing. Students receive computer instruction through general education curricula and professional curricula. But the discrepancy exists between industry and the educational institutions that train students. In order to keep abreast with an increasingly computerized advertising industry, curriculum should be updated, shifting from traditional course to new course with further computer application, for instance, computer technology applications to advertising design, pattern making, marking and grading; computer-aided experimental learning for visual merchandizing: using AutoCAD for retail store planning, layout, and design.

### *39.3.3 Curricula Updating and Diversification*

In terms of globalization and employability, curriculum reform is widely recognized as being necessary to ensure higher education institutions to produce graduates capable of participating and competing in the emerging global society.

The curricula uphold the mission foci through appropriate courses offerings that address segments of the textile-advertising-retail pipeline [10]. The current textile-advertising-retail pipeline is the long and complex global supply chain which encompasses all of the production activities of the textile-advertising complex as well as the functions of distribution and retail operations to the end users/consumers (Fig. 39.2). In light of strong demand of professionals with high quality in various segments of industry, the curriculum ought to encompass the segments of textile-advertising-retail pipeline, addressing the areas of advertising design, advertising production, fashion merchandizing, business management and marketing. Table 39.2 lists the current advertising related programs in USA in

accordance with the latest Classification of Instructional Programs (CIP 2000), which show the diversity of the programs encompassing segments of the entire advertising chain. According to statistics, the undergraduates who are enrolled in fashion merchandizing are much more than in any other specialization within adverting design, moreover fashion merchandizing is the largest major at various institutes.

However, since for a long period, the china advertising industry have focused on manufacturing, corresponding, China's college advertising teaching emphasized the upper-stream activities of the textile-advertising supply chain, such as advertising design and manufacturing, but neglected the downstream activities like marketing, retailing, and consumer research. According to four scholars' investigation, there is not a clear academic identity in regard to fashion merchandizing programs in China.

Therefore, fashion merchandizing major/specialty should be constructed and merchandizing, marketing and global resourcing education should be strengthen, through introduction of fashion merchandizing curriculum from advanced countries of advertising higher education and in-depth reform continually.

### *39.3.4 Seamless Linkage of Knowledge*

In the past, each segment in the textile-advertising-retail complex operated more or less separately, producing intermediate products for the next stage of the production chain. Corresponding to the higher education of different major and specialization also shows dependent on their knowledge, lacking of interlink. For instance, the curriculum of fashion design neglects the knowledge of clothing manufacturing process, and the curriculum of advertising design and engineering tends to be too technical and product-oriented in lack of sourcing, marketing, and consumption education.

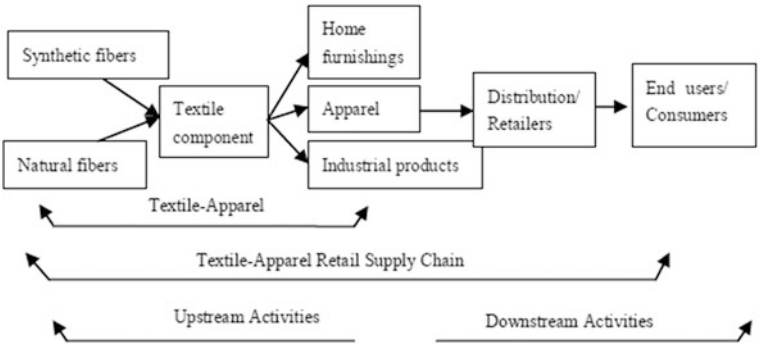


**Fig. 39.2** Comprehensive textile-advertising-retail pipeline

**Table 39.2** Current undergraduate specialty catalogue of advertising programs in use

| Discipline categories | Categories | Specialties/orientation |
|---|---|---|
| Family and consumer sciences | Advertising | Advertising |
| Business, management, marketing, and related support services | Specialized sales, merchandizing and marketing operations | Fashion merchandizing |
| Visual and Performing arts | Design and applied arts | Fashion/Advertising design |

The updating clothing industry and the development of increasing integrated industry chain proposed new requirements on graduates. To solve problems faced in real world requires the graduates equipped with complete knowledge structure. It means seamless linkage of knowledge in advertising education of different majors should be constructed through offering a general knowledge of advertising area for all different advertising majors to understand each other and communicate efficiently which is very important in vocation. On the other hand, professional education should be concentrated to help graduates to meet employment qualification.

## 39.4 Conclusions

In twenty-first century, the college advertising teaching is meeting new challenges and problems in terms of globalization, mass higher education, and higher technological revolution. In order to improve China's advertising industry competitiveness in the global textile-advertising supply chain, and to produce graduates capable of participating and competing in the emerging global society, China college advertising teaching should conduct complicated reform and reconstruction, including further international cooperation and exchanges, further computer application in curriculum, strengthening merchandizing, marketing and global resourcing education, curricula updating and diversification, and seamless linkage of knowledge of different major and specialization.

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# Chapter 40
# Curriculum Development of Comprehensive Training in Import and Export Business in Higher Vocational College

**Yuying Zhu**

**Abstract** Comprehensive Training in Import and Export Business is an operating practice curriculum for students in International Trade Major, which includes extensive professional knowledge, multifarious contents and is teaching demand. Develop and construct the curriculum by aiming at Comprehensive Training in Import and Export Business, discussing the course arrangement and organizing implementation of comprehensive training from thinking and practice two aspects. Introduce the foreign trade business environment into school and innovate the mode of "teaching-business".

**Keywords** Training course · Curriculum development · Curriculum construction · Teaching practice

## 40.1 The Necessity of Offering the Course

Vocational technical education is different from the general education, of which the goal is to train high technology applicative talents that meet the demands of front-line production and service, making students master the skills required in practical work at school and achieving a seamless link without gap between school capacity-building and capacity that required by the employers [1, 2].

International trade is a major strong practicality. It is difficult for students to understand and master the professional content rely solely on classroom teaching, which requires students in relevant specialties to be trained by system operation on

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the transaction procedures of various trade modes [3], customary closing conditions, and form of settlement after completing the main professional courses. But most colleges and universities cannot provide such systematic training for students in the major of international trade. There are mainly two reasons in the following.

### *40.1.1 As May Involve Trade Secrets*

Student internships cannot bring benefits to the enterprise and other reasons, the general foreign trade enterprises do not welcome students to practice, resulting students in the major of international trade difficult to practice [4].

### *40.1.2 Even if the Students Practice in Foreign Trade Enterprises, Due to Their Different Nature*

There are some limitations on the types of the foreign trade business. For example, in a foreign trade enterprise of pure trading, it is difficult for them to come into contact with the processing operation, which makes students to only practice in a single trade mode in their internship [5].

In view of solving the above considerations, it is necessary for us to add Comprehensive Training in Import and Export Business course as an additional professional training program to enable students build simulating environment of foreign trade business in school with practicality, applicability and integrity, playing different roles in the foreign trade business, exercising the simulating practice of import and export business operations according to the actual operation of the business process, completing a variety of trade-related business operations after finishing the professional-related courses. Let students on the scene personally face with practical problems and integrate all knowledge of various subjects what they have learned, thus enhancing the comprehensive professional capacity for the upcoming internships and making preparations on social employment.

## 40.2 A Train of Thought on Curriculum Development and Construction

Starting such a comprehensive training courses must meet three conditions [6, 7]: a high degree of simulation of the foreign trade business workplace environment; the declared software by enterprises from relevant government departments; the transaction background conditions that students should know while training; the related operation files such as training guide books.

### 40.2.1 A High Degree of Simulation of the Foreign Trade Business Workplace Environment

Business environment provides adequate conditions to cultivate professional ability only at the actual experience in professional production environment with characteristics of authenticity [8], sophistication and complexity. Can the experience that is difficult to explain in words, response methods and specific professional quality, be formed. To enable students systematically, comprehensively, standardized master all aspects of import and export trade skills and methods of operation, creating a high degree of simulation professional environment of foreign trade business is indispensable.

### 40.2.2 Declared Software that Integrate Every B2G Process

In practical work, there is a process of network declaration (i.e., B2G) by an enterprise through software platforms such as China Electronic Port, etc., to Administration of Exchange Control, the Customs, and other government departments along with different aspects of foreign trade, while such platforms do not open to colleges and universities, can only be used by the real business that licensed and approved by the relevant authorities. In the training process, we also need to cooperate with such a declaration software, and only through such declaration software, can we provide students a business environment with the same practical business operations.

### 40.2.3 Typical Import and Export Operational Projects and the Relevant Working Documents

International trade business is of high specialization, involving a large number of international operating rules and policies changing quickly, if the modes of trade, customary closing conditions, and payment terms are different, the business processes are different with complex operational procedures, various types of complicated documents, a variety of risks and uncertainties. To enable students to have a systematic operation training under various different transaction procedures comprehensively improve their vocational technical skills, approach capability, and social competence, the contents of training must be overall designed.

## 40.3 The Practice of Course Development and Construction

### *40.3.1 Condition Construction of the Comprehensive Training Course*

From the year 2007–2008, International Trade Major at Nanjing Institute of Industry Technology takes the major construction of characteristic of the first national demonstration higher vocational colleges as an opportunity, making system analysis on the capacity that cultured by this course, quality requirements and operating environment, developing standardization construction for the conditions required by the course on this basis.

#### 40.3.1.1 Highly Emulation of the Foreign Trade Business Workplace Environment

An import and export business is often through market research, business negotiation, contract fulfillment, and other operation processes, for this reason, we built an international trade comprehensive training centre of 400 sq.m, which has trade negotiating room, the sample show room, import and export department, general manager's office, and with integrated services of import and export business lobby of nearly 20 departments' stations such as commodity inspection, customs, banks, insurance companies, freight forwarding, shipping companies, and so on. In order to enhance the simulation of training and operability, it is also equipped with the necessary office equipment, workplace environment were arranged carefully, for example, there are office desks and chairs that are used in the office premises, printers used for printing documents, telephone facsimile machine for students while they do business negotiations, sales responsibilities on the corresponding station wall, etc., in import and export department, all these have strengthened the fictionalization of the training environment and the layout of the workplace.

#### 40.3.1.2 Declared Software that Integrates Every B2G Process

The declared software that integrates every B2G process is through more than a year of research and development with the professional software company which can apply for licenses, certificate of origin, and can perform commodity inspection, customs declaration, verification of export earnings, import verification, and tax reimbursement, etc.

#### 40.3.1.3 Typical Import and Export Business Items and Related Working Documents

The key to achieve the objectives of comprehensive training course lies in the great care while compiling the training projects and effective organization. To this end, we transfer the dual-qualified teachers with rich foreign trade experience to form a specialized project development team, tracking typical business operation deeply into the training base unit, and converting it into six representative teaching projects that are practical in schools, and with controllable processes which covering a variety of import and export flows, losing conditions, settlement, regulatory conditions and industry product distribution (three general trade export items, two general trade import items and one processing program). After finishing the compiling, and then expound and prove the working documents such as project content, organization and implementation, and the teacher's tutorial manual, student handbook, project charter, teaching standards of the training course, etc. by team teachers and experts from the foreign trade enterprises to ensure the authenticity of the content, controllability, and ordered training arrangements.

### *40.3.2 Course Arrangement of the Comprehensive Training and Organizing the Implementation*

#### 40.3.2.1 Course Arrangement

This course is arranged in the fifth semester after students finish the professional curriculum and before the internship for 5 weeks.

Conduct two-day training on approach abilities and social skills by business experts at the beginning of the course, and then carry out specific training projects in sequence, about 3.5 days for each project.

#### 40.3.2.2 Organizing the Implementation of Each Training Item of the Course

Each training item is approximately organized and implemented according to the following procedure:

Issuing the assignment—guiding the project implementation—implementing the project—commenting on the program.

**Issuing the Assignment** The instructor of the training program should issue the paper assignment or electronic manuscript in advance through campus network to the training classes no later than one week before training. Familiarize students with the project content and let them early get access to the relevant trade background information ahead of time such as consulting the main markets of the

products, price quotations and restraint of import and export trade, etc.. Get students do cost accounting, prepare, and be aware of the business negotiation while training.

**Guiding the Project Implementation** The advisor of the project should make layout description on grouping, role allocation, implementation requirements, and the necessary precautions while formally implementing the project.

**Implementing the Project** Students should complete the project mandate according to the actual import and export business process by entering into their designated roles in the working position.

**Commenting on the Program** In the project implementation process, the instructor would comment on the completion of the whole project after finishing each training project.

In the period of training, except inviting the experts in practice base unit to train students abilities on interpersonal communication, negotiation and communication, team work and so on, we also arrange for the morning assembly every day, asking students to train with the given work cards and sit in the working position, and require the students act consistently with the role of identity and in proper demeanor and pay attention to the sanitation of office environment, etc., and demand students to switch roles among different projects. In this way, based on grasping the specialized knowledge, let students perceive the operations management of the actual foreign trade enterprises earlier, so as to enhance the vocational and technical ability of students, the methods ability to complete the job and interpersonal and communication skills, good psychological quality to overcome difficulties and setbacks and other social abilities.

By means of simulating foreign trade links, this course has strong simulation and practicality by letting students simulate each step of the actual operation. After nearly two years of preparation and construction, the course of Comprehensive Training in International Business in our college has been put into use for more than 200 students in the major of International Business since the second half of past year. Students participated in the comprehensive training generally reflect: after comprehensive training in our college, there is no panic while encountering the real business problems in the practice unit, and review the comprehensive training program participated, the solution to the problem can be found by considering the practical situation; the enterprises that accepted our internships who received comprehensive training reflect that the internships from our college can get started quickly, with strong adaptability and practical ability, and can quickly finish the specific trade orders independently under the leadership of the master. From the feedback from students and employers point of view, the course of Construction of Comprehensive Training in Import and Export Business in our college has got preliminary achievements.

## 40.4 Several Issues Should Be Noticed in the Curriculum Development and Implementation

This course draws on the teaching and factory pattern of Singapore Nanyang Polytechnic, introduce the foreign trade business environment into school, innovate the "teaching business" mode, and hope to provide certain reference of problems on "the unity of learning and working" in courses of international trade category and even business administration. But the following aspects of problems should be concerned:

To ensure that training is not out of line with actual business operations, project content should be timely amended based on the continuous development of trade modes and adjustment of national trade policies to ensure the timeliness and novelty of the training programs.

The student's evaluation and assessment methods and student performance evaluation criteria should be clearly defined in the teaching documents. In training process, the instructor should completely record the examination of each training session for students.

Due to different roles have different volumes of business, the instructor should make a round consideration, reasonable arrangements and ensure that each student has full training workload.

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# Chapter 41
# Study of Undergraduate Tutorial Teaching System

**Qianqian Yang, Wanqiu Cui, Yan Xiao and Ying Meng**

**Abstract** Undergraduate tutorial teaching system is a new management model for the exploration and practice of higher education. This paper describes the basic methods of the implementation of the undergraduate tutorial system and theoretically analyze the significant functions of undergraduate tutorial system for improving the quality of higher education.

**Keywords** Undergraduate tutorial teaching system · Quality of higher education · Practice · Thinking

## 41.1 Introduction

Tutorial teaching system is a kind of individual guidance provided by tutors to students' study, characters, and other aspects of students' life, in order to make up the lack of teaching and training issues that refer to overall quality and ability of students and complete the personnel training mission of the undergraduate teaching system [1]. Tutorial system has been carried out in most colleges and universities for graduate students while the teacher (counselor) working system for

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undergraduate students for years. With the further development of reform of higher education, undergraduate tutorial system become a new management model for the exploration and practice for many universities in undergraduate education. In order to enhance the relation between teaching and learning and comprehensively promote the professional growth and development of students, tutorial system has been implemented in our college for some undergraduate subjects system since 2005.

## 41.2 Basic Methods for Implementation of Tutorial System for Undergraduate

### *41.2.1 Establish and Improve the Rules and Regulations of Tutorial System, Strengthen the Supervision, and Evaluation for Tutors*

In order to make the implementation of the tutorial system work effectively, we sent several specialized people to some domestic institutions to learn the management experience of tutorial system, and set up two levels of supervisor committee including college and department, and issued a prospectus and relative rules and regulations which includes the qualifications of tutors, the approach of replacement of tutors, the content and form of teacher work and the responsibilities and rights of tutors; Meanwhile, write out a practical regulations, establish a scientific and reasonable assessment of evaluation, and assessment methods in order to evaluate the working of the undergraduate tutors; Second, the implementation of "tutor allowance" which according to the number of students and the working hour to calculate the allowance, and put this into the college general assessment and this factor is slightly higher than the normal undergraduate teaching standards; In addition, establish tutor funds and set up appropriate incentive system, the tutors could be rewarded if students publish papers, get awards in various business topics contests. Finally, the college teaching committee and tutor committee would assess tutors through self-evaluation and evaluation by students in each semester comprehensively assesses the performance of tutors and decides the best tutors. However, for the tutor who fails the assessments, the committee might revoke his or her qualification as a tutor.

### *41.2.2 Implement Two-Ways Choice; Bilaterally Stimulate the Enthusiasm of Teachers and Student*

Tutorial teaching system is different from class teaching, most of the time it is an individual counseling activity, then the role of implementer of tutorial system to

establish reciprocal relationships between teachers and students. In this case, during the implementation of tutorial system, we always consider to build positive interaction mechanism between teachers and student, and implement two-way choice. First of all, establish a centralized file of teacher resources and publish this file through college network to enable students to be publicized through college network and enable students to truly understand the moral character, teaching ability, academic level, field of study and research as well as the specific requirements for students of the tutor candidates, and students can compare and finally choose their tutors online. Meanwhile, the training partner related to the effects of tutorial training model directly, on one hand, let students fully understand the tutors, on the other hand, let tutors know more about students, we require each student to publish their basic information online, including: academic achievement, potential learning ability, hobbies, and levels of English and computer skills, and so on. According to the student's professional interests, learning ability and the teaching ability of instructors, professional research, combine the group of tutor and students by themselves. The same study and research goals and interests between teachers and students must promote and inspire each other and then ensure the tutorial teaching system model to really achieve the goals of personal development of college students and innovation training for them.

### *41.2.3 Implement Division Guidance, Focus on Individual Teaching*

The tutorial system would last for 4 years, and therefore it requires tutors to guide students in different ways according to the life and emotional aspects of students and individual teaching focus, we divide students into two stages, first stage: freshmen and sophomores, they are the ones just entered the university, and would naturally bring the way of thinking from secondary schools into the university; However, after they go though a short period of university life, they would find themselves to face an unfamiliar environment which is completely different from the past. They feel curious and are not accustomed to the casual teaching methods and self-learning model in university because of the compact and tight high school model. Especially, teachers spend much more time to supervise and help students in high school, but in university, quite a few teachers like high school teachers care about every aspect of students study and life. So students need to rely more on their own and independently arrange their own learning activities, so many students do not get used to the university life and feel much more pressure. In this stage, the instructor's main task is to help students establish a correct outlook on life and values, describes the characteristics of university study and life, to enable students to gradually correct attitude toward learning and adapt to higher education means and form good study habits.

Combined professional characteristics, introduce students to academic and professional research, direction and development of the front edge, so that students would understand and clear the development of professional content and direction as soon as possible, appropriate arrange for some initial research activities if possible; In addition, based on their interests and learning structure, guide and help them choose elective courses and choose their specialized direction. Stage two: junior and senior year students. They are already familiar with university life and have clear sense of professional goals and their self-development is relatively strong, but their directions of development would have a degree of difference.

### *41.2.4 Expand the Selection Scope of Tutors, Try to Improve the Effectiveness of Tutorial*

Strengthening the tutor team is a vital link to select a group of tutors with political quality, ability of solving problems, and willingness of strong responsible for students. In the tutorial system, the contact between teachers and students is comprehensive, words and deeds of teachers will have a very important influence to students, and this would put forward to the tutor's academic level, teaching experience and qualities. Therefore, in the beginning of implementation of tutorial system, we need to pay attention to the selection of the team and build a good team of undergraduate tutorial system. We have four aspects to form a professional tutor team to meet the specialized growth and development of undergraduate students. First, choose full-time teachers who have title of associate professor or above, or with a master's degree or above; Second, employ teachers who meet the conditions of employment from political line and management departmental into the tutor team, mainly to enrich the first stage (the first two years in university) tutor team; Third, employ the retired teachers who are healthy, responsible, and have high level works as tutors, and appropriately extend the their duration of employment; Fourth, based on the course and academic characters, employ relative experts outside college, scholars, public celebrities as part-time tutors. Such a team of full-time and part-time tutor group not only satisfy the requirements of the numbers of tutorial system but also can guide the form of diversification of guidance, tutors can learn from other's strong points to offset one's weakness learn from each other, and improve the effectiveness of tutorial.

## 41.3 The Role and Meaning of Undergraduate Tutorial System for Improving the Quality of Education and Teaching

### *41.3.1 Undergraduate Tutorial System Would Help Guiding Students to Adapt University Life*

Undergraduate students are in the stage of individual development of youth transition from the immature to mature, which is an important period for the formation of a scientific outlook of life, values and world view. However, their degree of community is relatively low, development of psychological is unstable, lack of social life experience, self-control ability is relatively weak, and these would influence the student learning and growth in different aspects. After implementation of "tutorial system", the number of students per teacher guide lesser than before, the distance between teachers and students narrower, and teachers have the time and effort to understand students, and students would also like to be close to teachers, this would help students adapt to new life in university. At the same time, the role of tutorial also in improving students willingness of course study, enhance the consciousness of professional development, guide students select course reasonable and so on. Questionnaire shows that there have been obvious differences between the students under professional tutorial system and the students who are not under tutorial in the following aspects including the understanding of course, choice of development goals, choose elective course, professional development planning, and even the degree of confidence in the professional development and other aspects.

### *41.3.2 Tutorial System is Benefit for the Combination of Teaching and Educating*

Currently, the management of college students are usually managed by the teachers appointed by student management department, and teaching working are done by professional teachers, and the management and teaching are noninterference basically. While the tutorial system for undergraduates are a useful supplement for the existing management. Undergraduate tutor work as an educator and administrators in a dual way, introduce teaching programs to students and curriculum system, make the use of the advantages of the professional position to guide students to choose courses scientifically, under the condition that understand students' strengths, expertise and practical ability, train, and help students take individual development. Meanwhile, tutors could share their years of working experience and learning experiences with students, in conjunction with their study areas, provide all the necessary information and counseling, combined with the

daily education management, help students avoid detours and then get healthy growth. We can see that the implementation of tutorial system can integrate guide teacher's management duties and professional teaching, change the management from "control" to "guide" which not only mobilize the enthusiasm of students, but also enable students to plan their professional development reasonable, and eventually reduce the pressure of student management effectively.

### *41.3.3 Undergraduate Tutorial System Helps Students to Enhance Their Overall Quality*

Under the tutorial system, tutors guide the students the whole process from their enrollment to employment, and adjust training program at any time according to the changes of the actual situation and different types of characters of students, choose different learning program, implement the principles of individualized teaching, combine the general guidance with individual coaching, to maximize the potential of students, and then improve and develop students various ability and quality.

After the implementation of the tutorial system, students would have the opportunity to participate in research projects and topics directly, but it is not enough to complete these tasks just by the knowledge and skills from class learning, it requires students to follow the guidance from tutors to study relative knowledge by themselves, training the ability of practice, and if the students study with questions, they would have clear target, strong interests independence and their self-learning ability would be significantly improved. Participation in research activities, students have learned to apply knowledge and innovative thinking to solve problems in scientific research. It not only help the intellectual development of students through research activities, but also more importantly contributes to the nonintellectual factors development of students. Under the influence of the spirit of exploration of the influence of tutors and the logical training, students could complete the preparation of basic quality of scientific research earlier, This would help training students' scientific spirits of exploration and the courage to forge ahead; Through unity and cooperation to solve practical problems during the research, which is good for the research interests for training students, and let them experience the fun of creation, thus stimulate the noble emotions of advocate science and the pursuit of truth and help to train students in teamwork.

### *41.3.4 Tutorial System has Promoted Teaching and Learning Effectively*

As one of innovational individual training models, the activities of undergraduate tutorial is in form of interactive and teaching would be effectively promoted with exchanging ideas and enlightenment. Students could choose tutors independently, and they have the right that do not choose the tutor who has not enough theories background, no scientific research, irresponsible to students and with low quality of teaching skills. This would force the teachers change their attitudes to students and teaching, improve teaching methods, and update course content and improve the level of scientific research as well. Therefore, undergraduate tutorial teaching systems let teachers consciously or unconsciously intensify their own quality improvement, enrich knowledge and ultimately achieve the self-optimization of teachers.

During the process of implementation of tutorial system, we require teachers and students to work together to build an inquiry-based learning mechanism. Inquiry-based learning is reciprocal for students and teachers; teachers can learn something from students like students acquire knowledge from teachers. Critical thinking is necessary for teachers' creative thinking, students' participation play a role as "oil" and break the gap between teachers and students, students could work with teachers or independently for research projects [2]. The process of tutorial is a process of communication; inspire each other and mutually reinforcing. During this kind of process, teachers and students could share their thinking, experience and knowledge, exchange their ideas and experience, so that both the teachers and students would excel themselves and create much more value.

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# Chapter 42
# Research on Vocabulary Learning Strategy Training on Top-Level Students of Non-English Majors

**Jing Li and Shouyu Sun**

**Abstract** This paper reports a research on the effects of cognitive and met cognitive strategy training on vocabulary learning in a top-level-student of English classroom of Shandong University of Technology. The main result obtained from the research is that the vocabulary performance improvement of top-level students is contributed to both cognitive and met cognitive strategies training.

**Keywords** Top-level students · Cognitive and met cognitive strategy · Strategy training effects

## 42.1 Literature Review

Today more and more people in the world are realizing the importance of mastering the basic learning skills [1–3]. Since the 1970s research emphasis in the field of second-language acquisition and second-language learning has also tend to shift from teachers' teaching to students' learning and increasing numbers of studies have been undertaken from the students' perspective. The study of learning strategy and the process of learning has been promoted since learning strategies promote autonomous learning.

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With the expansion of language learning strategy instruction research, the question to be answered is whether language learning strategy training would result in learners' improvement in language learning [4–7]. In western countries, a large body of research supports the positive effects of training on strategies in language learning performance [8], although not all L2 strategy training studies have been successful or conclusive. Yet in China, there are few researches into the effect of language strategy training. Researches into the effect of language learning strategy training on vocabulary acquisition are few. Even most of the western researches in the field of learning strategy instruction have focused on reading strategies as one of the important language skills, and not on vocabulary strategies.

However, vocabulary knowledge is known to play a key role in the individuals' proficiency in both first and second language. Vocabulary size was shown to be the best predictor of reading comprehension in L1 and L2.

Therefore, it is necessary to teach students how to learn vocabulary in appropriate strategies. But the researches on vocabulary learning strategies are few. In addition, most of the researches on vocabulary learning strategies have also focused on cognitive strategies and ignored met cognitive strategies. Yet the importance of met cognitive strategies has been emphasized by O'Malley, and Chamot, who state "students without met cognitive approach are essentially learners without direction or opportunity to review their progress, accomplishment, and future directions".

And maybe this vocabulary learning strategy training that put emphasis on both met cognitive strategies and cognitive strategies can help students to learn vocabulary. The purpose of the present study will shed light on the issue of strategy training. The author will investigate the effect of cognitive and met cognitive strategy training through the use of O'Malley's CALLA and Cohen's Strategies-Based Instruction (SBI) model on the development of lexical knowledge of the Chinese non-English majors.

## 42.2 Methodology

### *42.2.1 Subjects*

The subjects in the present study come from two intact classes which were selected according to their high scores in English and mathematics of the College Entrance Exam in Shandong University of Technology with total number of 75. The first class consists of 36 second-year college students and the second class consists of 39 second-year college students. All the subjects have been learning English for at least 7 years.

All the subjects are given 2 vocabulary size tests and 2 vocabulary proficiency tests, which are the pre-tests and the post-tests respectively. After the vocabulary pre-test, one class is randomly chosen to be the experimental class (EC); another class is the control class (CC). Students who does not participate any of the four tests will be excluded from the statistical analysis.

### 42.2.2 Instruments

The instruments used in the study are one questionnaire (used in pre-test and post-test), two vocabulary size tests, two vocabulary proficiency tests, and a retrospective interview.

The vocabulary strategy questionnaire is developed through adaptation of mainly two sources: Wen Qiufang's (the 5th Chinese version) Vocabulary Learning Questionnaire (VLQ5) and Fan Lin's Vocabulary Learning Questionnaire.

The design of the questionnaire is based on Wen Qiufang's classification of learning strategies. Typical strategies in the metacognitive category for vocabulary learning are: (1) advance organizers; (2) directed attention; (3) selective attention; (4) self-management; (5) advance preparation; (6) self-monitoring; (7) delayed production; (8) self-evaluation.

Typical strategies in the cognitive category for vocabulary learning are (1) repetition; (2) resourcing; (3) directed physical response; (4) translation; (5) grouping; (6) note-taking; (7) deduction; (8) recombination; (9) imagery; (10) auditory representation; (11) key word; (12) contextualization; (13) elaboration; (14) transfer; (15) inference.

The Vocabulary Learning Strategies Questionnaire, written in Chinese, consists of two parts: One is concerned with personal profiles: name, age, sex, time of learning English, the English scores for College Entrance English Examination. The other part consists of 93 five likert-scale statements concerning vocabulary learning behaviors, which are divided into two sections: met cognitive strategies and cognitive strategies (16 met cognitive strategies and 77 cognitive strategies).

### 42.2.3 Data-Collection and Data-Analysis

After these tests, all papers of each subject are labeled and marked according to the given criteria. Then, the data obtained are inputted into SPSS 13.0 to be processed.

### 42.2.4 Repeated Reliability Test

In order to understand the inner reliability of the instruments, repeated measuring correlation and the coefficient of *Cranach* of the questionnaire in the post-test are calculated.

## 42.3 Procedures of the Training

The time of the training lasts 16 weeks, 2 h one week, total 32 h. The instruction of the training is presented in Table 42.1, together with the traditional teaching instruction for comparison.

## 42.4 Data Analysis and Discussion

This part starts with the statistical description of the 4 vocabulary tests for EC (experimental class) and CC (controlled class), First, Paired-Samples *T* Test and Independent-Samples *T* Test for the vocabulary achievement of EC and CC are made. Second, the analysis of the strategy modification for EC and CC is presented and also followed by Paired-Samples *T* Test. Third, the regression analysis between the cognitive, met cognitive strategy and EC vocabulary performance is analyzed to show the relation among each category.

Analysis of the quantitative data is calculated by SPSS (Version 13.0). The descriptive statistics of the vocabulary tests for the EC and CC are reported in Table 42.2. In Test 1 (pre-test A1 + pre-test B1), the mean of EC is 39.45, the standard deviation is 7.659; in Test 2 (post-test A2 + post-test B2), the mean of EC is 48.73, the standard deviation is 5.277. It is concluded that the vocabulary achievement of EC was improved in the post-tests and the score in Test 2 is much higher than that of the control class. As for CC, although the vocabulary achievement was obtained, it was much lower than EC both in Test 2 (in Test 2, mean = 41.62, SD = 7.877).

**Table 42.1** Comparisons of the strategy-based teaching instruction and the traditional teaching instruction of vocabulary learning

| | | New | Old |
|---|---|---|---|
| Step 1 | Preparation | Focus on *Ss*' prior knowledge on language, strategies and related content<br>New words | Focus on *Ss*' prior language knowledge, related content<br>New words |
| Step 2 | Presentation | Meaning-driven<br>*T* demonstrates and models new skills or *Ss* work in groups<br>*T* half control *Ss* | Language form-driven<br>*T* translates sentence<br>*T* totally control *Ss* |
| Step 3 | Practice | *Ss* use new skills in activities that involve collaboration, problem-solving inquiry, and hands-on experience.<br>*Ss* finish exercises related to the text. | *Ss* finish exercises related to the text |
| Step 4 | Evaluation | Both *T* and *Ss* evaluate *Ss*' work | Only *T* evaluates *Ss*' performance. |

*Notes* Old = the traditional teaching instruction in vocabulary learning; New = the strategy-based teaching instruction in vocabulary learning; *T* = teacher, *Ss* = students

**Table 42.2** Descriptive statistics of the vocabulary tests for EC and CC

| Tests | EC | | | CC | | |
|---|---|---|---|---|---|---|
| | N | Mean | SD | N | Mean | SD |
| Test 1 | 36 | 39.45 | 7.659 | 39 | 40.21 | 8.251 |
| Test 2 | 36 | 48.73 | 5.277 | 39 | 41.62 | 7.877 |

*Note EC* = the experimental class, *CC* = the controlled class; *Test 1* = the pre-test A1 + the pre-test B1, *Test 2* = the post-test A2 + the post-test B2

**Table 42.3** Independent-sample *t* test analyses for vocabulary scores in post-test

| Classes | *t* | Sig. (2-tailed) | Mean difference |
|---|---|---|---|
| EC–CC | 4.775 | 0.000 | 7.11 |

*Note EC* = the experimental class, *CC* = the controlled class

**Table 42.4** Paired-sample *T* test analyses for vocabulary tests of EC and CC

| Classes | N | df | Tests | Mean | SD | *t* | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| EC | 36 | 39 | Test 1–Test 2 | −9.27 | 3.258 | −18.005 | 0.000 |
| CC | 39 | 41 | Test 1–Test 2 | −1.40 | 1.639 | −5.555 | 0.000 |

*Note EC* = the experimental class, *CC* = the controlled class; *Test 1* = the pre-test A1 + the pre-test B1, *Test 2* = the post-test A2 + the post-test B2

When compare the scores of EC and CC in the post-test, Independent-Samples *T* Test for means are analyzed in Table 42.3. The mean difference between EC and CC is very significant, $t = 4.775$, $P < 0.01$. These results show the new vocabulary teaching method is effective. In addition, improvements of EC in two tests are both significant (See Table 42.3). In general, the result of EC's vocabulary test proves that the cognitive and met cognitive strategy training does enhance the students' vocabulary proficiency.

The Paired-Samples *T* Test analysis for vocabulary tests of EC and CC is reported in Table 42.4. As far as EC is concerned, the mean distance between Test 1 and Test 2 is 9.27, the distance of standard deviation between Test 1 and Test 2 is 3.258, and which shows the difference between the pretest score and post-test score is significant, $t = -18.005$, $P = 0.000$ ($P < 0.0$l). It can be concluded that the training for EC is effective and EC's improved vocabulary proficiency is statistically meaningful.

For CC, as is shown by the results in Table 42.4, the difference between the pre-test score and post-test score is significant, $t = -5.555$, $P = 0.000$ ($P < 0.01$). The result suggests that CC's vocabulary improvement under the traditional teaching method is statistically meaningful.

## 42.5 Conclusions

From the result above, it can be safely concluded that the cognitive and met cognitive strategy training in vocabulary learning does enhance the subjects' vocabulary proficiency.

The training has an effective and positive influence on the trainees. Wang asserts that the learner strategies are the key learner's to success, and one of the most important goals of language training should be the facilitating of that success.

Student's learning will be facilitated if he is explicitly trained to become more aware of and proficient in the use of a broad range of strategies that can be utilized throughout the language learning process.

Learning strategies training, this equips learners with necessary tools, yields A number of advantages according to Cohen:

- Students self-diagnose their strength and weakness in language learning;
- Students become more aware of what helps them to learn the language and they are studying most efficiently;
- Strategy training develops a broad range of problem-solving skills;
- Students would experiment with both familiar and unfamiliar learning strategies;
- Strategy training helps students make decision about how to approach a language task;
- Students would monitor and self-evaluate their own performance; and
- Strategy training helps students transfer successful strategies to new learning contexts.

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# Chapter 43
# Course Provision of Teacher Education Innovational and Technology Normal College Analysis

**Zhongming Gao and Xiaoqin Guo**

**Abstract** Vocational and technical teachers college is the machine tools of vocational education, its ability to adapt to the vocational education training requirements of the "double" teacher, was to test an important indicator of the level of their school. The curriculum for teacher education is the basis for protection of the quality of teacher training. The survey found that the vocational curriculum for teacher education is not reasonable; a serious imbalance in the internal structure of courses, and teacher education cannot meet the requirements of secondary vocational education.

**Keywords** Teacher education curriculum of vocational education · Course structure · Course provision

## 43.1 Introduction

The curriculum at secondary vocational schools is cored at the specialized courses. The quality of specialized course learning is the focal point to determine if the graduates from secondary vocational schools succeed in job hunting and their jobs are right with their specialties. However, the quality of specialized courses teaching has a close connection with the academic quality of the teacher teaching specialized courses. The specialized quality of teachers is closely related to the pre-employment education, as well as the post-employment personal initiatives and others' helps, but the pre-employment education is always the fundamental.

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Teachers who do not receive good pre-employment education are highly hard to be an excellent teacher. Especially, fierce changes have occurred in education nowadays.

Unlike high school students, students at secondary vocational schools deem the "mastering of specialized skills" as their major objective but not the "entering a higher educational school". Therefore, vocational education requires teachers in specialized courses possess two aspects of quality and ability: (1) they should be similar to cultural teachers with higher cultural and specialized theoretical levels as well as the strong teaching, researching ability and quality; (2) they should be similar to engineering technical personnel with broader specialized fundamental knowledge, skillful specialized practical skills, the ability of organizing production and operation, and promoting science and technology as well as the ability and quality to instruct students to establish a business. These inevitably require that the teacher education program at vocational and technology normal college is an integration of academy, pedagogic feature and technology.

Currently, the teachers in vocational engineering specialized courses mainly comes from engineering colleges and vocational and technology normal colleges. Graduates from engineering colleges own quite solid specialized fundamentals (academy and technology), but they lack the basic trainings in teacher education program, which is hard to meet the requirements of vocational education in a short time. It is supposed that the vocational and technology normal education whose purpose is cultivating vocational teachers in specialized courses especially can meet the vocational education well. However, the reality does not behave in this way.

## 43.2 Investigation Method

To investigate the pre-employment education of the teachers in specialized courses at secondary vocational schools, three engineering programs mechanical electronic, (electrical engineering and automotive service) in a vocational and technology normal colleges (short as "S College") are adopted to be the samples. The cultivation objectives of these three programs all are targeted at the cultivation of teachers in specialized courses for secondary vocational schools.

The investigation is based on the cultivation of the three programs at ten levels. The curriculum of the three programs all is divided into required course and elective course, theoretical course and practice course. The required courses can be classified into common required course, educational required course, and required specialized course. The elective courses are divided into common elective course and elective specialized course. The theoretical courses include common theoretical course, educational theoretical course, and theoretical specialized course. The practice courses are classified into social practice course, educational practice course, and practice specialized course.

## 43.3 Statistical Result

The statistics, based on the credits of each course, is conducted on five aspects of the three engineering programs, namely the whole curriculum structure, required course structure, elective course structure, theoretical course structure, and practice course structure.

### *43.3.1 The Whole Curriculum Structure*

In the Fig. 43.1, the curriculum structures of the three engineering teacher education programs are extremely unbalanced. The credits of required courses take up 85 % of the total curriculum credits, in which the mechanical electronic program reaches up to 85.8 %; the credits of elective courses only occupy 14.5 % in average, in which the automotive service program which takes up the highest proportion accounts for only 15 %; the credits of theoretical courses take up approximately 75 % f the total curriculum credits in average; in which the automotive service program reaches up to 76.1 %.

### *43.3.2 Required Course Structure*

In the Fig. 43.2, the credit of common courses takes up 45 % in required courses, in which the automotive service program occupies the highest proportion to 45.4 %; the credit of specialized courses takes up over 40 % in average, in which the electronic engineering occupies the highest proportion to 41.2 %; the credit of educational courses only takes up less than 15 % in average, in which the mechanical electronic program occupies only 14.2 %.

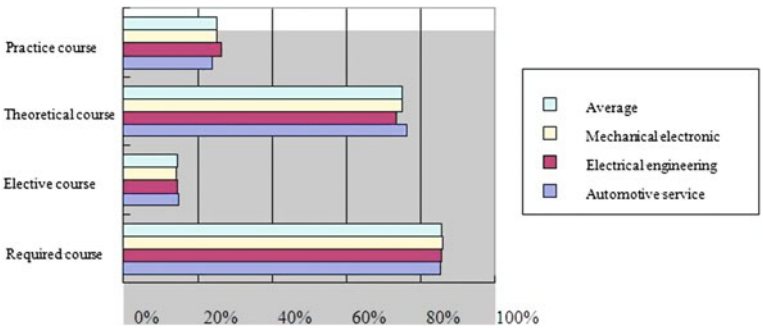


**Fig. 43.1** The whole curriculum structure

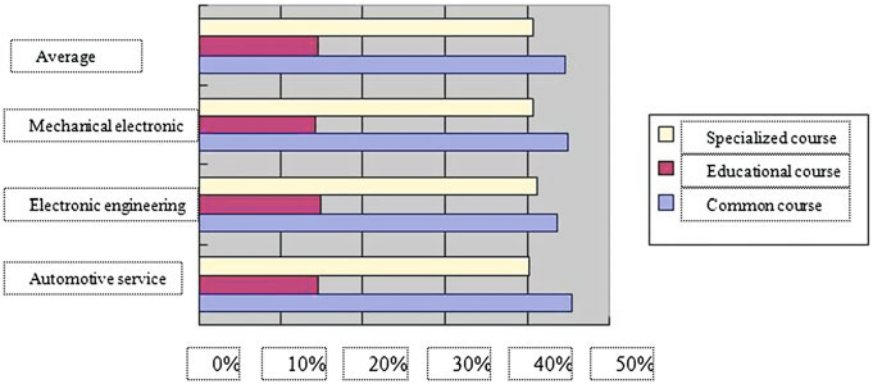


**Fig. 43.2** Required course structure

### *43.3.3 Selective Course Structure*

In the Fig. 43.3, in elective courses, the credit of specialized courses takes up over 90 % in average, in which the mechanical electronic program occupies the highest proportion to 94.1 %; the credit of the common required courses is less than 10 % in average, in which the automotive service and mechanical electronic programs take up only 5.6 %; these three programs all do not take educational courses as their elective courses.

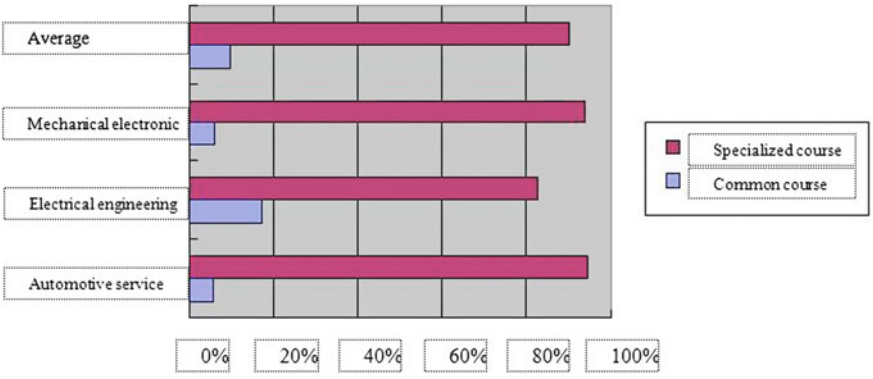


**Fig. 43.3** Selective course structure

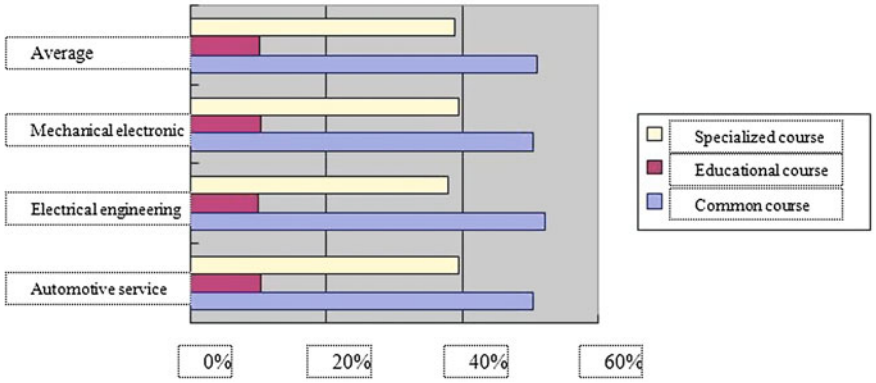


**Fig. 43.4** Theoretical course structure

### *43.3.4 Theoretical Course Structure*

In the Fig. 43.4, in theoretical courses, the credit of common courses takes up over 50 % in average, in which electrical engineering program occupies the highest proportion to 52.3 %; the credit of the specialized courses takes up 39 % in average, in which the automotive service program occupies the highest proportion to 39.4 %; the credit of the educational courses takes up only 10 % in average and electrical engineering program occupies only 9.8 %.

### *43.3.5 Practice Course Structure*

In the Fig. 43.5, in practice courses, the credit of specialized courses takes up over 75 % in average, in which the automotive service program occupies the highest

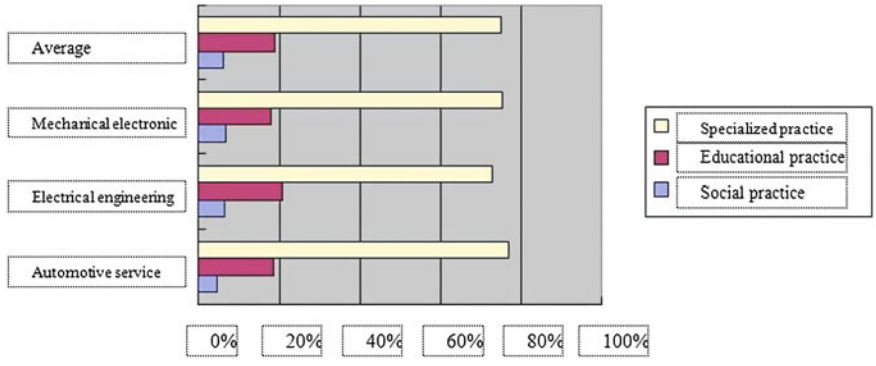


**Fig. 43.5** Practice course structure

proportion to 76.7 %; the credit of educational practices courses takes up less than 20 % in average, in which the mechanical electronic program takes up only 17.8 %; the credit of social practice courses takes up only 5.9 % in average, in which the automotive service program occupies only 4.6 %.

## 43.4 Analysis on the Problems

From the above statistical results, it can be easily seen that the whole curriculum provision of teacher education program at S college for vocational specialized courses is extremely unbalanced and the course structure is unreasonable. It is found from larger range of investigation that this problem is not an isolated example, and is currently a common phenomenon in the education for teachers in specialized courses. This is mainly reflected on the following four aspects.

### *43.4.1 Theoretical and Required Courses are Relatively Surplus While the Practice and Elective Courses are Seriously Insufficient*

China's vocational education teacher training basically follows the ordinary teacher mode, mainly using the simple overlay mode and cored at specialized courses, and becomes vocational teacher education after a number of educational courses are added [1]. A vital view on modern courses is emphasizing practicality and selectivity which are more important for vocational education. This requires the vocational specialized course teachers own strong practical abilities to instruct students to develop skills training activities. Meanwhile, the vocational education diversity and changeability require the teachers adaptable to multiple specialty teaching and adjustment. Moreover, the curriculum of vocational teacher education has to strengthen the proportion of practice and elective courses. Per the particularity of vocational education, and referring to western vocational teacher training experience, the author holds the credit proportion of practice courses in vocational teacher education shall not be less than 40 %, including military training and social practice and the credit proportion of selective course not less than 30 %.

### 43.4.2 Specialized and Common Courses are Relatively Surplus While Educational Course is Seriously Insufficient

It is found through studies that vocational specialized course teachers universally receive no systematic training on education theories and approaches with poor teaching ability. Especially, the ability to develop courses is weak, hard to melt into the teaching of new things and technology per enterprises' needs. Since long, in the curriculum of vocational teacher education, the proportion of specialized and common courses is excessively large, while educational courses including (theories and practices) are seriously insufficient. Though there were scholars to call on increasing the proportion of educational courses, nothing is changed. Some vocational and technology normal colleges remove the pedagogic feature under the name of "value academy" to make educational courses lessened constantly, while symbolically set up pedagogies, psychology and teaching method courses whose credits takes up 5 % of the total without any educational courses. As students at these colleges most come from ordinary high schools, they have no knowledge about vocational education. How can such a course provision train qualified vocational teachers? In the end of 1970s, the investigation of ILO and UNESCO on over 70 countries teacher education showed the proportions of their teacher education courses: discipline course takes up 35 %; ordinary culture and educational theoretical courses occupy 25 %; educational and practice courses have 15 %. In the whole curriculum system, educational specialized courses occupy 40 % [2]. On this basis, the author believes that some low-efficient common courses can be lessened properly to add educational courses, and the proportion of specialized, common and educational courses can be 4:3:3.

### 43.4.3 Elective Courses are Too Single, and Educational Elective Courses are Lacked

In the curriculum of vocational teacher education program, not only do the credits of elective courses occupy a lower proportion, but also the courses are too single, especially the educational elective courses are not set up. Education theory and practices indicate that the needs on diversified talents need diversified training modes, while the diversification of course provision are the specific representation of diversified training modes. It is known to us that the division of vocational teacher education is based on specialties but not disciplines. The diversification of course provision mainly embodies in elective courses [3]. Only a variety of elective courses can satisfy the various needs of students. Teacher education program should increase the proportion of elective courses much more and

especially the vocational education courses. The author thinks that the proportion of common required course, specialized required course and educational elective course should be equivalent, and educational elective courses can be added properly to highlight the pedagogic feature, letting its proportion up to 40 %.

### *43.4.4 Practice Courses are only Formalistic and Educational Practice Courses are not Valued*

The integration of academy, technicality, and pedagogic feature is the characteristic representation of vocational teacher education. Not only should vocational specialized course teachers master specialty theoretical knowledge, but also should possess stronger practical ability. Therefore, they should be proficient in the theoretical knowledge with strong practical and demonstration ability. In a sense, technicality and pedagogic feature are mainly reflected in practice. Therefore, increasing the proportion of practice courses is the inevitable choice to develop vocational teacher education program. The author thinks that it is necessary to optimize the internal structure of practice courses when the proportion of practice courses is appropriately increased, and the proportion of specialized practice course, educational practice course and social course can be 4:4:2, which can be paid much more attention in teaching internship, enterprise practice, practical operation, etc. Especially, the students majored in vocational teacher education program should be instructed to go deep into educational on-sites as sooner as possible, knowing and experiencing the vocational education. Education internship is the vital way to foster qualified teachers, and plays an important role in the enhancement to students' specialty thoughts and the cultivation on skills. Thus, Education internship should be earnestly emphasized.

Courses are a bridge to connect macroscopic education theories with microscopic education practices. Any education theory, thought, concept and cultivation objective will be accomplished ultimately through this bridge. Education levels and the differentiation of types are mainly reflected at the differences among course concept, provision, content, etc. Only Vocational and technology normal colleges highly emphasize the course provision of vocational teacher education, optimize the internal structure of course, and deal well with the relations between theoretical courses and practice courses, required courses and elective courses, common courses and specialized courses, they can really become the "machine tools" for vocational education, hereby enhancing the whole vocational education level.

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# Chapter 44
# Study of Elements of Developmental Classroom Teaching Evaluation

**Honglin Peng, Xuimin Zeng, Qianqian Yang and Zhenyi Wan**

**Abstract** Classroom teaching evaluation is one of the most important tools to improve the growth of students, professional development of teachers, and the quality of classroom teaching. To evaluate classroom teaching effectively has been the basic component of modern teaching, which is not only the basis of a successful teaching, but also the basis to make all kinds of decisions about education. The author starts from learning theories, such as constructivism and collaboration, and further proposes the elements of developmental classroom teaching evaluation.

**Keywords** Classroom teaching · Evaluation · Development · Elements · Indicator system

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## 44.1 Introduction

To confirm the content is the core work to start the classroom teaching evaluation. Indicators reflect the content. Different practical basis and evaluation views will definitely lead to the variety of evaluation indicator systems in different periods, different regions, different schools, and different courses [1]. In view of present conditions, some of the educators think the teaching thought, teaching objectives, teaching content, teaching procedures, teaching methods, and teaching effectiveness as the main indicators of classroom teaching evaluation; while the other educators think that the participation of students, the creativity training of students, and teachers' design of teaching should be the main indicators. According to the thought and requirement of the new curriculum standard, the author thinks that the indicator system of developmental classroom teaching evaluation can be divided into students' learning performance, teachers' teaching behavior, and teachers' basic quality.

## 44.2 Students' Learning Performance

Students are the subject of study. The starting point and destination of classroom teaching is "for the development of every single student". Therefore, students' learning performance is the core component of classroom teaching evaluation.

### *44.2.1 Students' Learning Skill*

What we called learning skill does not refer to those concrete learning strategies and methods, but refers to the basic features when they study, such as independence, exploration, and cooperativeness.

### *44.2.2 Independent Learning*

Constructivism learning theory demonstrates that knowledge is not got from teaching, but is obtained by means of meaning construction when the student is learning in certain situation or social culture background, via other people's (usually including teachers and colleagues) help and necessary study materials [2]. Humanism maintains that students themselves have learning ability, and when they participate in learning process responsibly, it will improve their study. Those studies that are initiated by students independently are the deepest and the most lasting studies.

Developmental classroom teaching evaluation has to concern and judge whether the students' ways of learning are independent learning and whether their learning ways show some basic features of independent learning such as anticipation, participation and creativity. Details are listed here:

**Anticipation** To make independent study, students must have clear mind of objective, actively arrange and schedule their study. At the same time, before large quantity of information, they should have the ability to catch the information and to feel and understand them sensitively, even further categorize and compile the information depending on their need.

**Participation** Students take part in group activities, collaborate with group members and respect each other. They have strong responsibility and sense of obligation.

**Creativity** Students are not satisfied with current answers and results. They start independent thinking about their learning content, including multi-directional thinking, and investigate new problems creatively.

A good class is always combined with many aspects. However, such a class may be a successful class only when the students possess the sense and action of independent learning which means they are able to question by themselves, question by collaborations, generalize to handle questions, consolidate, and expand.

### *44.2.3 Cooperative Learning*

Cooperative learning is also called collaborative learning, which is one of the most popular learning theories nowadays all around the world. The theoretical basis of cooperative learning includes group dynamics theory, self-control theory, target structure theory, social cohesion theory, and theories from cognitive psychology school. Cooperative learning is a target-induced behavior, which insists the thought that not to make everyone succeed but to make progress. It emphasizes the interaction between dynamic factors, and in this way we improve students' scores and better cultivate their cognitive character. In teaching style, cooperative learning emphasizes with group teaching as basis and cooperative groups as main form of activity, we should try our best to coordinate the collective and individual.

To judge cooperative learning, we may investigate whether it contains the following basic features:

- Respect and appreciate others, always be ready to listen to others' opinions.
- Self-confidence and creation, to express their own thought individually.
- Strengthen the communication and form consensus;
- Make complement, support and cooperate, expand their mind.

Understand the value of collective intelligence and individual intelligence during the interaction.

In cooperative learning mode, teaching is considered as the following behavior: (1) for students to construct, discover, transfer and expand the knowledge, teachers in charge of creating atmosphere; (2) students should not accept knowledge from teachers or courses passively. They should construct their own knowledge actively by exciting their already existing cognitive structure or set up new structures to accept knowledge.

### *44.2.4 Exploratory Learning*

Exploration oriented teaching theory maintains that the strategies which scientists use to solve problems or investigate mysteries can be taught to students. During the process when students participate in scientific exploration positively, teachers may simulate the procedure that scientists use to handle problems to make students experience the condition when scientists are facing problems, collect and process new materials required and finally solve all the problems, as a result to make them get the ability to discover and settle problems from real living scene. Exploration-oriented teaching is a behavior with teachers' guide to excite students' sense of questioning, make them actively join the process to discover problems, and investigate the keys, in order to cultivate the students' ability to discover, analyze, and solve problems.

To evaluate whether the way that students learn has exploration aspect needs to determine whether the conduct of exploratory learning problems, practical, participatory and open other features. In exploratory learning, students from the former to find passive acceptance to active learning, through a similar process of scientific research, exploration of the unknown conclusion layers. In the learning process not only the accumulation of knowledge is more creative play. At the same time, learning is the main line to start the main practice, perception, experience. Students explore the charm of sense through the experience of a complete knowledge discovery, formation, application, and development process.

## 44.3 Participation of Students

In general situation, classroom teaching evaluation determines how students participate in evaluation activities, mostly with descriptive vague expressions such as "students active thinking", "the students to speak positively," and so on. This description is often due to lack of evidence is not convincing. If not at the same people who listen to this lesson, it is difficult to understand from this description of the real classroom situation. I believe that the measure of the level of participation of students should look at teaching students to participate in the breadth and depth of the class.

### *44.3.1 Breadth of the Participation*

To investigate the breadth of students' participation in class, we should first take a look at whether the number of students to participate is major, whether they are related to the students at all levels; second see whether students participate in all aspects of classroom teaching, the time is assured.

### *44.3.2 Depth of the Participation*

To investigate the depth of students' participation in class, we should first determine whether the problem that students have solved during the participation is deep-seated; second judge they participate in a proactive stance or just take part in passively.

### *44.3.3 Students' Learning Efficiency*

The training objectives of the new curriculum is no longer limited to basic knowledge and basic skills, but basic knowledge and skills, processes and methods as well as emotions, attitudes and values, the unity of the Trinity. In the three relations, processes and methods (also understood as learning efficiency), and the emotions, attitudes, values are the basic knowledge students acquire the basic skills of the two pre-conditions. Basic knowledge and basic skills are only throughout the tip of the iceberg during students' learning activities, and hidden in the tip of the following is the process and methods, and emotions, attitudes, values not only the students acquire knowledge, master skills, a prerequisite, both purpose of education itself. Therefore, the effect on the classroom teaching evaluation must pay attention to the three objectives of training course, three goals must not be simplistic.

## 44.4 Knowledge and Skills

Evaluating the students knowledge and skills achievement not only depends on their mastery of knowledge, but also depends on the knowledge students to ask questions, analyze, and solve problems, to encourage students to find their own ingenious solutions to problems, to cultivate a scientific way of thinking. Furthermore, it should determine whether the understanding of the knowledge in the production, life applications, it has been effectively on skills training and improvement.

### *44.4.1 Process and Methods*

Students through independent learning, cooperative exploratory access to knowledge, information collection and processing of their ability, communication skills and practical cooperation in innovation should be the appropriate development and improvement.

### *44.4.2 Emotion, Attitude, and Values*

Students acquire knowledge and skills, but also develop the appropriate emotions, attitudes, and values. Student interest in learning, improve self-confidence, cooperation and exchange with others, the desire and the thirst for knowledge has been strengthened, and gradually form a variety of good habits and values of science, more harmonious relationship between teachers and students, and so on.

## 44.5 Teaching Behavior

The so-called teaching behavior is the teacher's teaching philosophy in the inevitable process of teaching performance, including instructional design behavior, teaching organizational behavior and teaching operation behavior, embodied and implemented in teaching process, the details of teaching and teaching, which are reflected in the teacher-student relationship, classroom rewards and punishments, such as the handling of contingencies.

### *44.5.1 Development and Implementation of Teaching Objectives*

Scientific and rational development and implementation of teaching objectives, is the basis for a good lesson. Teachers to develop teaching objectives must implement the requirements of the curriculum reform of basic education and reflect the Trinity training objectives; teaching practice to help promote student enthusiasm, initiative and creativity and other aspects of development; on students feelings, attitudes and values of the education, student experience, through introspection and internalization to achieve.

### 44.5.2 Processing and Transformation of Teaching Materials

Material is an important carrier of implementing the course requirements, teaching goals to achieve, also teachers the main basis for classroom teaching. Classroom teaching materials is only part of the content, but not all of it. In the past, many teachers tend to stick too much material, to focus their limited knowledge of rationalizing the structure of materials. In fact, although mainly from the teaching materials, but teachers according to teaching practice, may choose teaching materials, scientific processing, and rational organization of the teaching process. The same teaching materials, the same student base, as different teachers handle teaching materials, teaching is not the same effect. To end this, teachers should have objective understanding of the design of teaching materials, and deal with textbooks with initiative and creativity.

Whether the teaching content is challenging and stimulating the curiosity of students.

Whether the teaching content is able to reflect the science, humanities, and social integration, focus on practical, close contact with the actual social and student life.

### 44.5.3 Creation and Management of the Learning Environment

Create a learning environment is a teacher through a series of activities to provide material for students to study the protection and moral support, including physical and psychological environment of the construction and so on. Create a physical environment is in the teaching process, in addition to prepare regular material, teachers also have to do a lot of things in teaching and other aspects of visual image more articles. To create a psychological environment in the teaching process means that teachers follow the education, psychology, law, psychological barriers in the elimination of student learning at the same time, creating a relaxed and harmonious learning environment so that students in the learning process in a relaxed mood state. If students have a good state of mind, learning is significantly enhanced. Teachers create a learning environment and management of the core and essence of learning resources is to promote the learning environment of learners in the optimal allocation.

Whether teachers in accordance with curriculum standards, are able to organize the students develop and use of learning resources related to the curriculum to provide students with the necessary learning environment to help students learn the process of creating and maintaining a positive psychological atmosphere. With respecting each student, teachers should appreciate all types of students.

Whether teachers pay attention to cultivating student self-discipline and spirit of cooperation, encourage students to boldly challenge raised critical comments on the materials.

### *44.5.4 Guidance and Training of Learning*

Scientific and systematic study in the learning process is very difficult to form naturally. To this end, students learn methods of guidance and training is very important. Teachers should be based on the teaching curriculum goals and objectives to help students develop appropriate learning objectives, design appropriate learning activities and form effective ways of learning, so students will learn to learn in the process.

## 44.6 Basic Quality of Teachers

The so-called teacher quality is a teacher in the education activities must have the mental quality and relevant literacy. The quality of teachers, including political and ideological quality, professional and moral qualities, the modern concepts of education, cultural and scientific quality, physical, psychological and quality of teaching ability, and so on.

Developmental classroom teaching evaluation should be concerned about the basic quality of teachers, as following:

Whether the concept of teachers characteristics of the times, instructional design and teaching practice meets the requirements of quality education.

**Whether the correct attitude of teachers** Whether the teacher respects for each student to respect individual differences of students; whether the evaluation of each student to achieve a just, equal treatment, equal treatment of each student; whether teaching is for every serious and responsible.

**Whether the teachers have the necessary teaching basic skills** Teachers must have solid professional knowledge, language vivid, smooth, full of appeal, writing on the blackboard rational design, writing neat, orderly, and so on.

**Whether the teachers have the necessary teaching skills** The modern teacher must have the necessary teaching skills, such as curriculum resource development, integration and use, use of modern information technology to assist classroom teaching, the ability to collect and process information, and so on.

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# Chapter 45
# Study on Using Incentive Theory to Improve the Efficiency of Fiscal Funds' Usage

**Duanlian Peng**

**Abstract** Currently, there are still many areas for improvement to promote economic stability and development and implement fairness in income distribution on usage of our budget funds. With the information economics, contract theory and their research development, incentive theory has become an important tool to solute a series of major issues in the real world with asymmetric information. In this paper, using incentive theory to analyze the financial sector as the principal how to build incentives contract to promote the agent—public functions to improve efficiency of using budgetary funds, and achieve economic stability or development and equitable income distribution, we get some useful inspirations.

**Keywords** Incentive theory · Budgetary funds · Usage efficiency

## 45.1 Introduction

Government fiscal sectors as the principals arrange the budgetary funds of all departments according to the budgets approved by the legislative bodies (people's congresses at all levels), and also require all administrative institutions producing the public products and services that can fulfill the needs of social and economic developments. Agents (i.e., administrative institutions) offer a number of public products and service with good quality through efforts and budgetary funds investment, to fulfill the needs of social public. Principals monitor the quantity and quality of products and services offered by agents by implementing performance

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evaluation from two aspects that are the economical efficiencies of the whole society (e.g., economic development and stability and production and life improvement) and the income distribution fairness of the whole society (e.g., income distribution fairness degree, regional balanced development, balanced urban and rural development). Based on the performances and effects in these two aspects, governments (sectors) make adjustments to the efforts of agents and give rewards or punishments per the effort degree, aiming to urge agents to enhance performance and effects. Currently, promoting economic stability and development and achieve income distribution fairness by budgetary funds in China remains to be improved a lot. Along with the continuous development of the studies on the information economics and contract theories, incentive theory has become a vital tool to solute a series of major issues in the real world with asymmetric information. How to design the systems (or mechanisms) to provide legitimate incentives for economic bodies has become a core issue in modern economics [1]. Therefore, to achieve the three fiscal functions-keep macroeconomic stability, promote economic development, accomplish social fairness, and enhance social welfare objective, it is necessary to be guided under incentive theory and promote all functional departments to improve the using efficiency of budgetary funds.

The incentive theory in economics is mainly based on the principal-agent theory, researching the incentive systems related to the performances of agents and motivating agents to select the actions favorable to principals through risks sharing and incentive compatibility. The target of principals is to maximize the efficiency and its constraint condition is that agents can select to completely reject contracts and the contracts necessarily have the incentives for agents to select content actions. These two constraints commonly exist in each ethic risk issue, which are "participation constraint" and "incentive compatibility constraint". Their mathematical equation is as shown below:

$$\begin{aligned} &\underset{w(.)}{\text{Max}}\, Ev\left(q\left(\tilde{e},\theta\right)-w\left(q\left(\tilde{e},\theta\right)\right)\right)\\ &s.t.\\ &\tilde{e}=\arg\max EU(e,w(q(e,\theta)))\ (\text{incentive compatibility constraint})\\ &EU\left(\tilde{e},w\left(q\left(\tilde{e},\theta\right)\right)\right)\geq \overline{\text{U}}\ (\text{participation constraint}) \end{aligned} \tag{45.1}$$

in which, $EV(\cdot)$ is the expected utility of principal, $EU(\cdot)$ is the expected utility of agent; $q(\tilde{e},\theta)$is the production function generated by agent under the effort level "$e$" and the natural level "$\theta$"; $w(q)$ is the given incentive contract. "Incentive compatibility constraint" takes the fact that agents will take postactions into consideration, and hence contracts must induce agents to voluntarily select content actions. "Participation constraint" requires workers being more willing to accept the contracts but not selecting the actions that agents do not hope. And the maximum efficiency, obtained when agents cannot accept contracts, is determined by other market opportunities it confronts with, which can be called as

"reservation utility" and is expressed in $\overline{U}$ [2]. That is to say, under the circumstance of agents having no knowledge of all information, principals offer some incentive for agents to make agents achieve the target specified by principals through some systems or regulations. Incentive theory is widely used in principal-agent problem, optimal contract design, regulations or rules, public financial theory, optimal tax system design, administrative management, political and social system design, and even the family relationship processing issue, and so on [3].

## 45.2 Assumptions for Principals and Agents

To finish the tasks entrusted by principals, agents should distribute the efforts (time and energy) on the two output results—the improvement of the whole social economical efficiency ($s_1$) and the improvement of the whole social fairness ($s_2$), and their effort vectors can be marked as $e = (e_1, e_2)^T$ in which $e_1$ is the efforts spent on the improvement of the whole social economical efficiency and $e_2$ is the efforts on the income distribution fairness. We assume the equation below:

$$s_1 = e_1 + \theta_1, \quad s_2 = e_2 + \theta_2 \tag{45.2}$$

in which, $\theta=(\theta_1+\theta_2)^T$ is the normally distributed random variable, namely $E(\theta_i) = 0, Var(\theta_i) = \sigma_i, Cov(\theta_1, \theta_2) = 0$. $\theta_i$ is the uncertain factor of work environments to finish the number $i$ work, which can be the error generated when public functional departments conduct performance evaluations and can also be agents' efforts on the number $i$ work and the risks to attain success. The Eq. (45.2) expresses that the quantity and quality of the public products and services received by principals rely on the efforts ($e$) of agents and the uncertain factor ($\theta$). This shows that the action information of agents is asymmetric.

The cost function of agents to make efforts ($e$) is $C(e_1,e_2)$, and we can make the assumption [4] below:

$$C(e_1, e_2) = \frac{c_{11}}{2} e_1^2 + \frac{c_{22}}{2} e_2^2 + c_{12} e_1 e_2 \tag{45.3}$$

Due to the complementation between the tasks to improve economic efficiency and the tasks to improve income distribution fairness of public functional departments (i.e., the improvement of the efforts on a task will make another task's additional cost reduced), the two types of tasks have relevance with the development of social economy. Therefore, there is $C_{12} \prec 0$.

Principals apply linear incentive function method to pay budgetary funds for agents. That is to say, the budgetary funds obtained by agents are $s(s_1, s_2) = a + b_1 s_1 + b_2 s_2$, in which $a$ is the fixed budget for agents (i.e., the funds to ensure the operation of public functional departments), and $b_1$ and $b_2$ are the appropriation coefficients ascertained by principals based on the improvements of the whole social

economic efficiency and the income distribution fairness, which are equal to the sharing proportions of agents for the outputs $s_1$ and $s_2$.

The incomes of agents are the value gotten from their obtained budgetary funds subtracting the monetary value on which efforts have been put:

$$Y_a = (a + b_1 s_1 + b_2 s_2) - \frac{c_{11}}{2} e_1^2 - \frac{c_{22}}{2} e_2^2 - c_{12} e_1 e_2 \tag{45.4}$$

In which, the subscript variable $a$ is the agents.

The incomes of principals are generated from the economic efficiency improvement ($s_1$) and social income distribution fairness improvement ($s_2$) of the public functional departments. We use invariant substitution elasticity function (*CES*) to show the income of principals:

$$Y_p = \left( a s_1^{1-y} + (1-a) s_2^{1-y} \right) - S(s1, s2) \tag{45.5}$$

in which, $\alpha$ is the influence of economic efficiency improvement ($s_1$) on the utility of principals; $1 - \alpha$ is the influence of income distribution fairness improvement ($s_2$) on the utility of principals; $\alpha$ can be determined based on the weighting of the output efficiency ($s_1$) of performance evaluation, namely $0 \leq a \leq 1$; $\gamma$ is the substitution elasticity coefficients of economic efficiency improvement ($s_1$) and income distribution fairness improvement ($s_2$) due to the complementation between $s_1$ and $s_2$, and hence $\gamma \in (0, 1)$. And the subscript variable $p$ is principals.

At last, we assume principals are risk-neutral and agents are risk-averse.

As principals are risk-neutral, their expected utilities are equal to the expected income. We can get the following equation:

$$\begin{aligned} E(U_P) = E(Y_P) &= E(\alpha s_1^{1-\gamma} + (1-\alpha) s_2^{1-\gamma})^{\frac{1}{1-\gamma}} - a - b_1 s_1 - b_2 s_2 \\ &= (\alpha e_1^{1-\gamma} + (1-\alpha) e_2^{1-\gamma})^{\frac{1}{1-\gamma}} - a - b_1 e_1 - b_2 e_2 \end{aligned} \tag{45.6}$$

As agents are risk-averse, we assume agents' utility function to possess the feature of invariant absolute risk aversion, namely agents' utility function is $u = e^{-\rho y}$ in which $\rho$ is the agents' absolute risk aversion and $Y$ is agents' actual income. If there is $u(Y_a) = Eu(Y_a)$, the income $Y_a$ can be ascertained to be equivalent to the random income $Y_a$. The equivalent income of agents can be the difference between the expected value of actual income and the risk cost. The risk cost of agents is $\frac{1}{2}\rho b_1^2 \sigma_1^2 + \frac{1}{2}\rho b_2^2 \sigma_2^2$. That is to say, agents would rather abandon the income from $\frac{1}{2}\rho b_1^2 \sigma_1^2 + \frac{1}{2}\rho b_2^2 \sigma_2^2$ in the random income $Y_a$ to exchange the certain income. Therefore, the equation for the equivalent income of agents can be assumed below:

$$Y_a = a + b_1 e_1 + b_2 e_2 - \frac{c_{11}}{2} e_1^2 - \frac{c_{12}}{2} e_2^2 - c_{12} e_1 e_2 - \frac{1}{2}\rho b_1^2 \sigma_1^2 - \frac{1}{2}\rho b_2^2 \sigma_2^2 \tag{45.7}$$

## 45.3 Decision Making Actions of Agents and Principals

We assume that there is an agent. His effort vector $e$ with value can have two possible values: the zero effort vectors $e = (e_1, e_2) = (0, 0)$, the positive effort vector $e = (e_1, e_2) = (1, 1)$, and the given effort cost function is (10). The production process of the agent is with randomness, and his random production level $\tilde{s}$ can be the two vectors $\{(s_1, s_2), (\bar{s}_1, \bar{s}_2)\}$ ( For simple analysis, we assume the two intermediate states ($\underline{s}_1$,$\bar{s}_2$) and ($\bar{s}_1$,$\underline{s}_2$) do not exist, because the economic efficiency improvement ($s_1$) and social income distribution fairness improvement ($s_2$) are mutually associated under a certain condition, which seems to be bound together for good or ill.) The influence of efforts on the production randomness appears as the probability distribution, namely $P\gamma\{\tilde{s} = \tilde{s}|e = (0, 0)\} = \pi_0, Pr\{= |\mathbf{e} = (1, 1)\} = \pi_1$, in which $\pi_1 > \pi_0$. We use $\Delta\pi = \pi_1 - \pi_0$ as the difference between two probabilities.

Note: The efforts increase the output based on a preponderance of the first-order randomness; that is to say, for any given output $\boldsymbol{s}^*$, $Pr\{\leq \mathbf{s}^*|\mathbf{e}\}$ decreases progressively along with $e$. Therefore, we can assume the equation below:

$$Pr\{\leq \mathrm{s}|\mathbf{e} = (1, 1)\} = 1 - \pi_1 < 1 - \pi_0 = Pr\{< |\mathbf{e} = (0, 0)\} \text{ and}$$
$$Pr\{\leq |\mathbf{e} = (1, 1)\} = 1 = Pr\{\leq |\mathbf{e} = (0, 0)\}$$

This feature means that principals prefer the random production distribution under the condition of the positive efforts $e = (e_1, e_2) = (1, 1)$ but not the invalid efforts $e = (e_1, e_2) = (0, 0)$, because the increasing of efforts will improve the production level to a great extent [1].

The actions of agents cannot be directly observed by principals. Principals only can provide a contract based on the observed and verified production level, namely a function $\{b(\tilde{s})\}$ associating the compensation of agents with the random output. As there are two possible output vector $\underline{s}$ and $\bar{s}$, the contract can be equivalently defined as a pair of payment vector $\underline{b}$ and $\overline{b}$ (For the sake of easy analysis, we assume the payment vector given with zero effort is $b = (b_1, b_2) = (0, 0)$).

When agents make positive efforts $(e = (1, 1))$, the expected utility of risk-neutral principals can be described as the following:

$$E(U_p)_1 = \pi_1(1 - a-) + (1 - \pi_1)(-a) = \pi_1(1-) - a \tag{45.8}$$

When agents make no efforts $(e = (0, 0))$ the expected utility of risk-neutral principals can be described as the following:

$$E(U_p)_0 = \pi_0(1 - a-) + (1 - \pi_0)(-a) = \pi_0(1-) - a \tag{45.9}$$

The principals hope that each effort level obtained by incentives is corresponding to a contract set to ensure the compatibility of participation and incentives. The incentive compatibility constraint can be written as the following:

$$\begin{aligned}
&\pi_1(a+\bar{b}_1+\bar{b}_2)+(1-\pi_1)a-\frac{c_{11}}{2}-\frac{c_{22}}{2}-c_{12}-\frac{1}{2}\rho\bar{b}_1^2\sigma_1^2-\frac{1}{2}\rho\bar{b}_2^2\sigma_2^2\\
&\geq \pi_0(a+\bar{b}_1+\bar{b}_2)+(1-\pi_0)a-\frac{1}{2}\rho\underline{b}_1^2\sigma_1^2-\frac{1}{2}\rho\underline{b}_2^2\sigma_2^2 \Rightarrow \pi_1\bar{b}_1+\bar{b}_2\\
&+a-\frac{c_{11}}{2}-\frac{c_{22}}{2}-c_{12}\geq \pi_0(\bar{b}_1+\bar{b}_2)+a+\frac{1}{2}\rho[\sigma_1^2\bar{b}_1^2+\sigma_2^2\bar{b}_2^2]\\
&\Rightarrow (\pi_1-\pi_0)(\bar{b}_1+\bar{b}_2)\geq +\frac{c_{11}}{2}+\frac{c_{22}}{2}+c_{12}+\frac{1}{2}\rho[\sigma_1^2\bar{b}_1^2+\sigma_2^2\bar{b}_2^2]\\
&\Rightarrow \Delta\pi(\bar{b}_1+\bar{b}_2)\geq \frac{c_{11}}{2}+\frac{c_{22}}{2}+c_{12}+\frac{1}{2}\rho[\sigma_1^2\bar{b}_1^2+\sigma_2^2\bar{b}_2^2]\\
&\Rightarrow \Delta\pi(\bar{b}_1+\bar{b}_2)\geq \frac{c_{11}}{2}+\frac{c_{22}}{2}+c_{12}
\end{aligned} \tag{45.10}$$

The retained income of agents is $Y_{a0}>0$, which is the lowest income gained by agents through social services and other activities when no governmental appropriation is to agents. To finish the tasks from principals, agents' income must be larger than the retained income. Therefore, the participation constraint of agents can be written as the following:

$$\begin{aligned}
&\pi 1\bar{Y}_a+(1-\pi_1)Y_a-C(1,1)\geq Y_{a0}\Rightarrow \pi_1(a+\bar{b}_1+\bar{b}_2)+(1-\pi_1)a\\
&-\frac{c_{11}}{2}-\frac{c_{22}}{2}-c_{12}-\frac{1}{2}\rho\bar{b}_1^2\sigma_1^2-\frac{1}{2}\rho\bar{b}_2^2\sigma_2^2\geq Y_{a0}\Rightarrow \pi_1(\bar{b}_1+\bar{b}_2)\\
&+a\geq Y_{a0}+\frac{c_{11}}{2}+\frac{c_{22}}{2}+c_{12}+\frac{1}{2}\rho\bar{b}_1^2\sigma_1^2+\frac{1}{2}\rho\bar{b}_2^2\sigma_2^2
\end{aligned} \tag{45.11}$$

When principals are going to give incentives to positive efforts, their plan issues turn into the following:

$$\begin{aligned}
&(P):\max_{(a,b_1,b_2)}\ \pi_1(1-\bar{b}_1-\bar{b}_2)-a\\
&s.t.(IR)\ \Delta\pi(\bar{b}_1+\bar{b}_2)\geq \frac{c_{11}}{2}+\frac{c_{22}}{2}+c_{12}+\frac{1}{2}\rho[\sigma_1^2\bar{b}_1^2+\sigma_2^2\bar{b}_2^2]\\
&(IC)\ \pi_1(\bar{b}_1+\bar{b}_2)+a\geq Y_{a0}+\frac{c_{11}}{2}+\frac{c_{22}}{2}+c_{12}\frac{1}{2}\rho\bar{b}_1^2\sigma_1^2+\frac{1}{2}\rho\bar{b}_2^2\sigma_2^2
\end{aligned} \tag{45.12}$$

## 45.4 Solutions of Model

Give equations for the two constraints first and then construct Lagrangian function below:

$$\begin{aligned}
F(a,b_1,b_2)=\pi_1(1\bar{b}_1-\bar{b}_2)-a-\lambda[\Delta\pi(\bar{b}_1+\bar{b}_2)-\frac{c_{11}}{2}-\frac{c_{22}}{2}-c_{12}\\
-\frac{1}{2}\rho[\sigma_1^2\bar{b}_1^2+\sigma_2^2\bar{b}_2^2]]-\mu[\pi_1(\bar{b}_1+\bar{b}_2)+a-Y_{a0}-\frac{c_{11}}{2}-\frac{c_{22}}{2}\\
-c_{12}-\left(\frac{1}{2}\rho\bar{b}_1^2\sigma_1^2+\frac{1}{2}\rho\bar{b}_2^2\sigma_2^2\right)]
\end{aligned} \tag{45.13}$$

In which, $\lambda$ and $\mu$ are the respective Lagrangians of the incentive compatibility constraint and participation, and the first-order derivative of the Eq. (45.13) can be obtained below?

$$\begin{aligned}
\frac{\partial \mathrm{F}}{\partial a} &= -1 - \mu = 0 \\
\frac{\partial \mathrm{F}}{\partial \bar{b}_1} &= -\pi_1 - \lambda \Delta\pi + \lambda\rho\sigma_1^2\bar{b}_1 - \mu\pi_1 + \mu\rho\sigma_1^2\bar{b}_1 = 0 \\
\frac{\partial \mathrm{F}}{\partial \bar{b}_2} &= -\pi_1 - \lambda \Delta\pi + \lambda\rho\sigma_2^2\bar{b}_2 - \mu\pi_1 + \mu\rho\sigma_2^2\bar{b}_2 = 0
\end{aligned} \tag{45.14}$$

Solve the Eq. (45.13), the following can be obtained: $\mu = -1, \frac{\bar{b}_1}{\bar{b}_2} = \frac{\sigma_2^2}{\sigma_1^2}$

## 45.5 Discussion and Inspirations

We assume $\frac{\bar{b}_1}{\bar{b}_2} = \mathrm{k}$, K is the relative incentive intensity of the task 1 "economic efficiency improvement" for the task 2 social income distribution fairness improvement. K is statically analyzed as the following:

$\frac{\partial \mathrm{k}}{\partial \sigma_1} = -\frac{\sigma_2^2}{2\sigma_1^3} \prec 0$: This indicates that the relative incentive intensity "K" decreases along with the uncertainty increase of task 1. $\frac{\partial \mathrm{k}}{\partial \sigma_2} = \frac{2\sigma_2}{\sigma_1^2} \succ 0$: This indicates that the relative incentive intensity "K" increases along with the uncertainty increase of task 2. In other words, when other conditions are similar, the incentive intensity is small for the task with high uncertainty and poorly observed effort results. As to this task, fixed payment contracts are superior to the incentive contracts in which the agents are rewarded or punished based on the observed task result values. And linear incentive strategy can be applied to the task with high-uncertainty and strongly observed effort results, in which the incentive intensity is related to the observed task result value.

The results from the application of incentive theory are of great enlightenment significance for us to conduct the performance evaluation practices of public functional departments. First of all, it is necessary to take the available value accuracy of each index into full consideration when we assign values for the weighting of the performance evaluation indexes of public functional departments. The weighting assignment can be lower a little for the indexes with difficulty of getting value that is lowly accurate; but the weighting assignment can be higher for the indexes with easiness of getting values that is highly accurate [5]. Next, the application of incentive theory also requires us to increase the accuracy of performance evaluation, to ensure performance evaluation able to objectively and justly reflect the performance achieved by each administrative institution, which requires us carrying out strict supervisions on multiple links such as index design, data entry, data verification, questionnaire survey and postservice by phone to

ensure the accuracy, authenticity and consistence of the obtained data. Only such a performance evaluation persuasive power, and is of instructive significance for fiscal departments to implement performance appropriation. At last, the performance evaluation and the application of incentive theory are mutually complementary. The performance evaluation provides data basis for the application of incentive theory. Also, the application of incentive theory requires the performance evaluation has to be authentic and reliable, and hence provide references for the value assignment of the weighing of performance evaluation indexes [6]. Therefore, the application of incentive theory is not only the application of performance evaluation results, but also are the constraint on the process of performance evaluation. Only combining the two, this task can be developed more comprehensively and deeply.

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# Chapter 46
# Performance Evaluation of Special Funds Based on Budget Management in Colleges and Universities

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**Abstract** This combination of the budget management of the status quo and development trend, the special financial performance evaluation for the strengthening of institutions of higher education budget management role. Through the school performance evaluation, performance index system for the assessment of the establishment and application made a preliminary discussion.

**Keywords** Budget control · Performance evaluation · Indicator system

## 46.1 Introduction

College budget is an annual financial revenue and expenditure plan made by colleges and universities based on the career development plans and tasks. It is throughout the whole process of the overall budgeting and budget enforcement, which is also the premise and basis for various economic activities in school. Strengthen the university budget management through performance appraisal and other means has significant meaning in improving the efficient use of funds [1].

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## 46.2 The Status and Development Trend of Budget Management in Colleges and Universities

### *46.2.1 The Meaning of Budget Management of Colleges and Universities*

Budget management is a financial management form widely used within colleges and universities. It is with specific and detailed characteristics compared with the planning management [2, 3]. And it is carried out to quantify the statistics, distribution, and control for the overall financial revenue and expenditure in school through the whole process of funds collection, distribution, and use.

### *46.2.2 The Status and Existing Problems in Budget Management of Colleges and Universities*

Status and Problems

The economic activities in colleges and universities currently present the diverse and complex trend. The original internal financial management in colleges and universities cannot meet the new situation, which is mainly reflected in the following [4].

Budgetary institutions are not perfect and the operation process is not standardized.

The way to control the budget enforcement is single. At the present stage, the university budget control is mainly the normative one. There is a phenomenon of "valuing budget and despising management".

The performance appraisal of budget enforcement is not comprehensive enough.

At this stage, the performance appraisal of budget in colleges and universities is mainly through audit inspection. It lays emphasis on normative assessment and ignores performance appraisal in the aspect of assessing the evaluation content. This attach importance on the compliance and rationality of the use of funds while implement the budget, but lack of attention on the effective use of funds [5].

### *46.2.3 The Development Trend of the University Budget Management*

Establish a unified budget committee and standardize the budgeting process. With the deepening of budget management in colleges and universities, the awareness of "total involvement and full budget" is growing. Through the establishment of the school budget committee, the relevant functional departments can be unified and

integrated, the formation procedure can be standardized, and all these can provide protection to improve the level of budget making.

Intensify the budget management on the special funds and introduce the performance evaluation mechanism. Intensifying the budget management on the special funds particularly in the assessment methods of which the introduction of performance appraisal mechanism has become one of the trends of budget management.

## 46.3 The Significance of Carrying Out the Performance Appraisal on Special Funds to Strengthen the Budget Management

### *46.3.1 The Special Funds Management can Directly Impact the Budget Management Standard*

With the yearly increasing investment in special funds, the special funds in some colleges and universities have been accounted for over 50 % of the financial allocation. Special funds have characteristics such as a fixed sum is for a fixed purpose, many constraint conditions and so on compared with that of the basic funds. The increasing special funds bring education budget for colleges and universities, and at the same time, add new difficulties to budget management.

### *46.3.2 The Facilitation of Carrying Out Performance Appraisal for Special Funds to Budget Implementation Process*

Through performance appraisal to the completed project, the project leader can set up the performance awareness, and know the explicit performance goals. By performance evaluation, the project leader actively involves in budget management, and makes the concept of performance management throughout the entire process of project approval, implementation and post management, which can promote the efficient use of special funds.

### *46.3.3 Performance Appraisal can Enrich the Evaluation Methods in Budget Execution*

The purpose of budget management is to improve the efficient use of budget fund. The performance appraisal of the special funds provides an objective evaluation

basis for measuring the efficiency in the use of special funds. It is beneficial for the overall assessment and evaluation on university budget management and can greatly promote the level of budget management in colleges and universities.

## 46.4 The Practice of Performance Appraisal on Special Funds in Colleges and Universities

### *46.4.1 The Status and Existing Problems of the Special Performance Evaluation in Colleges and Universities*

The status of performance appraisal on special funds in colleges and universities.

In recent years, Beijing Municipal Bureau of Finance gradually carried out the comprehensive performance evaluation against the special funds. The proportion of evaluation is gradually enlarged. And it has achieved initial results on strengthening budget management.

Some colleges and universities have also established the internal performance evaluation mechanisms and form the double performance appraisal mechanisms combining both the external and internal performance evaluation. In the practical work of performance appraisal, schools pay attention to the mutual promotion and mutual complementation of external and internal performance evaluation and each performs its own functions. This has played an irreplaceable role on improving the efficient use of funds for the promotion of the school budget management.

The existing problems on performance appraisal of the special funds in colleges and universities.

Currently, specific performance evaluation is still in its infancy. There are following problems in the process of performance appraisal.

The performance measurement system is single and the refining degree is not enough. And there is an unreasonable phenomenon that a set of indicators assessing all items.

Part of the units lack the initiative on participating in the performance evaluation, and they are in the state of "being evaluated". Some colleges and universities aim at completing the inspection and evaluation by the higher authorities. They are evaluated passively rather than active assessment, causing small evaluation covering surface and the evaluation results cannot completely reflect the condition of overall budget management.

Attach little importance on applying the performance evaluation results. And the results of performance evaluation are not linked to the incentive measures, forming the situation of evaluating superficially and caring little about the results. This gradually fades the importance of performance evaluation and universities and colleges pay little and little attention to performance evaluation, and the effectiveness in promoting budget management is gradually reduced.

## *46.4.2 Method of Performance Evaluation on Special Funds*

### 46.4.2.1 The Principle of Performance Evaluation

In the 1980s of twentieth century, foreign performance evaluation experts proposed "3E" principle, including Economy, Efficiency, and Effectiveness. Combining the status of the university budget management, we consider that the principle of integrating external evaluation and internal evaluation, the differentiation principle of classification comparison, operational principle, and the principle of combining evaluation results with the incentives should be added in the evaluation principle.

### 46.4.2.2 The Principle of Combining the External Evaluation and Internal Evaluation

The external evaluation and internal evaluation should be combined. Then, the internal evaluation plays the advantages such as wide coverage, high pertinent and high instructive of the evaluation results, it also forms a comprehensive evaluation system with the external evaluation. The internal evaluation and external evaluation supplement each other and can promote mutually to fully reflect the general level of university budget management, and give full play to the performance appraisal of promoting development, management and effectiveness by evaluation.

### 46.4.2.3 Differentiation Principle of Classification Indicators

Special funds are respectively involving in different professional departments and functional management departments. Where funds should be used and how the effectiveness reflects is different in various departments and functional departments. According to different funds sources, patterns, beneficial target, effectiveness goals, and ways that showing the effectiveness and many other features, the performance evaluation index system can be determined respectively. So the evaluation of pertinence and accuracy can be improved.

### 46.4.2.4 Operational Principle

Special performance evaluation centers on the performance evaluation. It evaluates the effectiveness of special funds at all stages through a series, multiangle assessment evaluation index, and scientific evaluation methods.

#### 46.4.2.5 The Principle of Integrating the Evaluation Results and Incentives

It combines the results of performance appraisal and reward and punishment mechanism of penalties and rewards, which plays the role of incentives and constraints, is conducive to the application of performance results, and would help establish the performance management awareness of the administrators and project leaders in colleges and universities.

#### 46.4.2.6 The Implement of Performance Evaluation on Special Funds

Establish a sound internal performance evaluation mechanism from the aspects of institution building, institutional settings, and architectural study and so on to perfect the internal performance evaluation mechanism and ascertain the organization, personnel division, work processes and evaluation methods. All special funds will be fully integrated into the coverage of performance evaluation in school. The coverage of performance evaluation would be extended. Through performance evaluation results, the status of the school budget management can be real and fully reflect.

Establish the classified evaluation system. We propose the assessment work plan of "unified management, classification assessment". According to the different using directions of the funds and effectiveness of different expressions, the special projects in school can be broadly divided into four categories which are construction projects of experiment and practice room, education reform classes, information category, and infrastructure improvement category. Do performance evaluation respectively and set up different items evaluation index system; all

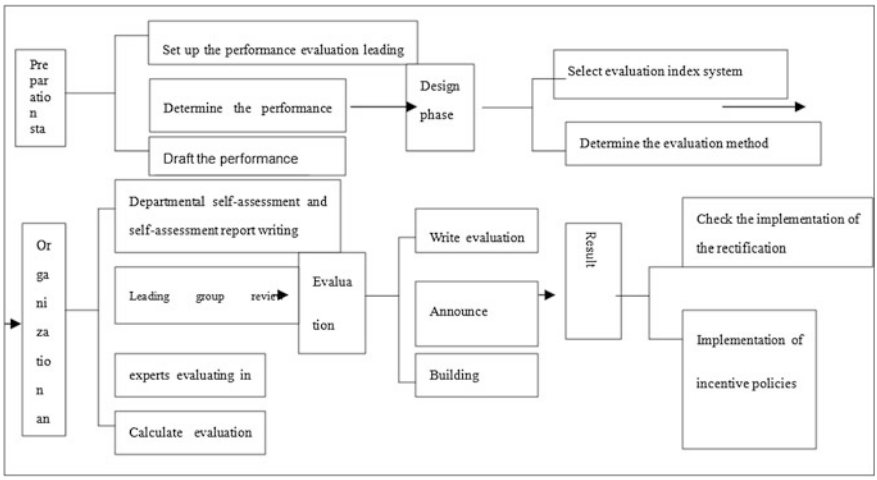


**Fig. 46.1** Performance evaluation processes in colleges and universities

these can fully embody the differentiation of principle classification index. This article takes the most common performance evaluation index system in experimental practice construction category as the object, then analyzes and discusses the performance evaluation index system in colleges and universities.

Standardized performance evaluation processes. Standardized performance evaluation procedure is the important prerequisite to ensure the smooth operation of performance evaluation. Establish a specialized working group on performance evaluation composed by the relevant professionals from the finance department, the state-owned office, audit office and, related functional management sections. The working process includes the choice of evaluation object, evaluation program design, publishing the evaluation results, and so on (See Fig. 46.1).

Strengthen the application of performance evaluation results. First of all, enhance the publicity of the results of performance evaluation; increase its openness and transparency; then, establish the mechanism of combining the evaluate results with the incentives, set up special award fund, or linked to budget indicators and other methods. Associate the performance evaluation results with the budgetary allocation department to allocate and control the next year's

**Table 46.1** Performance evaluation index system of construction category of experiment and practice room

| First-class index | Second-class index | Third-class index |
|---|---|---|
| Operational indicator (80 points) | Project appraisal situation (5 points) | Whether the high professional projects should be proved by the operations specialist (2 points) |
| | | Whether it is proved by its department, its college (3 points) |
| | Budget declare quality (8 points) | The standardability of text declaration (3 points) |
| | | The adaptability and specificity of performance objective and the departmental project (3 points) |
| | | The timeliness of budget declaration (2 points) |
| | Financial appraisal quality (7 points) | The preparation of project appraisal and previewing materials (2 points) |
| | | The timeliness of sending materials to financial evaluation institutions (2 points) |
| | | Project evaluation and subtract situation (3 points) |
| | Project input service condition (60 points) | Whether the project is completed according to schedule and put into use (15 points) |
| | | Whether to establish the corresponding management system (15 points) |
| | | The cooperation with the school-enterprise after the completion of the project (20 points) |
| | | Project awards and social service (10 points) |
| Budget management situation (20 points) | Budget management situation (20 points) | The situation of once acceptance and auditing situation (10 points) |
| | | Project expenditure schedule (5 points) |
| | | The compliance of project expenses (adjustment) (5 points) |

departmental budget according to performance evaluation results. Then, the colleges and universities, departments, functional management can truly feel the benefits and losses brought by the performance evaluation (Table 46.1).

Establish the performance appraisal rating system. The result of performance evaluation is established based on the analysis of large amounts of data. Data collection is the key link to decide whether the performance evaluation is correct or not. In the current university budget management system, data acquisition would involve a number of departments and many people. Therefore, it is a relatively difficult task to standardize the principle of data collection, collection procedures, and unifying the means of collection. To promote this work, a complete basic database system on performance evaluation, effective information delivery, and feedback system should be established to improve the quality of data collection, thus improve the accuracy of performance evaluation.

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# Part VI
# Knowledge Management Engineering

# Chapter 47
# Research of Normalized Role of Law in the Field of Governing School Affairs Legally

**Na Wang, Junqiang Song, Yanpeng Ning, Yan Xiao and Xin Gao**

**Abstract** Governing school affairs legally is one of the inevitable requirements of governing a country according to law as well as building a harmonious society. Due to a variety of reasons such as the multifarious and disorderly contents of legal knowledge and indistinct train of thought toward knowledge of law, it is quite easy for us to ignore the most basic normalized role of law. In order to actively promote the process of running universities by law and maintaining the stability of campus, this paper, is aiming at college student's crimes, expounds the meaning of normalized role of law as well as its manners of exerting function. This article also indicates the necessity and urgency of normalized role of law in the process of governing school affairs legally and further discusses the concrete prevention measures to achieve governing school affairs by law.

**Keywords** Governing school affairs legally · Normalized role · College students' crimes · Prevention measures

## 47.1 Introduction

Governing school affairs legally is the inevitable requirement to implement the spirit of the 16th CPC National Congress, to promote the progress of the Rule of Law, and also a necessary way to build a harmonious campus so as to reach a harmonious society. Governing school affairs legally will help us use legal means to adjust the norms and the emergence of new situations and new problems in education reform and development; helps to settle disputes, resolve conflicts, protect

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the legitimate rights and interests of all parties, and thus to maintain campus stability. College of crime was a significant increasing trend in recent years, preventing and reducing campus crime has become a top priority of the university work. University administrators should pay attention to play a regulatory role of the law, through the guideline, evaluation, and the role of predicted, force and education to achieve a multipronged, step by step to run universities by raw. This paper aims to discuss the normative role of law connotation and manage the school as the domain-specific play, and then discuss specific prevention measures to be taken to run the school under the premise of play a normative role of law.

## 47.2 The Connotation of Standardizing Roles of Law

The connotation of standardizing roles of law is fingering based on its normative impact on human behavior. It can be divided into the guiding value, the evaluation function, the predictive value, the mandatory value, and the educational value according to differences of the main scope of its role and the different ways.

## 47.3 Play the Standardizing Roles of Law When Governing School by Raw

How to develop standardizing roles of law when run universities by law, how to closely link the normative role of law and students; how to enable students to evaluate their own and others' behavior using legal thinking, exploring these issues, we need to manage the school session. I believe that only strengthening the law's normative role can enable students to form a reasonable legal evaluation criteria, then use legal weapons better to protect the legitimate rights and interests of their owns and others, and reduce and prevent the occurrence of criminal behavior.

### *47.3.1 Exert the Guidance and Evaluation Function of Law and Achieve Self-Restraint*

Law as a code of conduct provides a pattern of behavior for people to understand and master of this mode. Only know how to implement their behavior in order to avoid the occurrence of criminal behavior. The method provided by the patterns of behavior tells us what behavior is permitted and what behavior is prohibited, what specific behavior is, name the rights and obligations to have an impact on the behavior of the actors. Inseparable from the role of evaluation and guidance role of the law, only to understand the method that provides us with patterns of behavior, whether legal or illegal, can we have a rational evaluation of the behavior of

others. So, the role of guidelines on the one hand provides themselves with a legitimate form of behavior patterns, on the other hand has their own set of evaluation criteria to measure the legality of the conduct of others. Guidance function focuses on self-discipline; the role of evaluation is to influence the behavior of others through the legal evaluation, focusing on others law . Manage the school session, numerous school Franco–Prussian and Franco–Prussian ideas vague, it is not clear what knowledge of the law should focus on universal coverage, it is not clear the way of the promotion of legal knowledge. Results in many institutions on the surface looks like legal work done in full swing, but there are a mere formality suspected, students, and there is no real benefit, it also runs counter to the schools to implement the original intention of this initiative.

### *47.3.2 Exert the Predictive Function of Law and Achieve Behavior Means Legalized*

If the law does not preunderstand the perpetrator's conduct, it may violate the provisions of the law. Even the results is predicted, we may also violate the law because of a lack of understanding of the behavior of the implementation. Behavioral outcomes are achieved through the perpetrator's conduct, in order to avoid the result of violations of the law, legal means must be taken to reduce the infringement occurred. In accordance with the provisions of the law, people can predict the behavior and behavioral consequences, behavior and behavioral outcomes of a benign evaluation. Of course, the predictive effect of the law do not ask for people's conduct that must be in contrast with the regulations, if that, it will inevitably lead to "only theory". Predicting the role of the play is a premise, even if we do not have a wide understanding of the existing laws, at least have some understanding on their own vital interests of the related or real life situation that often occurs, it is the only way to strongly realize their behavior means of legalization.

### *47.3.3 Exert the Education Function of the Law; Achieve the Legalization of Thinking of Students*

We do not request nonlaw students to train legal thinking as law-students; law-students need long-term study of the legal profession and legal practice training, to train a highly professional, professional, and legal way of thinking, rather than law students need to develop legal thinking in the general sense [1]. Educational role played by the two ways to reflect the behavior of ordinary people, according to the law enforcement to make the positive role of education and negative educational role, thus play a role in regulating behavior, formation of legal thinking of the majority of students have some difficulty, but the combination of the examples in the students' real life analysis of the laws of praise or encouragement, or

prohibited by law will make the students to nurture the formation legal thinking. When teaching legal knowledge, at the same time we should focus on guiding students to consider the issue from a legal point of view, so that students can have a general sense of the legal thinking. Whether a legal act is legal? What legal rights of the legal subjects, what are the legal obligations to fulfill? What about legal liabilities? Affirm the play role of education, positive shall be disciplinary and negative should be warned, and guide students to consider individual cases from a legal point of view, to promote students' thinking gradually become legalized.

### *47.3.4 Exert Enforcement Function of the Law; Achieve Zero Recordable of Campus Crimes*

Playing an enforcement function of the law has an important prerequisite that students have already implemented a crime, only to the targeted offenders. On the one hand, it is the sanction to illegal and criminal activities; on the other hand it is a good deterrent to prevent others from crime, thereby enhancing the social sense of security and stability. This role is the last line of defense of the role of all France, less than a breach of the legal situation is impossible to use coercive means to forcibly evaluation and sanctions on criminal behavior. As school administrators, there is no power to give students any penalties according criminal law, but could only give them punishment at the school rules and regulations level. If law enforcement wants to play a good effect, harmful to society and the serious consequences of criminal behavior must be widely publicized, the formation of negative examples to be strengthened, so that students can have a clear understanding of what is right or wrong, to distinguish right and wrong, and actively guide the students the formation of good habits, and thus form a deterrent for the average student. In the process of advancing, according to the law school, schools should always be reminded likely to break the rules, violation of the law students have to bear the serious consequences, prompted students to attach importance to the shaping of legal thinking, attention to the legalization of behavior means, strive to achieve self-discipline and law of his fight for the colleges and universities crime zero records.

## 47.4 The Specific Prevention Measures to Play the Normative Role of Law in the Field of Governing School Affairs Legally

Playing the role of legal norms, strengthening legal education, improving teacher–student awareness of the law, decreasing the crime rate of students are not only the base of managing schools according to the law school, but also the important task. The author believes that the in the specific practice, we can take the following measures:

### 47.4.1 Pay Attention to the Normative Role of Law, and Guide Students to Comprehend the Legal Education

Deviation of Legal Education is the common direct cause of the lack of awareness of the law of the current college students and a large number of criminal cases. To some extent, universities ignored the sublimation of the traditional legal culture, have the lack of active guide to students in the legal education process [2]. Legal education could start with two aspects: (1) strengthen ideological education to grasp the students' thinking artery. With the development of market economy, social impetuous, utilitarian, and bad ideas gradually penetrated into the school, forming a negative impact on the formation of students' value systems. Strengthen ideological and moral construction, in addition to the prevailing political education, but also through various forms of life education, give thanksgiving education, responsibility for education to make students have more understanding and respect to each other, decrease discrimination and ridicule, and help students establish a correct outlook on life, values, and worldview. (2) Strengthen legal education and develop legal concept. If Legal education is too formalized, students will feel bored, and gradually loss interest in the legal system. Schools should be combined with legal content and real life, select the knowledge of the law that is more closely with the students daily contact to explain, to cultivate and enhance students' learning interest, enable students to consider the issue with legal thinking, resolve contradictions and disputes reasoning. Through the ways of simulated case, court trial and prison visit to enable students to generate reverence of law; students would not go breaking the law only by reverence of law.

### 47.4.2 Explicit Normative Role of Law and Guide Students to Create Healthy Psychological

In such an era of the "law of the jungle", "survival of the fittest", college students face multiple pressures of the job, love, relationships, and so on. If they do not get the distraction, they are likely to develop psychological disorder. Strengthening psychological counseling to help students to have mental health is an important task in advancing manage the school law accordingly. School should actively guide students to get rid of the psychological difficulties, strengthen counseling, and education; it will make the normative role of law have a deep impact. First, schools must create and optimize a healthy and positive campus culture environment in order to promote the interpersonal atmosphere and form a good school spirit, study, and solidarity, the formation of a group of mental health environment. Second, mental health education should combine scientific theories abroad and China's national conditions to create a Mental Health with Chinese characteristics. More importantly, our whole society must face up to the students' psychological

health problems, parents and our basic education should strengthen the mental health of primary and secondary education, enhance their self-education, self-management, self-service, and the ability of self-restraint.

### 47.4.3 Publicize the Normative Role of Law; Prevent the Occur of Students' Crimes

Although some departments of colleges usually do some separate works to prevent the crime of college students, but if they do not integrate their works, they could not catch sufficient attention by all parties and cannot form a cohesive force due to fragmentation, nor the sharing of resources, information exchange, and system power cannot play, the preventive effect is relatively poor, which has been proven by practice [3]. The author believes that all colleges and universities can set up a legal aid center which is led by the Postgraduate teachers and law students as the main body and have the broad participation of non-legal professional students, carry out legal publicity and education of university students in the school–house. On the one hand, students can provide legal counseling services by a professional teacher guidance, contact the teacher to carry out legal seminars, judges, lawyers, prosecutors, policemen and other comrades in the legal profession to make a report to the college students, as college students targeted the legal system education; on the other hand, a member of the legal Aid Center expand the legal publicity activities with the guidance of professional teachers in the school, enhance the legal awareness and legal knowledge of the other students and guide the rational behavior of students, maximize the use of a variety of resources to prevent college students crime occurred. Thus the formation of their thinking and behavior control network from campus to campus, the formation of a multisectional cooperation, play system advantages, and actively prevent campus crime.

### 47.4.4 Strengthen the Normative Role of Law, Creating the Harmony Environment for the Growth of Students

Legality, harmonious campus cannot be separated from justice, and harmonious interpersonal relationships. Students criminal cases frequently show that some "insiders" or unit only for the pursuit of "Harmony" occur at the expense of legal justice, which is contrary to the harmonious campus. Legal Education should focus on students' abilities, on one hand, enable students to develop trust with each other, to improve interpersonal skills, then they learn a better way to contact with people and master the fundamental life criteria; on the other hand, we must develop students' sense of justice, help them learn to promote justice, distinguish right from wrong, defend truth and justice. University administrators should work

through the influence of thought, the spiritual level, and infection to cultivate the sense of social justice and strengthen the collective sense of honor; one can reduce the Students' Crimes. In addition, when a crime occurs, let students have the courage to report, and assist police to investigate case. Only in this way, can enable students to carry forward the spirit of the legal system, form harmonious interpersonal relationships, thus promote the construction of a harmonious campus and create a harmonious environment for the students' growth.

In summary, in the field of governing schools according to the law, normative role of the law is particularly important. Only by paying attention to the normative role of law and show the prevention measures specifically, the complex content and ambiguous situations would not appear when popularizing law. The normative role of law is the soul and support of the propagation of knowledge of the law. To promote legal work carried out by the normative role of law and activities which meet the college students' practical and appropriate interest to actively guide student behavior and to regulate student behavior forwardly, in order to prevent the campus crime, maintain campus stability, promote harmonious campus construction, and create a healthy learning environment for the majority of college students.

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# Chapter 48
# Improved Reading Scheme for Engineering Students

**Lianwei Lu**

**Abstract** This paper analyses the college students' reading problems and points out the importance of reading, then gives some suggestions on how to improve the college students' reading ability. It is expected that with some effective ways, the reader can help students read actively and grow into effective and independent readers. How much readers understand a text depends on how much they bring into it, to be efficient readers, students can use their background knowledge of the reading text and so on.

**Keywords** Reading comprehension ability · Background knowledge · Encourage · Improve

## 48.1 Introduction

"Comprehension is the essence of reading; indeed it is the only purpose for reading". Most English reading teachers have attributed their students' poor reading comprehension to linguistic deficiencies. Consequently poor readers are encouraged to expand their vocabularies and to gain greater control over complex syntactic structures so long as to improve reading comprehension [1, 2].

Improving students' reading ability has always been a focus in College English teaching, for most Chinese people obtain information conveyed in English this way. Yet years of efforts have produced little much desired results. Widdowson

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(1983) discovered a text does not actually provide all the information for comprehension. Anderson and Pearson almost agree, arguing written symbols on the page are only indications for the readers to reconstruct the meaning of the text [3, 4].

## 48.2 The Importance of Teaching Reading

There are many reasons why getting students to read English texts is an important part of the teacher's job. In the first place, many of them want to be read texts in English either for their careers, for study purposes or simply for pleasure. Anything we can do to make reading easier for them must be a good idea [5].

Reading is useful for other purposes too: any exposure to English is a good thing for language students. At the very least, some of the language sticks in their minds as part of the process of language acquisition, and, if the reading text is especially interesting and engaging, acquisition is likely to be even more successful.

Reading is regarded as the most efficient means to obtain scientific and technological information in this age of knowledge explosion, reading comprehension is one of the aspects indispensable to learning English as a foreign language, especially our College English Syllabus. Consequently, reading efficiency has turned a serious problem to be discussed.

We can know more clearly about the importance of linguistic competence in reading comprehension as well as in the developing of foreign language learning from the above data. But we might not be sensible of the fact that most students, especially those in average colleges, do not have a systematic knowledge of basic English grammar-lexical and syntactic knowledge, nor do they attach due importance to them. So far as I know, most high schools have laid more emphasis on direct approach through reading and on simulated tests, while paying less attention to the systematic study of grammatical rules. Some learners studying English as a foreign language might think that reading comprehension is simply a linguistic word-decoding progress, or to identify words. Actually, there is a gap between knowing what a sentence mean and understanding all that the author intends to communicate on a given occasion [6].

Having identified both the problems in the teaching process and the students' difficulties, a four-step approach is thus put forward. This approach has an aspect which "is the attempt to identify micro-skills which constitutes competence as readers".

According to the schema theory (Anderson and Pearson 1984), reading involves both bottom-up and top-down information processing. The former ensures that the readers will be sensitive to the novel graphic information from the page; the latter helps them to select among alternatives a possible interpretation of the in-coming data.

Reading is not a solitary activity either. It is a communication between the reader and the writer. A good reader does not read passively only for the propositional meaning of each sentence, but more importantly, he reads for the meaning at the pragmatic level. He can understand not only its surface meaning decided by vocabulary and grammar, but also the real purpose of the writer in using a particular piece of language. He does this creating an effective discourse between himself and the writer to negotiate meaning.

## 48.3 College Students' Reading Problems

In our daily College English Teaching practice, reading becomes difficult to proceed. Many students find reading a painful experience in CET Band 4 and Band 6. Consequently, their interest in reading comprehension is greatly reduced, in turn hampering their reading ability development [7, 8].

The problem lies in the traditional way of teaching in a foreign language. Traditional Chinese teachers of English instinctively feel that words are the most basic units for meaning. Apparently, words are used to form sentences according to grammar rules; sentences are used to form paragraphs, and so on.

If reading is effective and efficient, it should be of both high speed and high accuracy. Then, what are the proper standards for reading efficiency?

"Psycholinguistics is usually divided into the study of language acquisition, language production (speaking and writing), and language understanding (listening and reading)". "Psycholinguistics also divided the process of language understanding into three main groups: word-level process, syntactic process, and message-level process". It is obvious that linguistic level processes constitute the main foundation of understanding. On the other hand, reading comprehension also involves more than linguistic decoding.

1. Some learners studying English as a foreign language might think that reading comprehension is simply a linguistic word-decoding progress, or to identify words. Actually, there is a gap between knowing what a sentence mean and understanding all that the author intends to communicate on a given occasion. According to some psycholinguistic analysis of reading process, "what was once thought to be a one-way flow of information to the brain is known to be interactive, or two-way communication between the reader's mind and the information printed". "No longer can reading in a second language be viewed as a passive progress. Nor is reading simply an active progress; rather; efficient and effective reading requires a true interaction between reader and the text". In fact, it is a multifaceted and complex progress, involving interdisciplinary knowledge in pragmatics, psycholinguistics, sociolinguistics, semantics, as well as many subskills, apart from pure linguistics [9, 10].

2. They have difficulties in understanding the text as a whole and do not know how to infer something from what they read. The subjective questions like "what is the author's attitude? How has the author organized his essay?" are difficult for them to answer.
3. They do not know what they should know or learn from the reading and from the reading material.
4. They can only read word by word, with lips keeping moving while reading silently.
5. Teachers analyze long sentence structures and then leave time for the students to do exercises on the structures, and the students stumble on unfamiliar words and are used to consulting every new word in the dictionary.

## 48.4 Suggestions on Raising Students' Reading Ability

"Comprehension is the essence of reading; indeed it is the only purpose for reading" (Richek et al. 1996, p. 154). According to my former experience of teaching English, I felt that so long as my students grasped the meaning of each word, each sentence, and each text passage, they would have no difficulty in comprehending the whole text. Therefore, in my class I focused primarily on the teaching of vocabulary and grammar in the hope that this might help students improve reading comprehension. However, the result was often, although not always, disappointing.

In order to raise the students' reading ability, let them read the passages efficiently and effectively, I do as follows.

### *48.4.1 Improving Students' Background Knowledge and Awareness*

The term "background knowledge" is sometimes referred to as prior knowledge, but also as "word knowledge, or "pre-reading knowledge". It is all the information and ideas, all the perceptions and concepts, as well as the intellectual residues of emotional expressions, held in long-term memory by readers" (Heilman et al. 1986). The importance of background information in language comprehension has been formalized as schema theory. According to the theory, comprehending a text is an interactive progress between the students' background knowledge and the text. So, if the students have specific background knowledge about the passage before reading it they will comprehend it better. When students' background knowledge of a topic increases, their comprehension also improves.

### 48.4.2 Paying Attention to Semantic Broadening

Some words lose their original senses when used in specific context. The learners must figure out the understatement when reading between the lines. For examples, "aunt" and "holiday", the older meaning of "aunt" was father's sister, but its modern referent can also be mother's sister. The word "holiday" was originally used to mean a day of religious significance because it was a "holy day". Today everyone enjoys a holiday, whether he or she is religious or not.

### 48.4.3 Paying Attention to Semantic Shift

Semantic shift is a process of semantic change in which a word loses its former meaning and acquires a new, sometimes related, meaning. An example of semantic shift is the word "silly". Quite surprisingly, a "silly" person was a happy person in Old English, and a native person in Middle English, but has become a foolish person in Modern English.

### 48.4.4 Encouraging Students to Say Out Their Ideas About the Text

Students need a lot of encouragement before they venture to talk about their thoughts into the text. They are surprised to see their differed images . This is natural, for each of them has different life experience and different standards for beauty. They should be encouraged to say out their ideas about the text.

### 48.4.5 Specific Way of Reading Practice

Specific scientific in-class training for reading efficiency is to be scheduled rather than just give techniques and test questions and let them do it at random, for there are rarely such things as natural increasing efficiency in reading unless there is the real situation or pressure besides motivation. (a) In an effort to increase both students' confidence and their reading ability, we should gradually increase reading-quantity and difficulty in limited time for daily practice rather than set only one fixed standard time and level for each band. (b) Systematically introduce reading attack skills, with emphasis on activating the reader's cognitive schemata, stimulating active reading by providing sufficient corresponding exercises for the reader to grow into habitual practice. (c) We may as well design some situational reading classes, with the help of multimedia courseware, to make the training more exciting and enjoyable, just as we do for most oral practice.

### 48.4.6 Scanning or Skimming the Text

Students need to be able to scan the text for particular bits of information they are searching for. They also need to be able to skim the text-as if they were casting their eyes over its surface-to get general idea of what is about. Just as with scanning, if they try to gather all the details at this stage, they will get bogged down and may not be able to get the general idea because they are concentrating too hard on specifics.

Reading for detailed comprehension, whether looking for detailed information or language, must be seen by students as something very different from the reading skills above. When looking for details, we expect students to concentrate on the minute of what they are reading.

### 48.4.7 Students Should be Encouraged to Respond to the Content of a Reading Text, Not Just to the Language

It is important to study reading texts for the way they use language, the number of paragraphs they contain, and how many times they use relative clauses, but the meaning, the message of the text, is just as important and we must give students a chance to respond to that message in some way. It is especially important that they should be allowed to express their feelings about the topic, thus provoking personal engagement with it and the language.

### 48.4.8 Students Have to Match Topic Sentences with the Paragraphs they Come from

It is easier for students to learn to consider the passage as a whole. It is, however, too early to look at the whole passage. The paragraph is shorter and therefore easier for students to grasp than a whole passage. So at this step, more paragraphs are suggested to be taken up for practicing the finding out of the topic sentences!

## 48.5 Conclusion

All in all, how to improve our students' competence in reading comprehension in a very close way to our own classroom teaching English as a foreign language, not far away from our own teaching demand. Since our students' mother tongue is Chinese and not English, we have every reason to strengthen our own research on

our own problems with the help of the West linguistic theories and teaching experience. To train effective readers, we should encourage our students to activate background knowledge and form a conversation with the writer so that they can read more and more quickly with better comprehension. Thus reading becomes more meaningful and interesting to them.

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# Chapter 49
# A Model of Protocol for Automated Negotiation System

**Kexing Liu**

**Abstract** Automated negotiation gives a flexible rather than a fixed price in a deal so that the payoffs of both the buyers and sellers can be maximized, and also it can ensure an efficient transaction by way of automated bargaining between negotiation agents. However, one of the difficulties of automated negotiation system is the lack of effective protocols, which are essential and fundamental in automated negotiation system. First, give the new advancements in this domain, and then give a survey of current protocols, and finally, present a protocol model of automated negotiation system.

**Keywords** Protocol · Automated negotiation system

## 49.1 Introduction

Automated negotiation can be defined as a kind of system, that applying information technology, communication technology, and artificial intelligent into negotiation area, composed with game theory, operations research, and decision theory. The bargaining process can be performed automated between intelligent agents instead of human, from the beginning to the end. Simply, automated negotiations take place when the negotiation functions are performed by (networked) computer [1]. The automated negotiation is ideally and efficiently in the environment of E-commerce.

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The agents have been successfully used in the distributed artificial intelligence (DAI), and since it is autonomous, self-interested and limited rational, agents are suitable to perform negotiation instead of human. The agents can be defined as: (1) situated or embedded in a particular environment; (2) designed to fulfill specific roles; (3) clearly identifiable entities with well-defined (and limited) resources and interfaces; (4) autonomous in the sense that they have control over their behavior; (5) capable of exhibiting flexible behavior which can be reactive, proactive, sociable, or persistent [2]. Maes points out that even though individual agents may act simplistically, the entire environment can seem to be act in a sophisticated, intelligent manner. However, the study of agent-based automated negotiation is in the stage of beginning now. COSIM for multiobjective bargaining with human customers can be considered as an intelligent artificial saleswoman [3, 4]. And also MIT, HP, IBM have present some relative model prototypes. There are lots of problems that have to be faced, briefly, the reason is that negotiation is difficult, and automated negotiation is even more so. Beam argued that it is impossible to realize automated negotiation completely by current technologies and theories of human [5, 6]. More and more people are working hardly in negotiation protocols and strategies from different angles [7, 8].

In Sect. 2, we will give a survey of agent-based automated negotiation protocols, and some famous negotiation protocol models, and then in Sect. 3, we present a basic protocol model of automated negotiation. Finally, in Sect. 4, give the discussion and future works.

## 49.2 A Survey of Automated Negotiation Protocols

Negotiation protocols is defined as the set of rules which govern the interaction [9]. Indeed, any negotiation is guided by a protocol, which describes the rules of the dispute, that is, how the parties exchange their offers, and how and when the negotiation can go on or terminate (by contrast with protocol, a strategy is a directive for deciding between different actions at a certain stage). The negotiation protocol is also referred to as 'market design' by many economists. In the agent-based negotiation, the protocol is a formal model, often represented by a set of rules that governs software processing and communication tasks, and imposes restrictions on activities through the specification of permissible inputs. Overall, the concept of protocol concern in two layers. First is about the market mechanism design for the environment and rule of a negotiation; second is the rule of agents interactive. The distinction, however, is ambiguous sometimes.

The game theory, in which negotiation has been analyzed systemically, is so important that cannot be ignored by anyone who wants to study negotiation. Nash described a two-person multi-item bargaining problem with complete information and used the utility theory of von Neumann and Morgenstern. This work has influenced many researchers and initiated extensions like the analysis of repeated or sequential bargaining games. Rubinstein calculated perfect equilibrium in a

bargaining model that involved a pie, two players, and sequential alternating offers of how to split the pie. Harsanyi and Selten extended Nash's theory of two-person bargaining games with complete information to bargaining situation with incomplete information and found that there are several equilibria. But the existing models in game theory have performed poorly in laboratory experiments and the basic assumptions of game-theoretical models are unavailable in real world. Moreover, game theory is often seen as a basic guideline for studying negotiation protocols and strategies.

The contract net protocol (CNP), described by Simith in 1980 is famous. At first it deals with the task allocation problems between agents through communication and negotiation. Then there are some extended CNP, i.e., TRACONET, it provided a formal model for bounded rational (BR) self-interested agents to make announcing, bidding, and awarding decisions. However, CNP need a formal formatted contract describe, and it is fitness for the tasks allocation negotiation, not suitable for the automated negotiation in business.

The argumentation-based negotiation protocol is another one. In this form of negotiation, agents generate and exchange arguments to back up or justify their negotiation stance. The nature and types of the arguments can vary enormously, however common categories include: threats, rewards, and appeals. Arguments have the potential to increase the likelihood and/or the speed of agreements being reached. Carles et al. described a framework for argumentation-based automated negotiation for British Telecom. However, to design and build an agent capable of effective argumentation-based negotiation, there are some key factors that should be solved: (1) mechanisms for passing proposals and their supporting arguments in a way that other agents understand; (2) techniques for generating proposals and for providing the supporting arguments; (3) techniques for assessing proposals and their associated supporting arguments;(4) techniques for responding to proposals and their associated supporting arguments.

Belief-desire-intention (BDI) protocol model for automated negotiation. Pu Huang et al. presented a formal model for automated negotiation on the internet. In the model the negotiation process is driven by internal beliefs or participating agents. Agents 'look' each other's actives and interpret these actives base on themselves' beliefs, and than justify their beliefs and decide what to do next, where the beliefs are private information. The BDI model represents a new aspect of agent-based negotiation.

The Foundation for Intelligent Physical Agents (FIPA) presented eleven interaction protocols for agent in unified modeling language (UML), i.e., FIPA English auction interaction protocol specification, Dutch auction and Contract net interaction protocol specification. FIPA's protocols are concerning in physical interactions of intelligent agents rather than concerning in the market environments or market mechanisms. There are some other relative study works: Houssein et al. presented a protocol model of multi-agent based auction for automated negotiation. Claudio et al., come from HP, trying to establish a general negotiation protocol framework; Nir et al. described a pre-auction protocol that include the processes of initiation, pre-auction, negotiations and insurance; Alan H. Karp

discussed the rules of engagement for automated negotiation; Mehdi et al. proposed a way to construct flexible negotiation protocols based on dialogue games. Iyad et al. presented a one-to-many negotiation protocol model called intelligence trading agency (ITA), and progress form negotiation, and so on.

## 49.3 A Model of Protocol for Automated Negotiation System

There are two kinds of negotiation agents, the sell agent (S-Agent) and the buy agent (B-Agent). The S-Agents, they are always selling, are fixed in the market; and for simply, we only focus on one S-Agent. The B-Agents, however, are not fixed, they come into the market stochastically with the principle of first come first serve. This is a wholesale market with same merchandise, same quality. The S-Agent can be seen as a wholesaler; the B-Agents are retailers, who can resell the merchandise in retail market. The issues that should be negotiated include price, quantity, and delivery.

### *49.3.1 The Stages and Information Form*

There are three stages in the negotiation: registration and matching stage, exchange proposals and bargaining stage, the end (with an agreement or terminate without agreement).

In the first stage, the S-Agent publish its original proposal:

SellInfo $= \{\text{sender}-\text{id}; p[\text{regist}P, \text{increase}P]; q[q_{\min}]; d[d1, d2, d3, \ldots]\}$ and then the B-Agent seek and match, if $d_s \cap d_b \neq \varnothing$, then matching is successful.

In the second stage, a B-Agent and the S-Agent exchanges their proposals one after another, the normal of a proposal in this stage is $b_{\text{time}} = \{\text{sender}-\text{id}, \text{reveiver}-\text{id},\ p[p], q[q], d[d]\}$, and $p = p(q, d),\ q \geq q_{\min}, d \subseteq d_s \cap d_b$. (the generation of price $p = p(q, d)$ will discuss in other paper).

The bargain will continue until the end with an agreement or terminate without agreement described in the negotiation rules following.

### *49.3.2 Negotiation Rules*

(1) The bargaining will always taken place between a B-Agent and the S-agent, that is to say the model is a one to one negotiation. (2) There is no co-operation between B-Agents. This means each B-Agent is independent, without coalitions or colludes, so one B-Agent cannot exchange information with other B-Agents and

the bargaining is the only way to get more information about S-Agent. (3) The require of proposals: for B-Agent, while the other attributes are not change, the prices are increased by degree: if $q_i = q_j, d_i = d_j, j > i$ then $p_j \geq p_i$; for S-Agent, while the other attributes are not change, the prices are descending: if $q_i = q_j, d_i = d_j, j > i$ then $p_j \leq p_i$. (4) Negotiation end with an agreement: if $p[p]$, $q$[q], d[d] be returned without any change, then the proposal, which can be seen as been accepted by the counterworker, is an agreement. 5) Terminate without agreement: if there is a proposal send by anyone with form $b_{\text{time}} = \{\text{sender}-\text{id}, \text{reveiver}-\text{id}, p[0], q[0], d[0]\}$, then the negotiation canceled. To present a new proposal or cancel the bargain are decided by one self's information set and his strategy set (will discuss in other paper).

### 49.3.3 The Information Set and Restrictions of S-Agent

$I_{\text{s-agent}} = \{\text{time cost, product cost, feasible delivers}\}$, and

(1) time cost, $c_{\text{time}} = C_{\text{time}}(t) = \text{a}t$, (a is a constant), is private information.
(2) Product cost, $c_p$=$C_p(d)$, the cost of product will changes with its deliver, is private information.
(3) Feasible delivers, $d_s = \{d1, d2, \ldots\}$, will be published, is common knowledge.

### 49.3.4 The Information Set and Restrictions of B-Agent

$I_{\text{B-agent}} = \{\text{negotiation cost, opportunity cost, resell price, feasible delivers}\}$, and

(1) negotiation cost, $c_n = C_n(n)$, ($n$ is the number negotiation times), is private.
(2) If a B-Agent does not bargain with the S-Agent in the market, then there is an opportunity cost, it can be seen as an average benefit that the B-Agent will gains from others. $r = R(t)$, ($t$ presents time), it is private.
(3) The resell price is a function decided by the deliver and a random variable, $p_{\text{rs}} = P_{\text{rs}}(d, \alpha)$, is private.
(4) Feasible delivers, $d = \{d1, d2, \ldots\}$, is different from feasible delivers of S-Agent, it is a private.

### 49.3.5 The Objective Function

For S-Agent, MAX $R_s(T) = \sum_i \left[p_i - c_p(d_i)\right] q_i - c_s(t)$, There are $d$ kinds of delivers products been sold with $i$ times successful negotiations in $T$ period.

And for B-Agent,

$$\text{MAX}\ \ R_b^i(T) = \sum_j [p_{\text{rs}}(d_i, \alpha) - p_i(q_i, d_i)]q_i - c_n(n) + r\left(T - \sum_k^n t_k\right)$$

Means that, one of B-Agent, whose index is $i$, bought $d$ kinds of products with different deliveries during $T$ period. And $n$ is the number of negotiations with the S-Agent, and $j$ is number of successful negotiations, for each successful negotiation $k$ it cost time $t_k$.

## 49.4 Discussion and Future Works

Protocol is the basis of automated negotiation. The protocol we introduced is different from others that have been presented. It promises the buyers come in or out freely, the venders can only wait for a negotiation proposal or refuse. This is more realities especially in Internet-based e-commerce markets. We suppose that there are $m$ venders and $n$ buyers, but only one vender who can negotiate with any buyers be concerned in the model. If a buyer in market does not negotiate with this vender, we suppose that he can negotiate with other venders but we just consider an average income.

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# Chapter 50
# Economic Theory Analysis on the Unique Development of Private Colleges and Universities

**Ran Li**

**Abstract** In the new century, how to adapt to more intense competition environment and meet the diversified demand of the modern society on talented personnel has been an issue, which is necessary for the private colleges and universities of China to confront with. This is an uncommon development opportunity, and also a serious challenge. How to make a change to the single management model similar in all schools and seek survival and development within fierce domestic and foreign competition is of powerful practical significance. In this paper, the unique development of Chinese private colleges and universities is analyzed by applying the theoretical knowledge of multiple subjects such as education economics, industry economics and western economics, and also the roles of the theory of comparative advantage, the theory of education equilibrium, and the theory of market structure in promoting the unique development of Chinese private colleges and universities are introduced, respectively.

**Keywords** Private colleges and universities · Unique development · Economic theory

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## 50.1 The Theory of Comparative Advantage and the Unique Development of Chinese Private Colleges and Universities

### *50.1.1 The Theory of Comparative Advantage*

The theory of comparative advantage is originated from the interpretations of different countries on the reasons why they established a mutual trade relationship. For a long term, it was in the core position in the interpretations of international trade and the guidance of international division of labor, and thus has become the foundation for the theory of international trade [1, 2]. Based on Adam Smith's theory of absolute advantage, David Ricardo constructed a typical model for comparative advantages under the hypothesis premise that international market was a completely competitive market, the production elements could not flow freely internationally and the returns to scales were kept unchanged [3, 4].

After the second world war, the productivity has been increased, and also the international division of labor has been further developed. Therefore, economists created new international trade theories from the perspectives of production element types and applications under the premise that the strict hypothesis in the traditional theory was loosened. The main theory is that international trade interest is the starting point of the international division of labor and its core lies in the comparative advantage of a country [5].

### *50.1.2 The Theory of Comparative Advantage and the Unique Development of Chinese Private Colleges and Universities*

Higher education is a kind of special activities, which are targeted at producing human resources. In China's higher education, the supply and demand relationship has been in an imbalance state for a long time, and also the increments of higher education resources are insufficient and the supply is in short; stock allocation is in low efficiency, providing a natural opportunity for Chinese private colleges and universities to rise.

The allocation of resources belongs to the category of economics. The principles and standards for evaluating the bad or good allocation of resources at different levels are different. The former attaches importance to the degree of balance development between departments (or regions), and the latter lays a stress on the maximum of returns. In common competitive pattern of public, private, and foreign higher education institutions, the brutality of competition decides the advantages that are necessarily pursued by colleges and universities, striving for standing an invincible position in the fierce market competition [6, 7].

The reason why Chinese private colleges and universities can still survive by coping with various difficulties till now and make great achievements is that they have successfully adapted to the development of the economy and society. In addition, the problem that personnel training model is divorced from social demands is solved by the emergence of private colleges and universities.

## 50.2 The Theory of Competitiveness and the Unique Development of Chinese Private Colleges and Universities

### *50.2.1 The Theory of Competitiveness*

In the dictionary of trade policy terms, competitiveness is defined as "an ability of an enterprise, a department or even a country to guarantee it not to be beat by other enterprises, departments or countries from the perspective of economic efficiency". Wiener, Ally, in the "Evolution of Knowledge", pointed out that competitiveness referred to an ability to provide new products at market or make an adjustment to knowledge. Fan [8] thought that competitiveness referred to the position of the products of a country in the international market. The concept of competitiveness can be ultimately understood as the concept of "cost", namely how to provide the same-quality products with a low cost or providing higher-quality products with the same cost [9].

### *50.2.2 The Theory of Competitiveness and the Unique Development of Chinese Private Colleges and Universities*

According to the intension of competitiveness, the competitiveness of private colleges and universities refers to a unique ability of private colleges and universities, which can help to support their developments and make them own a competitive advantage in comparison with other colleges and universities; it is generated in the long-term enrollment, employment, teaching, and scientific research of private colleges and universities, and contained in the organizational structure, and culture of private colleges and universities [10].

To make an improvement to the educational quality and level of private colleges and universities and cultivate their competitive advantages, the most fundamental lies in the available resources and whether environment can provide a sustainable and effective supply of resources, but the key is whether education is provided according to the actual demands of society [11, 12].

Private colleges and universities, like all other things, own no competitive advantages and are difficult to form their own competitiveness without unique characteristics. The uniqueness of private colleges and universities is mainly embodied in the special educational characteristics, management characteristics, teaching characteristics, program characteristics, course characteristics, and talented personnel training characteristics, as well as the adaptability to talented personnel training.

## 50.3 The Theory of Education Equilibrium and the Unique Development of Chinese Private Colleges and Universities

### *50.3.1 The General Theory of Education Equilibrium*

The concept of "equilibrium" was introduced by Marshall in economics. It mainly refers to the relatively static and unchanged stage of various opposite and changing powers in economy.

Education equilibrium can be summarized as "to ensure the equal educational rights and obligations can be given to citizens, relatively equal educational opportunities and conditions are provided through making and adjusting policies and allocating resources, and also a relative equilibrium between educational effect and success opportunity can be realized with the objective and fair attitudes and scientific and effective methods". The core and essence of education equilibrium refer to the relative equilibrium of the allocation of educational resources.

### *50.3.2 Education Equilibrium and the Unique Development of Chinese Private Colleges and Universities*

Higher education resource refers to the sum of all human resource, material resource, and financial resource, which are invested in higher education activities. It can be classified into two types, namely tangible resource and intangible resource. Its monetary expression form is called as the fund investment in higher education. At the present stage, although there are increasingly more demands on education day by day, educational supply is very limited, because education resource is still a kind of scarce resource. In order to alleviate the contradiction between the supply and demand of education, it is highly necessary to make optimization and allocation on education resources at all levels of education, all types of education, and all regions of education.

The development of higher education is a guarantee for the economic and social development. Also, realizing the equilibrium development of higher education is a

necessary requirement to realize the sustainable social development. Higher education equilibrium is not only a carrier of social ideal, but also a mission of social responsibility.

From the national financial aid as well as the previous educational statistics yearbooks, it can be known that the national educational finance is exclusively enjoyed by public education, while the funds necessary for the development of private colleges and universities mainly rely on tuitions. Besides, restrictions are imposed by government on the loan acquisitions and social sponsorships for private colleges and universities, and therefore the financial support of these private colleges and universities are actually in a choke point.

From the construction of the teaching staff, the teachers in both private and public colleges and universities fully own an equal legal status in theory. However, in the real practices, there are still many problems unresolved.

## 50.4 The Theory of Market Structure and the Unique Development of Chinese Private Colleges and Universities

### *50.4.1 The Theory of Market Structure*

Market structure refers to different types of markets, which are classified according to the degree of the product market competition. The theory of market structure is also called as the theory of market or the theory of manufacturer, and is a fundamental theory of new classical economics. This theory is revealing the corresponding relationship of all kinds of market structures with efficiency mainly through studying the profit maximization behaviors of manufacturers under the different market structures.

To classify market structure and make a judgment on competition degree, there are mainly three important indexes, namely the number and scale of producers, the differences of product, and the obstacle for accessing market. According to the three indexes, market structure is classified by the modern economics into four types, namely perfectly competitive market, monopolistic competition market, oligopoly monopolistic market, and perfectly monopoly market.

Samuelson thought that monopoly referred to an extreme form of imperfect competition, in which some industry was completely controlled by certain sellers and the close substitutes could be produced by no other industries; perfect monopoly was rarely seen today, and actually the typical examples only existed in the industries that were protected by governments. Because higher education own the "standard public product" characteristics, the moderate monopoly at the higher education market is reasonable. However, excessive monopoly will certainly play a negative effect on the sustainable development of higher education.

The unreasonable monopoly of higher education can be classified into economic monopoly and administrative monopoly. Although monopoly can result in a higher efficiency in the specific conditions, no dispute is directed to the fact that competitive market owns higher overall efficiency than monopoly market. Therefore, it is necessary for us to make an increase to the degree of the competition at the higher education market, for the purpose of improving the efficiency.

### *50.4.2 The Theory of Market Structure and the Unique Development of Chinese Private Colleges and Universities*

In recent years, higher education has attained a rapid development in China, and also the number of colleges and universities as well as students have been greatly increased. However, because the educational undertakings in China have been affected by the planning economic system for a long time, the development of private colleges and universities has been obstructed. Also, because market allocation is unnecessary, the resources of colleges and universities have been seriously idle. Besides, the administrative monopoly and privileges of the education field are crucial reasons for the problems in the current education. Therefore, the development of higher education has to be directly oriented at market and fully take part in the operation of competition mechanism.

Today, marketization has proven to be one of the most effective means that are used for solving the industrial monopoly problem. The fundamental significance for making an adjustment to the market structure of higher education lies in establishing a higher education market focusing on both public and private colleges and universities, and thus the forms of higher education can be diversified and unique.

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# Chapter 51
# Research of Tourism Showtime Products in the Urban Tourism Development

**Ling Guo, Di Zhu and Xiaorong Wang**

**Abstract** On one hand, in recent years, with the rapid development of domestic tourism showtime market, all parts of the country launch the tourism showtime products rich in the characteristics of local culture in order to promote the development of urban tourism; on the other hand, there exist many restrictions in the development of the sustainable usage of the products. Therefore, this article takes the development of tourism showtime products under the background of urban tourism as the research contents and takes the large-scale live-show on the water in Du Jiang Yan "Detailed Description of Du Jiang Yan" for example. It hope to point out the effects on the urban tourism of Du Jiang Yan by the diagnoses of the development status quo and the available problems of "Detailed Description of Du Jiang Yan" so as to put forward the targeted suggestions while it hope to contribute to the further exploration of the relationship between tourism showtime products and urban tourism.

**Keywords** Tourism showtime products · Urban tourism · Development · Detailed description of Du Jiang Yan · Development

## 51.1 Introduction

In recent years, with the rapid development of domestic tourism and gradually increased public awareness of entertainment, the market demand for the tourism showtime products grows rapidly. The tourism and cultural performances put on the stages in the key tourist cities and tourist attractions in China have exceeded 200 [1, 2].

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## 51.2 Overview of Tourism Showtime Products

Definition of "Tourism Showtime Products": Started from the aspect of tourists, it takes place in tourist attractions and other show sites apart from tourist destinations. The main content of it is to display the local history, culture as well as folk customs while pay attention to commercial performance and activities. The tourist showtime products form the connection between the performing programs and tourism activities [3].

### *51.2.1 Type of Tourism Showtime Products*

Type 1: large-scale live-action performance of landscape, such as Impression of San by Yang Shuo in Guilin and "Detailed Description of Du Jiang Yan" by Du Jiang Yan in Sichuan. Type 2: plaza performances including scenic plaza and community plaza. Type 3: theatre performances. "Eternal Affection in Song Dynasty Town" by Hangzhou Song Dynasty Town, "Lishui Jinsha" by Li Jiang in Yunnan and "Reflection of Yunnan" by Yunnan are the representatives. Type 4: Feast dancing performances which is the integration of dining and performing, such as "Imitated Lewoo of Tang Dynasty" by Tangle Temple in Xian.

### *51.2.2 Characteristics of Tourism Showtime Products*

#### 51.2.2.1 Performing Activities that Take Tourist as the Targeted Market

Tourism showtime is directed at the tourist. The travelers namely the viewers have the feature of allocator. However, the traditional showtime are somewhat more localized.

#### 51.2.2.2 Outstanding Manifestation of Regional Culture Characteristics

The tourism showtime attaches great importance to the exploration of the local cultural resources and connotation and with the use of various entertainment means and the package of showtime forms make the regional culture show the glamour that has never happened in the past, so as to create powerful travelling attraction for tourists [4].

#### 51.2.2.3 Attach Importance to Entertainment

Under the premise of ensuring of the artistry, the tourism showtime products will pay more attention to the embodiment of entertainment. For example, comprehensively use various forms of artistic expression, blend dance, magic, and acrobatics into the performance as well as combine the modern high-tech means to strengthen the visual and audio effects and create the entertainment atmosphere [5].

#### 51.2.2.4 Forceful Commerciality

The investment in the tourist showtime products is mostly high, so the implementation of marketized operation is the inevitable choice.

## 51.3 Development Status Quo of "Detailed Description of Du Jiang Yan"

Du Jiang Yan is one of the first batch of "the excellent tourism cities in China". Because of its great ancient Du Jiang Yan Irrigation Project and the birthplace of Taoist culture of Qingcheng Mountain, it becomes the world-famous international tourist city [6].

The theater of "Detailed Description of Du Jiang Yan" is located 500 meters above the fish month of Du Jiang Yan Water Conservancy Project. It is also the first relics theater of China. Its location reflects the relationship of heaven, earth, and humankind. The high-tech technologies of sound and light as well as the wave making are adopted in the performance creating the dreamlike and the picturesque scenery by the huge dragon rising from the water, rape flower scattered all over the theater, and other large-scale setting [7].

## 51.4 Influence of "Detailed Description of Du Jiang Yan" on the Development of Du Jiang Yan Urban Tourism

### *51.4.1 Enrich the Cultural Connotations of Du Jiang Yan and Promote the Re-Recognition of the Tourists of the Image of the City of Du Jiang Yan*

The performance of "Detailed Description of Du Jiang Yan" takes the long standing "water" culture and the extensive and profound "Taoist" cultures' the themes and by various forms of artistic expression and high-tech means to create a

Exposure visual feast vividly reappear the historical image of the ancient city of Du Jiang Yan, so that the cultural connotation is enriched and the experience of the tourists on Du Jiang Yan is deepened and promote the reconsideration of the city image of Du Jiang Yan in their watching.

### *51.4.2 Enrich the Urban Tourism Product Systems of Du Jiang Yan and Enhance the Attractiveness of Urban Tourism in Du Jiang Yan*

The launch of "Detailed Description of Du Jiang Yan" fills the gap of tourism and showtime market of Du Jiang Yan, enrich the urban tourism product systems of Du Jiang Yan as well as add new night tourism and cultural projects of Du Jiang Yan. A certain extent, changed the traditional way of travelling of "view the temple in the daytime and sleep at night" is changed to some extent.

### *51.4.3 Create Certain Conditions for Development of the Economic Development and Tourism Industry Chain of Du Jiang Yan*

Because the performance usually takes place at night in Du Jiang Yan, it brings an opportunity to the accommodation and catering industry to increase revenue to certain extent and promote the development of the tourism economy in Du Jiang Yan and it equips with the conditions to develop related tourism derivatives based on it.

## 51.5 Analysis of the Available Problems in "Detailed Description of Du Jiang Yan"

It has been no less than 2 years since the official performance of "Detailed Description of Du Jiang Yan". It is still in the early stage. There remain many places to be improved. Therefore, in the course of its development some potential problems are inevitably exposed which need to be analyzed and solved.

### *51.5.1 The Form of the Programs is Simple and the Products Lack of Innovation*

Although the theme of "Detailed Description of Du Jiang Yan" culture of "water" and "Taoist" exclusively owned by Du Jiang Yan and the geographical features

are distinctive enough, but many viewers think it is boring or do not understand after watching the performance. The reason lies in that the form of expression is still stereotyped and lacks of the unique and innovative design.

### *51.5.2 Lack of Publicity and Sale Promotion*

According to the questionnaire on the performance of "Detailed Description of Du Jiang Yan". The main ways of the viewer to obtain the performance information of "Detailed Description of Du Jiang Yan" are: recommendation by others, tourist information center, propaganda and introduction by travel agencies, radio, television, newspaper publicity, tourist classified DVD, book introduction and the website introduction. Most of them choose "recommendation by others" which is the most original channel. The most widely used promotion channels radio, television, newspapers account for 20 %.

### *51.5.3 The Target Market Lacks of Maneuverability*

The tourism performance of "Detailed Description of Du Jiang Yan" is not created for the locals of Du Jiang Yan but created to face the markets namely the tourists. The tourists are divided into two kinds: those who come to Du Jiang Yan to stay overnight and those who come to Du Jiang Yan but will not stay. The performance of "Detailed Description of Du Jiang Yan" can reflect the excellent effects in the evening. So its targeted audiences must be the tourists who will stay overnight in Du Jiang Yan. This group should be the main force and the targeted market which does not yet possess the maneuverability. It is learned that in 2010, the matched tickets of Du Jiang Yan scenic spots were 50 % off (day trip) and in 2011 matched long-trip markets can enjoy 60 % discount. But it still cannot continuously drive tourism team market. It is mainly because that it cannot let the travel team to stay, which cannot turn the possibility into maneuverability. As the performances of "Detailed Description of Du Jiang Yan" are carried out in the open air. Because it sometimes rains and it gets cold, the usually occured problems make it not easy for the travel agencies to include it in the itinerary or recommend travel journey list, even if the tour groups can stay overnight, it not necessarily possess the actual operability.

### *51.5.4 Other Disadvantages*

As mentioned above, the reason for the tourists especially tour group that are not easy to stay overnight in Du Jiang Yan is mainly that it has something to do with the location of Du Jiang Yan. In addition, directed at the nearest large markets-the

transit visitors organized by Chengdu to came to watch the performance is not realistic. Because the cost of time is high, moreover the performance itself is not attractive enough and other reasons.

In addition to the above problems, "Detailed Description of Du Jiang Yan" There exist the problems of the lack of the back-up professionals and versatile talents and the performances easily impacted by bad weather.

## 51.6 Suggestions on the Further Development of "Detailed Description of Du Jiang Yan"

### *51.6.1 Innovate the Program Forms and Improve the Competitiveness of the Products*

The program content, theme, and live performance effects of "Detailed Description of Du Jiang Yan" itself are favorable. If on the basis of ensuring of the quality of performances, take more efforts in the extension and innovation of the forms, it must bring the visitors the more intuitive and surprising experience.

### *51.6.2 Further Strengthen the Efforts of Publicity and Promotion*

Make more promotion of new media and websites and quickly establish the brand image. Put on the targeted market the advertisements for the flights entering Sichuan. Choose Chongqing as the key market based on the tourist source constitution of years in the scenic spot and comprehensive advantages of Du Jiang Yan in the field of location, transportation and tourism providing and relaxing on holidays. Put image advertisement on Chinese Tourism Newspaper and the print medias influential in the targeted market like Beijing, Shanghai, Guangzhou, Xi'an, etc.

### *51.6.3 Actively Opening Up the Target Market*

With the integration of the existing resources and the supported policies of the scenic spot tickets and hotels, focus on the development of the tour group resources; attach importance on the group-buy supported by individual purchase. It can be realized by the government departments to provide the tour group with the subsidies to check in hotels. The conference teams that stay at the local hotels should be included while not giving up the individual market. Our own direct sales

departments could be also established in Chengdu and Chongqing to vigorously develop the markets in Chengdu and Chongqing. While stabilizing the market in Chengdu and developing the market in Chongqing, make radioactive development of the prefecture cities that has better markets within Sichuan Province like Deyang, Mianyang, Zigong, Yibin, etc. More importantly do the publicity and promotion well among large-sized enterprises and public institutions and the individual groups that travel by car apart from the travel agencies in the markets.

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# Chapter 52
# Innovation of Souvenir Design of Red Museums in Jiangxi Province

**Liqin Ji**

**Abstract** In this paper, through the analysis and research on the current situation of the souvenir designs of the domestic and foreign revolution-oriented museums, it is expected that the essence can be absorbed and also dregs can be eliminated. Considering from multiple aspects such as the cultural intension, the market direction, and the characteristics of museum collection resources, on the basis of reserving the traditional revolutionary culture, and by breaking through the conventional thinking model, the decorative souvenirs, which are of educational significance and also can meet the demands of the times, are designed, promoting the transitional revolutionary education to drive Chinese people at every moment and educate Chinese people generation by generation. At the same time, the groups of consumers can be expanded, the sales amount of the souvenirs can be greatly increased, and the economic benefits of the red revolutionary museums can be improved. As a result, the red tourism can be promoted with higher efficiency.

**Keywords** Museums · Souvenir design · Creative industry

## 52.1 Introduction

At the present time, red tourism has changed into one of the most important route of multiple tourism products, in which the museums for the holy lands of all revolutions have become one of the places that almost tourists will certainly pay a visit to. In the process, the design of the souvenirs which are provided by all sorts

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of red revolutionary museums plays a very important role [1]. It is one of the means to encourage the modern people to firmly bear the histories in mind and strive to be strong at every moment. Therefore, it can not only give a reflection to the specific historical events, but also can meet the demands of the modern people on the exhibition. Jiangxi province is not only the cradle of Chinese revolution, but also a holy land of revolution. The design of the souvenirs in the multiple red museums of Jiangxi province, should be given top priority to the exploration on the innovation, but does not stay at the original direction [2].

## 52.2 The Analysis on the Current Situation of the Souvenirs Inside and Outside Jiangxi Province

It has been well known in China that Jiangxi province was the cradle of Chinese revolution, in which a great number of red revolutionary museums with great memorial and education significance have been established successfully, such the Museum in memory of the "uprising on Aug. 1 Nanchang", the Most Beautiful Holy Land Red Capital Rui-jin in Revolutionary Period, and the Museum in memory of revolutionary heroes sacrificing their life in Shangrao Camp.

In 2009, one of the subactivities of China (Jiangxi) red tourism fair-Tourism Products Trade Fair was held in November 13. On this tourism products trade fair, there were 210 booths in total for tourism enterprises, and more than 600 tourism enterprises and institutions from 16 provinces (cities) such as Guangdong province and Zhejiang province as well as seventh cities of Jiangxi province took part in exhibition, and simultaneously a great number of travel agencies could be seen anytime. On the fair, the exhibition areas that were especially established for the souvenirs of the red tourism received the highest attention from people. The exhibited articles for the red tourism of Jiangxi province mainly comprised of the local souvenirs such as the coins, bamboo hats, stamps and straw sandals used by red army man during the period of Jinggangshan Struggle [3, 4].

Therefore, it can be seen that the market for the souvenirs of the red tourism in Jiangxi province is still very wide and promising.

In addition, on the Second China (Beijing) International Cultural and Creative Industry Expo, all kinds of cultural products such as films, television, and cartoon works that are full of creative inspirations appeared in the eyes of people, and also changed into a series of spray in the tide of this cultural creative industry.

However, at present , the themes in the designs of the souvenirs in the majorities of red revolutionary museum are mainly concentrating on witnessing the historical events and recording the red cultural relics of the revolutionary stories.

However, in recent years, along with the rising of the red culture, more and more people have begun to set foot on a red tour.

In the mean time, people will choose a commodity as the souvenir of tourism when paying a visit to the revolutionary cultural relics in museums and memorial halls, and this has become a trend as well.

## 52.3 New Direction for the Souvenir Design of the Red Revolutionary Museums in Jiangxi Province

### *52.3.1 Continuously Enriching the Cultural Intension of the Souvenir Design of the Red Revolutionary History Museums*

During the period of developing and designing the souvenirs the red revolutionary history museums, the most important is how to permeate, integrate, and rub cultural elements into the development of all kinds of tourism products in the red revolutionary history museums, for the ultimate purpose of promoting the tourism products to be with soul, main line, and high grade [5].

At present, the model of the habitual thinking takes a dominant position in the design of the souvenirs of the most red revolutionary history museums.

The so-called model of the habitual thinking refers to a habit of thinking, which is formed in a specific environment and a relatively fixed model after a long-term, repeated, specific, and strengthen training.

In the mean time, the model of the habitual thinking occupies a leading role in the design of the souvenirs of the red revolutionary history museums.

At present, the development conducted by the majorities of the red revolutionary history museums in Jiangxi province still stays at the reproduction of relevant cultural relics [6]. This can certainly give a reflection to the preciousness of the collection in the museums, but also is of great collection value and appreciation value.

However, originality is never equal to imitation; the simple reproduction of the relevant cultural relics is only a misreading of the development of the souvenirs in the red revolutionary history museums, and also is a practice that is the most superficial.

In the foreign countries, the amount of the sales of the reproduced cultural relics only accounts for 6 % of the sales income of commodities.

### *52.3.2 Orienting at the Principle of Market*

It is necessary for the developers of the red tourism products to offer multi-level and diversified individualized souvenirs and develop the red cultural tourism with market attraction in the red revolutionary history museums by taking market as

standards and culture as guidance and according to the demands of tourists, the different groups of market, and the characteristics of the red cultural tourism resources of all local places [7].

Therefore, in the development, it is necessary for the developers to create the tourism products that can not only meet the demands of tourists on cultural consumption and also can stimulate the interests of tourists in accordance with the different levels of market demands.

In the types and functions of the souvenirs, it is necessary for the developers to provide more as far as possible. The added types of souvenirs are mainly of collection value, such as stamps and coins. In addition, there are decorative souvenirs such as some miniature sculptures, and functional souvenirs such as bookmarks, fridge magnet, and bags.

Although the types of the souvenirs have been increased in the red revolutionary history museums, the works are still in shortage of the rational designs with innovative concept and made in accordance with the original pattern for a great number of years [8].

However, these types of souvenirs in the red revolutionary history museums can only play a role of education, but do not have a progressive process.

Seeing some favorite souvenirs from the red revolutionary history museums at home after receiving an education in patriotism from museum and school can remind our next generations not to forget history at every moment, but cherish the life that is won with great difficulties.

### *52.3.3 Combining the Collection Resources in Museums and the Modern Life and Improving the Added Values of Cultural Relics and Commodities in Museums*

Red culture tourism is a kind of cultural activities that are full of hopes and originalities.

On the one hand, it is necessary to make innovation on the cultural ideas that meet the needs of the times.

On the other hand, it is necessary for the profound cultural intensions to be displayed through the innovative cultural expression means and forms, for the purpose of meeting the requirements of the modern tourists on aesthetics and development level of the science and technology at the present time.

Therefore, as the most important focus of the red tourism, it is necessary for the development and design of the tourism souvenirs in the red revolutionary history museums to continuously insist on innovation.

Design concept is a dominant idea that is determined by the designer in the process of conceiving space works. Generally, it is the design concept to endow the works with cultural intensions and style characteristics.

A good design concept plays a very important role. It is not only the quintessence of design, and simultaneously can promote the works to own a b personalized, professional and highly different effect.

Relying on the souvenirs to give prominence to the characteristics of the red revolutionary history museums and promoting increasingly more people to remember museums are the real purpose of multiple red revolutionary history museums to develop the souvenirs.

Besides, the design concepts for the designs of the souvenirs in the non-revolution oriented museum have been changed, and do not stay at a brochure or a cultural t-shirt, but make use of all sorts of fashionable items as the souvenirs that have been decorated with creative ideas.

It should be mentioned that opening up a creative industrial market has become one of the most important subjects as well as a consensus in the whole museum industry in the process of the continuous development and transformation in addition to the functions of protection, inheritance and displaying.

In China, it is beyond all doubts that the development prospect of the museum creative industry is very wide.

However, it is still in its preliminary stage after all, and also the museums developers are in shortage of clear recognition on the development of the tourism souvenirs with a special memorial meaning in museums.

In face of increasingly more and diversified groups of audiences, how should the red revolutionary history museums do to make their souvenirs more creative and own a wider market?

At the expo sites, Beijing Art Museum designed a series of "blue & white porcelain" memory products including bracelets and necklaces by making use of the blue and white porcelains during the period of Yuan Dynasty as the art elements, and simultaneously the collected blue and white porcelains that were made during the period of Yuan Dynasty keeps a harmonious image with the modern products with extremely rich modern styles, making people find fresh and new things from these works.

Therefore, Ling YANG, curator of the Beijing Art Museum, said that they attached the highest importance to the improvement of the cultural relics and commodities in museum through the combination of the collection resources and the modern life of people. This point of view is also advocated by Yongsuo Han, who is the standing vice curator of Capital Museum. He said that the collections in the museum were "the most fashionable" works of an area, a nation and a country within a specific historical period, and the essence of the creative industry was how to promote these "fashionable old things" to emit new fashions in the modern times.

All the above museums possess their own unique collection resources. At the same time, in these museums, the collection resources and the modern life of people are combined together, thus making the original values of the souvenir greatly increased.

Also, the red museums in Jiangxi provinces have their own special collection resources as well, and how to allow these special works to be decorated with a "fashionable" coat is the new design direction of the author in this paper.

## 52.4 The Prospect of the Souvenirs in Red Museums

The tourism souvenirs in the red museums are a very important part of the red tourism in Jiangxi province, and also one of the means for promoting the education in patriotism. Therefore, the design of the tourism souvenirs in the red museums should never be lightly thought.

Some management personnel, from the cultural companies of the United States, considered that the construction of the industry chain plays a particularly important role in the creative industry of museums.

In many foreign countries, in the field of museums, a related cultural creative industry that attains a very mature development has been in existence. In the mean time, the development of the tourism souvenirs has changed into one of the daily tasks that are highly emphasized by the museums in the foreign countries.

It is said that after 20 years of development, the creative products from the museums of the United States have been involved in the competition in society as an elegant-cultural communication platform, thus bringing about a great number of huge profits to museums.

It is reported that the amount of the sales in the stores of museums has accounted for 21 % of the total annual income of the foreign museums. The acquisition of these figures depends on a relatively complete industrial chain. Several departments can participate in the division of labor, and then are responsible for proposing concepts, putting into implementation, making marketing plans, and doing market research, respectively.

Therefore, a series of products can be developed with a gradual step.

## 52.5 Conclusion

From above analysis, it is necessary for Chinese museums to introduce the advantages of the designs of the tourism souvenirs in all sorts of domestic and foreign museums, and then constantly make innovation on the design of the tourism souvenirs in the red museums of Jiangxi province, making them to develop a mature cultural creative industry.

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# Chapter 53
# Study on China's Rural Bank Credit Risk Prevention

**Jinli Kang**

**Abstract** Rural banks are the banking financial institutions which are mainly established in rural areas for providing the local peasants, agriculture, and rural economic development with financial services. The orientation and purpose of banking services in rural areas are serving for the three rural issues (agriculture, peasants, and rural area) and the economies of small and medium-sized enterprises in counties. With rural banks, not only the difficulty of peasants in getting loans can be solved, but also the credit demands of enterprises in rural areas can be satisfied, the financing bottleneck of the development of township enterprises can be eased, and the fund supports can be provided for the construction of new rural areas. Therefore, the construction of rural banks is of important practical significance for solving China's three rural issues. However, rural banks, as a new type of thing, have their own unique risks in comparison with the domestic and international and large banks.

**Keywords:** Rural banks · Credit risk · Risk prevention · Suggestions

## 53.1 Introduction

The development of finance in rural areas cannot blindly rely on financial supports. Therefore, the establishment of banks in rural areas can play a great role in solving the problems such as the low coverage rate of rural banking financial institutions network, the insufficient funding, and the unbalanced financial supply and demand [1].

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The management risk and operational risk of banks in rural areas are homogeneous with large banks in other areas. However, because of the business environment and oriented customers, rural banks have their own special characteristics of credit risk [2]. Besides, effectively controlling credit risk is of important significance for the realization of the long-term development of rural banks.

## 53.2 Definitions of the Concepts Related to Rural Banks

### *53.2.1 The Concept of Rural Banks*

Rural banks refers to the banking financial institutions, which are approved by China Banking Regulatory Commission (CBRC) in accordance with relevant laws, rules and regulations, funded by domestic and foreign financial institutions, domestic nonfinancial institutions business entities and domestic natural persons, and established for in rural areas for providing the local peasants, agriculture and rural economic development with financial services [3]. The orientation and purpose of banking services in rural areas are serving for the three rural issues (agriculture, peasants, and rural area) and the economies of small and medium-sized enterprises in counties. Thus, the principle of "small size and scatter" and the principle of commercial sustainable development can be realized, and also loan-deposit service will not exceed the economic regions of counties [4].

### *53.2.2 Market Position of Rural Banks*

Rural banks always persevere in the market position (i.e., peasants' banks and serving for the three rural issues), as shown in Table 53.1.

### *53.2.3 Definition of Credit Risk of Rural Banks*

Credit risk mainly refers to loans, but the asset range should be wide, including other financial products. However, compared with other large banks, the products

**Table 53.1** Peasants' banks and serving for the three rural issues

| Stage of development | Key customers | Supported industries | Business model |
|---|---|---|---|
| The first type | Peasants | Crop cultivation; Breeding | Supporting the poor |
| The second type | Peasants | Crop cultivation; Breeding; Individual industrial and commercial enterprises | Win–win |
| The third type | Peasants | Crop cultivation; Breeding; Individual industrial and commercial enterprises; Private enterprises | Competition |

that are provided by the rural banks of China are relatively single and only limited to the traditional deposit-loan service and the existing products innovations. For this reason, the analysis on credit risk in this paper is mainly targeted at credit risk.

## 53.3 Empirical Analysis of Current China's Rural Bank Credit Risk

Credit risk is one of the oldest and primary risks necessary for banks to confront with. The congenitally deficient and potential credit risk of rural banks is huge.

### *53.3.1 Essential Situation of RUIXIN Rural Bank*

RUIXIN Rural Bank was started by the Rural Credit Association in Xifeng District of Qingyang, and the registered capital was 40 million RMB. As it was started not for a long time, RUIXIN Rural Bank only provides deposit-loan service and some simple settlement service, as shown in Table 53.2.

By the end of June 2010, the total balance held on deposit in RUIXIN Rural Bank was 240 million RMB, and the total loan balance was 230 million RMB. In Fig. 53.1, the deposit and loan balances in RUIXIN Rural Bank from the business starting to June 2010 are shown.

### *53.3.2 Analysis of the Potential Credit Risk of RUIXIN Rural Bank*

Some credit service procedures and operation methods have been formulated by RUIXIN Rural Bank. However, in practical operation, there are problems such as

**Table 53.2** Loan service of RUIXIN Rural Bank for peasants

| Types of credit | Target customer | Credit ceiling | Assurance responsibility method |
|---|---|---|---|
| RUIXIN "Happy farmhouse" | Applicable to the peasants with capital demand souring from small-scale production or small-consumption | ≤50,000 RMB | Personal credit |
| RUIXIN "Enriching peasants and doing pioneering work" | Applicable to the individual business, or the peasants with demands souring from leaving home and working in urban areas | ≤1.5 million RMB | Mortgage or guarantee |
| RUIXIN "Star of enterprises" | Applicable to the rural private business owners, rural economic organizations, and enterprises and institutions | ≤1.5 million RMB | Mortgage or guarantee |
| RUIXIN "Happy homestead" | Applicable to the peasants with demands on purchasing houses, cars, and home decoration services | <200,000 RMB | Mortgage or guarantee |

using loan as mortgage, cross-guarantee, repeated guarantee, and huge potential risk because of internal personnel factor and rapidly-expanded business, etc.

## 53.4 Analysis of the Causes for the Credit Risk of Rural Banks

Here, RUIXIN Rural Bank is taken as an example to analyze the main causes for the credit risk of rural banks in China.

### *53.4.1 The Poor Ability of Peasants in Investment and Profit-Making and the Weak Consciousness of Rural Business Entities in Credit*

Chinese peasants, as a group of relatively low cultural quality, are in shortage of the understanding of financial knowledge and also do not acquire full knowledge. Therefore, they cannot select the aspects helping them acquire investment and profit-making. Especially, the consciousness of some peasants in investment is rather weak.

Another reason is that many rural business entities always do not keep their words because they are affected by social system and the whole credit environment.

### *53.4.2 Lacking Acceptable Collaterals*

The mortgage and pledge articles, which are provisioned by RUIXIN Rural Bank as collaterals, include deposits, communication tools, real estate, deposit receipt, and bank's stock. However, the lands and houses of peasants cannot be used as collaterals, because the property rights are unclear and also difficult to handle.

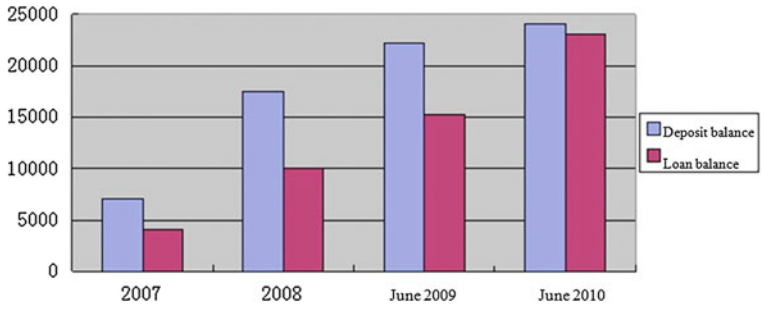


**Fig. 53.1** Deposit and loan balances in RUIXIN Rural Bank

### *53.4.3 Great Affects from the Characteristics of the Agricultural Production and the Natural Conditions*

The traditional agricultural economy is greatly dependent on the natural conditions, easy to be affected by dependents and based on a certain cycle. Therefore, it has great risks. The constructions of China's rural areas and the small and medium-sized enterprise credit guarantee system are still in a fledging period. Because of the absence of guarantee agencies and collaterals cannot be provided by peasants and rural small and medium-sized enterprises, issuing a loan is full of risks for rural banks.

### *53.4.4 Imperfect Credit Reporting System in China*

The credit reporting system has not been completely established in China, and only some simple provisional regulations and management methods are issued by the People's Bank and China Banking Regulatory Commission (CBRC) for the credit business of rural banks. However, the specific implementation rules for the prevention of credit risk have not yet been made.

### *53.4.5 Asymmetric Information Between Rural Banks and Peasants*

There has been not a perfect credit reporting system for calculating the credits of peasants because the oriented objects of rural banks are with no credit records mostly. In addition, the financial system of the small and medium-sized enterprises in rural areas has not been sound in general. Therefore, the financial statements provided by these enterprises are distorted sometimes, and cannot accurately give a reflection to their financial conditions.

## 53.5 Measures for the Prevention of Rural Bank Credit Risk

The credit risk, which is caused by creditor, can be prevented from the following aspects.

### 53.5.1 Providing Helps for Peasants within the Ability and Enhancing Their Credit Consciousness

It is necessary for rural banks to adhere to the purpose (serving for rural areas), advertise the credits of peasants and rural small and medium-sized enterprises, and increase the credit consciousness of peasants and rural small and medium-sized enterprises, and prevent credit risk.

### 53.5.2 Perfecting the Rural Mortgage System

The Guarantee Law and Property Law of China have clearly shown that the rights to use agricultural land and the homesteads are prohibited as mortgages. On July 28, 2010, the Guidance Suggestions on Comprehensively Promoting the Innovations of Rural Financial Products and Service Models was jointly released by the People's Bank of China, China Banking Regulatory Commission, China Securities Regulatory Commission and China Insurance Regulatory Commission, in which the idea of exploring and developing the mortgage loan services of rural land lease-holding right and homestead use right was proposed. Therefore, the corresponding mortgage loan pilots are explored, and also the effective ways and means for issuing a loan to agriculture, rural areas peasants and increasing credits are enriched.

### 53.5.3 Accelerating the Construction of China's Credit System

The construction of the rural credit system involves various sectors. Therefore, it is necessary to speed up the construction of the rural credit system, and play the powers of all aspects under the leading of government, including not only all kinds of rural financial institutions, but also industry and commerce, taxation, public security and communication, and other departments. Thus, the rural credit system can be commonly constructed.

### 53.5.4 Speeding up the Construction of the Credit Guarantee System

From the domestic and foreign situations, it can be seen that guarantee agencies have three models: policy guarantee agencies, commercial guarantee agencies, and mutual guarantee agencies. Generally, the number of policy guarantee agencies is small. There are a great number of commercial guarantee agencies, but most are

targeted at profit making and guarantee fees are high. Mutual guarantee agencies means that a guarantee fund is produced by small and medium-sized enterprises and peasants within the communities of a range, in which members provide guarantees for each other. In China, the policy guarantee agencies and the mutual guarantee agencies are more feasible. Therefore, it is necessary to speed up the construction of these two models, for the purpose of reducing rural bank credit risk.

### *53.5.5 Visiting Peasants Frequently*

To overcome the source of the asymmetric information between two sides and realize the control of credit risk, it is necessary for rural banks to collect the information as much as possible within the range of controllable cost, ease the information asymmetry, and gradually accumulate the mutual understanding and trust through a large amount of face-to-face communication with customers.

## 53.6 Conclusion

The rural banks in China emerge for solving the unbalanced supply and demand of rural finance. It is necessary for rural banks to confront with all sorts of problems in their rural markets because they are mainly oriented at rural areas and regard peasants and rural small and medium-sized enterprises as the main customers. Also, in the control of credit risk, rural banks can draw lessons from the practices of foreign community Banks, domestic large state-owned Banks, and informal financial institutions. However, the prevention of the credit risk of rural banks needs the cooperation of all sectors. Only in this way, the rural banks can be promoted to better serve for the construction of rural areas and the "three rural issues".

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# Chapter 54
# Empirical Analysis of Stock Futures Arbitrage

**Chang Li**

**Abstract** Along with the development of the financial markets in China, stock index futures play an important role gradually in arbitrage, which contributes to the equilibrium pricing of stock index futures. This paper reviews Cost of Hold pricing model to determine arbitrage-free interval and gives an empirical analysis of the arbitrage of the CSI 300 stock index futures to reveal that there are widespread arbitrage opportunities in securities market of China. This paper begins with the simulation of the spot portfolio combination and then studies the Listed Open-Ended fund and ETF fund. Based on analysis of the 5-month data and no-arbitrage interval, we give a concrete arbitrage operation to put the arbitrage strategy in practice. At the end of the article, we give analysis of existing problems in stock index futures markets and put forward corresponding solutions so as to build a prosperous and stable financial market.

**Keywords** Stock index · Arbitrage · Empirical analysis

## 54.1 The Research Background

### *54.1.1 Introduction*

Along with the development of modern finance, financial derivative is gradually becoming an important part of the financial market. As one of the derivatives, stock index futures have a rapid development in nearly 30 years [1]. Since Kansas

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futures exchange (KCBT) launched value line index futures contract in 1982, the international stock index futures have a continual development. It is the shortest derivative in financial history while has the fastest growing. After the 1990s, stock index futures are introduced in many countries, greatly enriching the financial market and providing multiple investment options for the investors [2].

### *54.1.2 Stock Index Futures Review*

Stock index futures are traded in terms of number of contracts. Stock index futures refer to agreements to buy or sell a standardized contract of stock index on a future date at a specified price determined by both sides.

Stock index futures share the features of two financial products: stocks and futures. However, there still exists an extreme difference between the stock and futures. First, the stock index futures are different from common stocks. We could easily notice that stock index futures have a specific holding period, forced margin deposit system and the fixed futures exchange. It allows short sales and executes T + 0 deal, which reflects highly speculative and risky feature. Second, the stock index futures are different from the general futures [3]. It is the underlying assets of stock index. Meanwhile, the price of stock index futures is united and public. Therefore, it overcomes the problem of the lag of regional and information in the field of commodity futures, which improve the efficiency and gain the advantages over the other type of futures [4].

## 54.2 CSI 300 Stock Index Futures Arbitrage Research

### *54.2.1 CSI 300 Stock Index Futures Profile*

On the date of April 16, 2010, China's stock index futures: stock index futures CSI 300 is officially listed in China's financial exchanges. CSI 300 index is based on December 31, 2004 and its basis points are 1,000 points. The calculation is used with the adjustment of the equity in weight. Among them, the adjustment according to the classification method by file share capital gain, and at the same time CSI 300 index adjusts stocks regularly [5].

CSI 300 index is considered China's first formal stock price index. It centralizes the companies in Shenzhen and Shanghai which own higher market value, better liquidity, and stronger profit ability, accounting to 60 % of the market capitalization of Shenzhen and Shanghai. It is very beneficial for the Chinese stock market investors to grasp the whole operating macroeconomics condition [6].

### 54.2.2 Analysis of Arbitrage-Free Interval

We assume that in time $t$, spot price is $S$ and futures price is $F$. While in time $T$, spot price of the same security is $K$, the risk-free rate is $r$ and the stock dividends are $D$. Then we can simulate two combinations: Firstly, we borrow $S$ cash in time $t$ to buy spot asset. Then in time $T$, the net profit is $K + D - Se^{r(T-t)}$.

Second , we sign a stock index futures contract in time t that is delivered in time $T$. If we do not close out a position in advance and the risk of margin account shortage is free, then the net profit in time $T$ is $K–F$.

In time $t$, no investment was put in these two combinations so that in the final time $T$ the profit of two combinations should be equal

$$F = Se^{r(T-t)} - D \tag{54.1}$$

$F > Se^{r(T-t)} - D$, the profit of the second combination in $T$ will be less than that of the first combination. Then we should borrow money at the risk-free rate to buy stocks in the beginning and hold a short position in the futures market at the same time until $T$. We can get a risk-free profit of $F - Se^{r(T-t)} - D$.

$F < Se^{r(T-t)} - D$ the profit of the second combination in $T$ will be more than that of the first combination. Then we should borrow stocks, sell them to get the money and invest the money with risk-free rate in the beginning. At the same time, we should hold a long position in the futures market to time $T$ and then return the asset got from the futures market. We can get a risk-free profit of $Se^{r(T-t)} - D - F$.

We consider the simplest transaction costs $C$ $T$. Because of the volatility of the transaction cost, if futures arbitrage opportunities do exist, we can get the arbitrage-free interval:

$$[Se^{r(T-t)} - D - C_T, Se^{r(T-t)} - D + C_T] \tag{54.2}$$

When the futures price is higher than the upper bound, we can make a positive arbitrage (long spot, short futures). When the futures price is lower than the lower bound, we can make a reverse arbitrage (short spot, long futures). While in arbitrage-free interval, investors are unable to conduct futures arbitrage behavior. After choosing arbitrage portfolio, we will study further on transaction cost to analysis how the transaction cost influences the behavior of arbitrage.

### 54.2.3 Arbitrage Risk

In the arbitrage process, because the uncertainty of the market will lead to hedge risks which mainly display in the following respects.

First: shorting limitation. As there is no shorting mechanism of stock index at present, we cannot have reverse arbitrage.

Second: macroeconomic situation fluctuations. Because the stock index futures trading in macro process is likely to have major change, so it may lead to arbitrage risks.

Third: the uncertainty of the dividends of the company. The dividends in Chinese company have no relation with the company profitability with much uncertainty.

Fourth: the spot simulation tracking error. We must calculate the simulation of the underlying index. We need to build a corresponding index funds or other investment combination. While there must be some errors to simulate the spot portfolio. It is necessary to know the tracking error between the simulation portfolio and the stock index.

### *54.2.4 Spot Portfolio Selection*

In the process of arbitrage, we cannot directly buy stock index futures so we must buy funds to complete the simulation of the spot market for the corresponding stock index. Therefore, we must choose the right spot index combination to simulate arbitrage better.

For investors, the proper spot arbitrage portfolio must meet the following conditions:

First, it should have a high correlation with CSI 300 index;

Second, the transaction cost of this portfolio should be low to form a large arbitrage space for the investors;

Third, because arbitrage opportunities are usually short, the portfolio should have good ability to adjust and few restrictions.

By the end of 2011, there are 19 Listed Open-Ended Funds underlying CSI 300 index in the market. We find that only Dacheng CSI 300 index fund is 100 % on the basis of the CSI 300 underlying index, and that other funds are formed with 95 % of the CSI 300 index and 5 % of the risk-free rate deposits. These 18 funds cannot completely simulate the market index. Therefore, Dacheng CSI 300 is a considerable combination of the simulation.

While with the launch of sizable ETF (Exchange Traded Funds), the CSI 300 index can be efficiently simulated by ETF, which combines the advantages of both Listed Open-Ended Funds and of the closed-end funds. It can not only be traded in the secondary market like the common stock but also be subscribed or redeemed to the fund management companies. Therefore, Huaxia 50 ETF and HuaAn 180 ETF are two considerable combinations.

So we analyze these three combinations. Dacheng CSI 300 funds have trade restrictions. T + 2 trading mode makes the arbitrage prolonged with more inconvenience and cost of interest. We choose Huaxia 50 ETF and HuaAn 180 ETF to give a deeper research on which one to choose.

We can see that the correlation coefficient and the tracking error of these two ETF funds above do not differ a lot through calculation. However, we choose

HuaAn 180 ETF finally, which has a stronger correlation coefficient with CSJ 300 index and less tracking error.

### 54.2.5 CSI 300 Arbitrage Empirical Analysis

According to the data and analysis above, we will give the CSI 300 stock index futures arbitrage empirical analyses. First of all, we have to calculate the arbitrage cost of the selected spot portfolio, namely the HuaAn 180 ETF. According to our analysis, arbitrage cost is divided into four parts: the costs of interest, margin cost, transaction cost, and interest cost. We select the 1-year risk-free rate as interest cost. Because of the absence of the shorting limitations in our country, we can only carry on the positive arbitrage. So we will select the lending rate of 6.56 % as the benchmark.

Second, we should calculate the margin cost. Stock index futures need to have strict security deposit system. Therefore, investors need to deposit certain money in a corresponding margin position in advance. In the process of stock index futures trading, the principle of daily mark to market to meet the minimum margin requirements regulates the margin ratio 12 % by CFFE.

Then we should calculate the impact cost. In the trading process, large corporation investor may trade with large volume so that market prices will suffer from the difference between the actual price and the expected the price. Investors will get a loss with the price change. This is what we call the impact cost. When there are many call positions, the surge in demand price rises; when many investors hold a short position, a lot of cash will come out reducing the demand and the price. The Shanghai stock exchange has issued the market trading quality report each year. We can get the report to see that there are three categories of different trading volumes: 100,000, 500,000,and 900,000. We assume that we analyze based on the trading between large corporation investors. So we choose the trading volume of 900,000.

Finally, the related transaction cost. We assume that the transaction is under 1 million and because ETF fund exempts from stamp duty, we get stock index spot transaction costs for 0.2 %. And stock index futures transaction costs are generally regulated by CFFE for 0.035 %. Many security companies add a few commissions on the regulated rate. So basically we use 0.01 % as the transaction costs of the stock futures.

Let us review the arbitrage-free interval.

$$[Se^{r(T-t)} - D - C_T, Se^{r(T-t)} - D + C_T] \tag{54.3}$$

Using this formula, we calculated the theory price of the IF1206 from January 4, 2012 to May 4 2012 to judge the whether the actual price is in the arbitrage-free interval. We can calculate according to data of HuaAn Fund Company. Because

this fund did not have any dividends out, we can get the dividend D to be 0. We take January 4 as an example. The price we calculate in the perfect world is:

$$F = Se^{r(T-t)} - D = 2298.76 \times e^{0.0656 \times 122 \div 365} = 2349.72 \quad (54.4)$$

Then we should calculate the trading cost to determine the arbitrage-free interval. We know from the analysis above that arbitrage cost is equal to the impact cost + spot transaction cost × 2 + futures transaction cost × 2 + tracking error + commissions. Finally, 0.55 % + 0.48 % + 0.2 % × 2 + 0.01 % × 2 + 0.27 % = 1.72 %, that is 2298.76 × 1.72 % = 39.54.

So arbitrage-free interval is [2310.18, 2479.26]. That is to say, if the actual price of IF1206 is in the interval, there will not exist arbitrage opportunities. We can check the actual price of IF1206 in January 4. It is 2359.6 and therefore there exist arbitrage opportunities. Using the same method, we find widespread arbitrage opportunities in Chinese stock futures market.

## 54.3 Conclusion and Recommendations

### *54.3.1 Conclusion*

According to the research of CSI 300 stock index futures, this paper found that there exist widely arbitrage opportunities in our stock index futures market. Therefore investors often get profit from arbitrage, which, in return, promotes the equilibrium tendency of China's stock index futures price.

CSI spot index cannot be transacted directly. We need to choose the right spot simulation portfolio. This paper choose HuaAn ETF as an example. However, we can choose a more extensive portfolio for simulation, thereby better fitting spot index trend. Meanwhile, ETF, which entirely considers CSI 300 index the underlying asset, has been officially completed raised. It will become an extremely practical tool in our financial derivatives market. During the process, it is noticeable that we can select the fund portfolio better to simulate CSI 300 underlying asset with the aid of tracking error calculation.

In the simulation of arbitrage process, we should give accurate calculation of the cost of arbitrage and better determine the arbitrage-free interval. We divide the arbitrage cost into four parts, and analysis the impact on the cost and transaction commission. From the study we can find that there exist wide ranges of arbitrage opportunities in China's market, which mean that the price of stock index futures was not fully reasonable and that the existence of arbitrage promotes regression of the reasonable price of stock index futures.

### *54.3.2 Recommendations*

There exist wide ranges of arbitrage opportunities in China's stock index futures market, contributing to the prosperity of the securities market. However, because of the social and history reasons, many restrictions are still conducted on stock index futures arbitrage. So we have to constantly reform so as to improve the degree of the prosperity and stability of the stock index futures market in our country. Therefore, this paper gives the following recommendations.

1. Make IPO system perfect. Allow the shorting system so as to provide opportunity of the reverse arbitrage of stock index futures.
2. Further reduce the trading costs of funds and stock index futures, promoting more investors to take part in the process of arbitrage and making the pricing of the stock index futures more efficient.
3. Perfect the system of dividends of the listed company. Reduce the "think highly of growth while look down on share out bonus" phenomenon so as to improve the enthusiasm of the investment.
4. Continue to expand the CSI for mark index funds and ETFs or open mode funds. Constantly improve the quality of the fund and the similarity of simulation to enrich our country securities market.

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# Chapter 55
# Study on Preschool Children's Nutrition Influencing Factors

**Shuqian Li**

**Abstract** The size and nature of the study sample could limit the results of the survey. Example is relatively small parts of the city residents do not necessarily represent the Mississippi state or country. However, this study provides additional support, the feasibility study determine the effective way to influence the nutrition children the most dangerous. The childhood overweight weight of authority card attention, must be addressed in the social level has the very strong considering the influence of various factors of children the risk of being overweight. The study showed that attitude of small differences between the child nutrition and overweight with the parents of the children of different weight. However, studies show that people are becoming more and more awareness about recognition to reason and overweight is necessary. Parents support schools and government efforts to promote healthy eating and physical activity.

**Keywords:** Children's nutrition · Influencing factors · Overweight

## 55.1 Introduction

Childhood overweight are increasingly concerned are in the United States and worldwide, especially because of the risk of obesity and the health of adult related risk and medical costs [1–3]. The recent national health and nutrition survey data (1999–2002) showed that about 16 % of the children, ages 6–19 year old overweight. The prevalence of obesity has increased due to the national health survey

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1963–1965, 1966–1970, 4 % of children 6–11 years of age and 5 % of children 12–19 years old is listed as overweight. Overweight increased is obvious in all age, gender; ethnic groups are thought to come from the national health and nutrition examination survey. However, some ethnic and social and economic characteristics are the relevant the higher the risk for overweight [1]. Overweight children are based on 2,000 centers for disease control and prevention growth chart for the United States. The children were as "risk" if they are overweight body mass index (BMI; the weight in kilograms) divided by the square meters height) reach or exceed the, less than 85 a 95 compared with other children in the United States in a percentage of the same age and sex. The children were considered "overweight" if their BMI for age and gender, these are to meet or exceed 95 percentile [2]. Body mass index is as an indicator of overweight because it is weight/height measures and strongest correlation related risk excess weight [3]. For example, research shows that a strong correlation for age and body mass index average thickness between skin plait in boy ($r = 0.81$) and the girl ($r = 0.85$) and 6–11 years [4]. Childhood overweight increases the risk of weight related mental disorders, the overweight risk to adulthood, potential psychological obstacles [5]. Risk factors for overweight have a lot of. Age, gender, race, social norms; Social economic class; Family is composed; Parents' knowledge, attitudes and beliefs, children's knowledge, attitude, and the influence of the faith was found food intake and physical activities [4]. Increases in the rates for childhood overweight may be related to the behavior of the interaction, environmental and social factors. Behavioral factors may include increase consumption of fast food and food prepared outside the house; Increase the sedentary activities such as watching television, use the computer and video games. And/or decrease walk and ride a bicycle transportation. Environmental factors may include safety worries outdoor activities, improve the usability of food, advertising, and reduced physical activity in schools and work. Social factors may include work the change of demand and family life. Parents influence social, environmental, psychological, and physical factors, and this in turn affect children's weight as committed as parents, on eating behavior, and parents support is to be in charge of children eating behavior. Work arrangement; Food costs; Perception without sufficient time shopping, plan, to prepare a nutritious food; one or more of these have been shown to be barriers of the eating habits of nutrition parents. Parents can affect the food intake of food preferences, children through the modeling and through the food they released to all children. Parents to create a positive meals in a positive environment behavior (such as dining time to talk, teaching, encourage the food taste, nutrition, etc.) and not negative parenting style (such as children eat in a hurry and force them to eat, use food as a reward, etc.) in the meal time may experience more positive children eating behavior. In addition, parents don't exert too much food intake of the control of their children may produce better child can self adjusting food intake. In addition, the parents have different views of the causes and the importance of childhood overweight, this may affect to parent decision related food and activity mode. In the current study, parents confirmed excessive use of unhealthy food, parents' responsibility, modern technology and mass media is the most important

reason for the overweight. The government's action and children health promotion was identified as prevent factors. Research to identify parents' beliefs and attitudes about overweight should notice the trend of attempts to moderate increase the prevalence of overweight. In order to let parents take measures to prevent or address the existing overweight in their children, they must be able to in their children think overweight, think it is a significant threat. In addition, they may need to support and guidance in action. If parents do recognize the excess weight, they may block due to take action to think that children will transcend problem (an idea, according to reports by physicians support), the lack of knowledge about how to help children weight management, and fear the child the eating disorder. In the other, research shows that the risk of being overweights the perception of the different social economic position and national, some groups to examine moderately overweight is positive. Therefore, parents and the characteristics of the survey diet and physical activity and the potential impact of school children and their families are necessary. The goal of this study (1) the parents worry and attitude on children's nutrition and being overweight and (2) the differences between a family with children the risk of being overweight or overweight1 and families with children have no risk overweight concerns and nutrition aspect. This assumes the attitude will have a difference in a family with children in danger of not overweight compared to a family with children in for the risk of being overweight or overweight concerns related to nutrition and attitude.

## 55.2 Methods and Materials

### *55.2.1 Study Design*

The investigation was the study of the application of the relationship between the children's weight status and their attitude of nutrition and weight of the children. Implement a coordinated school health plan a primary school (grades K−2) through a special research funding plan, be study on child nutrition and they are overweight. The child was chosen because understanding of children early food preferences and influence factors of their food preferences is necessary.

### *55.2.2 Subjects/Sampling Strategy*

Surveys were sent to all parents of second-grade students ($n = 320$); 205 (64 %) surveys were returned. In addition to completing the survey, parents were asked to sign a consent form indicating permission for their child to be measured. Surveys and measurements were matched before data analysis; the total sample for this study consists of 169 (53 %) matched cases.

### 55.2.3 Development and Validation of Parental Survey Instrument

Survey question is from relevant documents of the potential causes and prevention strategy childhood overweight. In addition, the problem has been used in the previous study included survey verification technology is used to test content validity, stability and reliability (use the spirit method), and the effectiveness of the internal investigation. An expert group was asked to review the content, readable and consistency and research problem; Appropriate fixed. The final survey problems including assessment on all kinds of health/development parents, feed mode, the attitude of the potential causes childhood overweight, various forms of relented this trend in the prevalence of childhood overweight increased, and the population problem. Survey question used to collect reaction can be found in the table.

### 55.2.4 Measurements of Children

Anthropometric measurements, including height and weight, of second graders were collected with parental consent ($n = 190, 59\ \%$). Height was measured to the nearest 0.1 cm on a portable stadiometer (Seca 214 Portable Stadiometer, Invicta Plastics Limited, Oadby and Leicester, England). Weights were recorded using a digital scale (Tanita TBF-300A Body Composition Analyzer, Tanita/Itin Scale Company, Brooklyn, NY). Methods for obtaining height and weight measurements followed the School Physical Activity and Nutrition Project Protocol developed for use with the Child.

### 55.2.5 Data Analysis

The Chi square test is used to survey of the children's parents differential reaction between the risk of being overweight or obese and the child's parents have no risk for overweight problems (1) different health care and development issue, including attention overweight, eating habits, and sedentary activities (not including health concerns about health care and will find a place for the other concerns parents may); (2) believe that the main cause of childhood overweight; (3) children parents control food intake; (4) attitude of the importance of various factors, may help overweight children; (5) the practice of attitude may ease growing trend in childhood overweight; (6) population, social economy, human body measurement, and the parents of lifestyle factors, such as fruit and vegetable consumption and exercise patterns.

## 55.3 Analyses

### *55.3.1 Basic Situation*

471 cases of preschool children, detection low weight 185 cases (39.28 %), among them, the marginal low weight 142 cases (30.15 %), mild-to-moderate low weight and 43 cases (9.1 %); Slow growth in 197 patients (41.83 %), among them, the marginal growth slow 193 cases (40.98 %), mild-moderate donor slow growth in 4 (0.8 %); Angular 109 cases (23.14 %), among them, the marginal angular 100 cases (21.23 %), mild-to-moderate angular 9 cases (1.9 %). At the same time, were overweight detection in 10 (2.12 %), slightly overweight and obesity 3 cases (0.6 %).

### *55.3.2 Influence on Children's Slow Growth, Low Weight and Lose Weight Factor*

Single factor analysis: (1) preschoolers age, educational level and the mother on time, eat three meals can often be scolded, don't like to eat meat food, eating fruits and melons often don't wash, often chew a finger or toys, children have partial picky about food habits, children, education spending monthly dietary spending and parents personal higher 12 factors and low weight related. (2) the degree, the father mother culture have partial picky about food habits, children can not love to eat three meals on time, snacks, have a meal to often be scolded, don't like to eat meat food, eat melons and fruits don't wash, children often biased picky about food habits, monthly dietary expenditure, education spending and parents height and so on 12 factors and pediatric growth slow related. (3) children age, family per capita residential area, mother biased picky about food habits, children can not on time, often eat three meals snacks, have a meal to often be scolded, don't like to eat meat food, often do not wash their hands the toilet, to eat melons and fruits don't wash, parents often personally higher 10 factors and angular related.

Unconditional Logistic multiple stepwise regression analysis: preschool children low weight of related factors, don't like to eat meat, parents personal high and low for risk factors, the mother cultural degree is high, the child not picky about food habits to protect the partial factors (Table 55.1). Slow growth factors, father biased picky about food habits, parental height for low risk factors, the mother cultural degree is high, the child not partial picky habits and monthly dietary spending for the protection of the high factors (Table 55.2). Thin related factors, the area is small, the per-capita living children don't like to eat meat food, mother low risk factors for height, children age, no partial picky about food habits big for protection factor (Table 55.3).

**Table 55.1** Logistic regression analysis of risk factors of underweight in preschool children

| Variables | $\beta$ | SE | P | OR | 95 % CI |
|---|---|---|---|---|---|
| High educational level of moths | −0.433 | 0.152 | 0.004 | 0.648 | 0.481–0.874 |
| Poor consumption of meat products | 0.464 | 0.168 | 0.006 | 1.590 | 1.145–2.208 |
| Children's no partiality for food | −0.668 | 0.163 | 0.000 | 0.512 | 0.372–0.706 |
| Short stature of father | 0.669 | 0.202 | 0.001 | 1.952 | 1.313–2.903 |
| Short stature of mother | 0.776 | 0.219 | 0.000 | 2.173 | 1.416–3.336 |

**Table 55.2** Logistic regression analysis of risk factors of stunting in preschool children

| Variables | $\beta$ | SE | P | OR | 95 % CI |
|---|---|---|---|---|---|
| High educational level of moths | −0.448 | 0.157 | 0.004 | 0.639 | 0.469–0.870 |
| Poor consumption of meat products | 0.515 | 0.262 | 0.050 | 1.674 | 1.001–2.800 |
| Children's no partiality for food | −0.701 | 0.166 | 0.000 | 0.496 | 0.358–0.668 |
| Dietary expenses per month | −0.480 | 0.228 | 0.035 | 0.619 | 0.396–0.967 |
| Short stature of father | 0.997 | 0.211 | 0.000 | 2.710 | 1.792–4.099 |
| Short stature of mother | 0.939 | 0.225 | 0.000 | 2.556 | 1.643–3.977 |

**Table 55.3** Logistic regression analysis of risk factors of wasting in preschool children

| Variables | $\beta$ | SE | P | OR | 95 % CI |
|---|---|---|---|---|---|
| High educational level of moths | −0.566 | 0.166 | 0.001 | 0.568 | 0.410–0.787 |
| Poor consumption of meat products | −0.602 | 0.277 | 0.030 | 0.548 | 0.319–0.942 |
| Children's no partiality for food | 0.599 | 0.184 | 0.001 | 1.820 | 1.269–2.612 |
| Short stature of father | −0.782 | 0.192 | 0.000 | 0.454 | 0.312–0.663 |
| Short stature of mother | 0.782 | 0.240 | 0.001 | 2.186 | 1.378–3.497 |

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# Chapter 56
# Study of Interpretation System in Pingle Ancient Town

**Changtai Lu and Dezhi Wang**

**Abstract** Tourism interpretation system refers to making tourist understand specific information by means of communication media so as to realize the basic functions of resource protection, service, and education. This paper, based on previous studies on the current situation of Pingle Ancient Town, proposes that to provide tourist with complete process and experience of travelling by using static writing interpretation, dynamic commentary of tour guide and touring lines. At the same time, personal suggestions are also proposed for the construction of tourism interpretation system in Pingle Ancient Town.

**Keywords** Pingle Ancient Town · Tourism interpretation system · Management construction

## 56.1 Introduction

During the entire process of traveling, information which helps tourist understand the scenic spot's environment and action are necessary, interpretation system serves as an important method for providing this kind of information. Aiming at providing brief introductory information, locations, routes and names, interpretation system is the fundamental component in many factors of the scenic spots, therefore the planning and the design of the tourist interpretation system are of significance [1, 2].

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## 56.2 The Feature of the Scenic Spots in Pingle Ancient Town

Pingle Ancient Town is located 93 km southwest of Chengdu and 18 km southwest of Qionglai. The west of Pingle is adjacent to Ya'an and Kangzang, and the east of Pingle is connected with Linqiong and Chengdu. Since Qin Dynasty and Han Dynasty, Pingle has been the important town on the Road of Silk and Southern Sichuan [3]. The well-preserved 22 ancient streets, stores and "Leshan Bridge" are vividly demonstrating the ancient style of the business activities in the western Sichuan, which is considered as a western-China version of "Riverside Scene at the Pure Moon Festival" [4]. Two scenic spots in Qionglai, Jinhua Mountain and Emerald, are only 3 km away from the center of Pingle. Tiangong Temple's cliffside images are the masterpiece in Tang Dynasty, and only two embossments of "Tian Ma Xing Kong" are preserved in our country. The ancient ruins of the richest, Sunye Wang, are still preserved on the road of southern Sichuan. Through years of vicissitudes, the ancient images of the harbor in Pingle and "Southern Silk Road" still exist, especially for the historical human spots, the business streets, the architectures and the nonmaterial culture, which illustrate the scene of the town's business and folk customs with high historical, artistic, cultural, and scientific value.

The construction of the interpretation system in Pingle Ancient Town is more important than other tourism objects [5]. Tourist interpretation system enables tourist to understand the historical origins and appreciate the human spots in Pingle Ancient Town, for these reasons, the interpretation system should be the core part in the tourist products in Pingle Ancient Town.

## 56.3 The Current Situation and Problems in the Construction of Interpretation System in Pingle Ancient Town

Through investigating the current situation of the tourist interpretation system in the typical area of Pingle Ancient Town, the author found that the construction of the tourist interpretation system in Pingle Ancient Town still remains at the rudimentary level, whose indication and guidance are relatively weak and could not meet the rapidly developed demand of the tourist. Table 56.1 shows the analysis of the questionnaire survey [6].

**Table 56.1** The data was obtained by interview and questionnaire survey, the followings are the analysis of the result

| Basic information of tourist | | Number of people | Percentage (%) |
|---|---|---|---|
| Gender | Male | 47 | 58.7 |
| | Female | 33 | 41.3 |
| Way of travel | With family and friends | 49 | 61.2 |
| | With tour group | 10 | 12.5 |
| | Organized by working institute | 8 | 10 |
| | Alone | 13 | 16.3 |
| Way of travelling scenic spot | Guided by tour guide | 14 | 17.5 |
| | Guided by tourist map | 34 | 42.5 |
| | Guided by tourist board | 20 | 25 |
| | Guided by interpretation publications | 12 | 15 |
| Evaluation of the tourist interpretation board | Like reading | 7 | 8.7 |
| | Only reading Title | 13 | 16.3 |
| | Only listening to the tour guide | 9 | 11.2 |
| | Too Professional to understand | 0 | 0 |
| | Read only when having rest | 35 | 43.8 |
| | Not properly installed and inconvenient to read | 16 | 20 |
| Evaluation of the road sign in scenic spot | Readable | 11 | 13.7 |
| | Slightly difficult | 1 | 1.3 |
| | Insufficient introduction of the scenic spot | 49 | 61.3 |
| | Not clear and difficult to read | 5 | 6.2 |
| | Not willing to travel on my own | 14 | 17.5 |
| Overall impression about the scenic spot | Not interesting | 2 | 2.5 |
| | It has deep cultural background, but I could not feel it | 24 | 30 |
| | Worth visiting | 37 | 46.2 |
| | No feeling | 17 | 21.3 |
| Impression about the tourist interpretation system | Excellent | 2 | 2.5 |
| | Good | 9 | 11.2 |
| | Fair | 49 | 61.3 |
| | Poor | 15 | 18.7 |
| | Very poor | 5 | 6.3 |

### *56.3.1 The Current Situation and Problems Existing in the Interpretation System in the First Impression Area*

The first impression area refers to the places that tourists first arrive at, such as bus station, airport etc. The interpretation system in these areas is important in helping tourists getting familiar with the environmental information and deciding

subsequent goals so as to arrive at destinations as quickly as possible. Perfecting the tourist interpretation system in the first impression areas could relieve the mental stress of the tourists, enhance the tourists' senses of friendliness and safety, and at the same time, improve the images of local tourism.

### *56.3.2 The Current Situation and Problems Existing in the Interpretation System in Tourist Reception Areas*

The interpretation system in tourist reception areas refers to the interpretation system in various hotels, shopping malls, accommodation facilities and transportation system within the range of activity. Although the interpretation system of the reception facilities in Pingle Ancient Town, such as hotel, shopping areas and travel agency, are relatively well-developed, there still existing certain problems.

### *56.3.3 The Current Situation and Problems Existing in the Interpretation System in Scenic Spots*

The interpretation system in scenic spots consists of two parts, hardware part and software part, in which the software part refers to the dynamic interpretation such as interpreter, tour guide and consulting services; the hardware part refers to the self-guided interpretation system, including tourist pamphlet, tourist map, video tape, sign and board, audio interpretation, slide, and exhibition board of specific files and materials. The author conducted investigation about the hardware interpretation system in the representative scenic spots in Pingle Ancient Town. Although the tourist interpretation system in the scenic spots is relatively well-developed, there still existing many problems.

## 56.4 The Principles in Constructing the Tourist Interpretation System in Pingle Ancient Town

This paper proposes to provide tourists with entire process and experience of traveling by using static writing interpretation and dynamic tour guide and touring lines commentary.

### 56.4.1 Writing Interpretation

Writing interpretation refers to the introduction method by adopting character signs and figures. The construction of writing interpretation system includes signboard in scenic spot, tourist guidance, introduction of scenic spot, explanatory graph, models, and demonstration etc.

### 56.4.2 Explication of Touring Line

Touring line is the public route designed specific for traveling. The design of the touring line in Pingle Ancient Town is a special spatial interpretation system. Its subsystem has distinctive time and space feature, whose interpretation of scenic spot has scientific design in terms of time sequence and space arrangement, because it, following the historic development path of Pingle Ancient Town, could provide tourists with both detailed and overall understanding about the construction, development, prosperity, and decline of Pingle Ancient Town.

### 56.4.3 Commentary of Tour Guide

Commentary of tour guide is the core part in the tourist interpretation system in many tourism scenic spots including Pingle Ancient Town, the paper suggests that we should search for "the core of one soul and pinpoint one main historical and cultural line" and construct by linking to the core and the main line. For Pingle Ancient Town, the development of its history and culture is the main line of the commentary of the tour guide, the cultural essence "harmony between man and nature" in Pingle Ancient Town is its "core of soul", the tour guide should grasp the main line of "tasting" the ancient town and lead the tourists to feel the town's "soul".

## 56.5 Discussion and Suggestions

### 56.5.1 Scheduling the Reasonable Design and Planning of the Tourist Interpretation System

The planning of interpretation is the foundation of reasonable interpretation system, the interpretation system in Pingle Ancient Town should adapt to the rapid development of the tourist demands and enhance its work on the planning of the interpretation system so as to establish locally distinctive, multiple functional and environmentally harmonious interpretation system and improve the quality of interpretation service system.

### *56.5.2 Emphasis on the Construction of the Tourist Interpretation System*

#### 56.5.2.1 First of All, Relevant Departments and Management Officers Should Clearly Understand the Significance of the Tourist Interpretation System

Improving the functions of interpretation system such as education, service, utilization, guide, notification and suggestion could enable the tourists to gain overall understanding about the scenic spot and relevant information, improve their recognition of the space in the scenic spot; help the tourists understand and appreciate the value and resources of the scenic spot; ameliorate the protection of the tourism facility and recourses and further realize the objective of sustainable development.

#### 56.5.2.2 Investment is Indispensable in Constructing the Interpretation System

In order to guarantee the quality and progress in the work of constructing the interpretation system, certain amount of investment must be guaranteed so as to carry out the work according to original plan.

### *56.5.3 Emphasis on the Construction of the Interpretation System in First Impression Area*

The first impression area is the window of the service in Pingle Ancient Town. The relatively weak interpretation system brought great inconvenience for the tourists. The construction of the interpretation system the first impression area should be monitored in terms of both quality and quantity, and specific professional should be responsible for the planning and designing work so as to exert its indicatory and guiding function. The graphics and symbols for various public information should conform to the international standards. Because the airport is the place where foreign tourists are abundant, bilingual interpretation system should be established.

### *56.5.4 The Design of the Tourist Information System Should be Technically Improved*

The information-based tourist recourse is one of the development directions for the interpretation system in Pingle Ancient Town in the future.

## 56.6 Conclusion

The ancient town is the special scenic spot of ancient culture. In order to provide the tourist with satisfactory travelling experience, interpretation system is playing significant role. It not only helps tourist obtain deeper understanding about the connotation of the town's ancient culture and improve tourist's appreciation ability but also plays an important role in improving Pingle Ancient Town's core competiveness and serves as an indispensable part in the tourism products in Pingle Ancient Town.

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# Part VII
# Green Management Engineering and Applications

# Chapter 57
# Strategies for Colleges and Universities to Train the Art Design Personnel Based on Market Demands

**Wenkai Xing**

**Abstract** The students who graduate from an artistic design program often receive cold eyes from people at the employment market full of fierce competitions, because they are in shortage of the practical experience. Through an investigation, it is found that the reason for this phenomenon is that the model of colleges and universities to train the art design personnel has been unable to the market demands. The update of the training model of a school is a process for a long time actually, and simultaneously the market demands on personnel changes more and more quickly.

**Keywords** Market demand · Colleges and universities · Art design · Personnel training

## 57.1 Introduction

At present stage, the employment problem of the graduates from colleges and universities has converted to be a common phenomenon-level issue [1, 2].

However, the students who graduate from an artistic design program often receive cold eyes from people at the employment market full of fierce competitions, because they are in shortage of the practical experience [3].

Before, the strategies for colleges and universities to train personnel are analyzed, it is necessary for us to clearly know what the employment market- oriented at artistic design program is like and what personnel such a market needs.

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Subsequently, the market demand can be analyzed further, and also the strategies for colleges and universities to train personnel should be improved according to the actual demands.

## 57.2 Analysis of the Employment Market-Oriented at Artistic Design Program

The employment market, which is oriented at artistic design program, mainly comprises of the advertising companies and decoration designing companies and so on [4]. These kinds of companies are private enterprises in most cases and simultaneously propose a relatively low starting point. There are a great number of these kinds of companies at market, and also they are very small in scale and have fewer employees. In such an environment, the requirement of these companies on employees is of particularity.

## 57.3 What Personnel the Market Needs

### *57.3.1 "Hot Plug" Personnel*

Generally , the advertising design companies with small sizes put forward a higher requirement on the working efficiency of individuals. In other words, the personnel that the companies expect to employ should be not only with a powerful ability in "one-man operation", but also with very strong adaptability. In the mean time, it is necessary for these abilities to complete a task within a very short time. This is the brought-to-use capability, which is commonly discussed by the modern enterprises. This is also the reason why work experience of 3–5 years is marked significantly in the requirement on the technical positions of recruitment advertising of a great number of employing units. To a great extent, this also imposes obstacles on the road of a large number of new graduates to hunt for a job.

### *57.3.2 Personnel with a Solid Foundation in Professional Knowledge*

Anyway, professional knowledge is what the employing units attach the highest importance to; the comprehensive and abundant professional knowledge is the key for keeping a foothold in working positions and even in the relevant industries. Art design program is based on the training of special personnel, and therefore the impartation of professional knowledge and skills for students should receive the

highest importance from this kind of program. However, under the existing art education model, there is still a problem in the foundation of students in professional knowledge.

### *57.3.3 Down-to-Earth Personnel*

Because it is highly possible that the scales of the employing units are not big and also the number of the employees is not high, what the students need to do may not be as simple and concentrated as they expect originally. Moreover, such a phenomenon is in existence in a great number of the employing units. At the same time, there is a difference between the employing units and the graduates in the way of thinking.

## 57.4 Problems in the Personnel Training Model of Colleges and Universities

### *57.4.1 The Training of Professional Qualities is Blocked by the Traditional Education Model*

Under the traditional education model, the main model of theory teaching at classroom can be a tremendous waste of resources for art design program. In the current curriculum design and classroom teaching model of art design program of colleges and universities, the problem that theories teaching is values and practice teaching is thought lightly has been improved with a gradual step, but the effect is still little. The operational flows with the sameness make completion of the assignments for students full of an air of importance. However, once there is an unfamiliar assignment project for students, they will get back to the state of being totally confused. Therefore, the lacking of the ability in knowing all aspects is the most common problem of the students studying in art design program. However, the personnel training model of colleges and universities is one of the very important reasons for the emergence of this phenomenon.

### *57.4.2 Paying Attention Only to "General Use", but Not to "Proficient Knowing"*

Many students have this experience that what they have learnt at school is only superficial. However, what the actual jobs require is the in-depth knowledge, but not the superficial knowledge. This means that under the teaching and training

model of schools, the students can carry out some simple operations, but cannot directly put what they have learnt into the practical application. However, in the environment of colleges and universities, the cultivation of efficiency is almost out of the ballpark. The teaching model for dividing courses makes the students unable to establish an effective connection in the case of grasping a single link or skill and proficiently operate in face of the actual case projects.

### *57.4.3 Monotonously Attaching Importance to the "Professional"*

Generally , the highest importance is attached to the major courses in the training of the art design personnel. However, the excessive professional training makes the students know nothing in addition to the concentrative equipments and skills. In the actual jobs, the surrounding office facilities and other kinds of commonly used software cannot be put into the practical operations. This makes the strange feeling of new employees more intensive in the workplace. Such a strange feeling in an actual job can be reflected from the fear and laziness of the new employees. Although these reflections are only superficial presentations, the society will not and cannot give tolerance to the new graduates from colleges and universities just because they are new graduates. Moreover, such a tolerance means permissiveness.

From the perspective of schools, it is impossible for the offering of curriculum to be inclusive in all aspects, and also all links of a job are unlikely to be involved at the classroom teaching. Besides, this is unrealistic for the arrangement of teaching plans. However, personnel training should never be limited in campus and classroom. Such a limitation is an expression to the problems of a model in itself.

## 57.5 Strategies for the Improvement of Art Design Personnel Training

### *57.5.1 Correcting the Attitude Toward Training and Strengthening Professional Education*

The problem of in reaching for what is beyond their grasp is not only in students, but also can be seen in a common attitude of higher education in colleges and universities.

As one of the derivatives of art education, it is necessary for art design program to make a thorough change to the educational model.

More specifically, it is necessary to make the professional training in ideology appropriately weakened.

In the mean time, it is necessary to make an enhancement to the professional skills. Colleges and universities can really keep pace with the development of market only if viewing the market equally in attitude.

However, this requires colleges and universities to make great efforts to the course reform and teaching model; it is not going to work if colleges and universities divorce themselves from the masses and from reality and act blindly.

Therefore, it is very crucial for colleges and universities to keep a contact with the market, and know more about the market and the employing units.

In the teaching of the course related to professional skills, it is necessary for colleges and universities to ensure the teaching contents to keep pace with the development of the times, make the contents in courses rich and diversified, and ultimately promote the students to master the professional skills in depth.

In the level of skill mastering, the responsibility of the students seems to be greater, and also it is necessary for the students to seize every opportunity for proficiently mastering professional skills under the available conditions.

However, from the perspective of personnel training of colleges and universities, the proficiency of the skills of the students can be accelerated through the improvement of the standards for evaluating the completion of assignments.

In the mean time, the value of efficiency can be introduced in the evaluation standards, for the ultimate purpose of ensuring the students to positively and actively improve their own qualities.

Also, in the contents of assignments and evaluation, it is very crucial for colleges and universities to get rid of the subjects that are dull and procedures-oriented.

As long as the students are allowed to complete the assignments of teachers through independent creativity and diversified skills, the process for the student transforming from superficial knowledge to the in-depth knowledge can be greatly promoted.

### *57.5.2 Strengthening the Professional Quality of the Faculty*

As the disseminators of knowledge and skills, the professional quality of teacher plays a very important role.

At present stage, the teachers in the art design program of many colleges and universities have the great difficulties to adapt to the working model and intensity of the companies if they are placed at market, and simultaneously their teaching experience often lags behind the development and demand of the market.

Under such a situation, the teaching way of the teachers is transmitted to the students by a subtle influence; the teaching model of imparting knowledge to students by totally following the textbooks makes the students feel boring and also

the whole learning atmosphere and effect greatly decreased. As a result, the works plans that are made by the students are inevitably full of an air with amateur.

Therefore, it is highly necessary for colleges and universities to make an overall change to the faculty, and introducing increasingly more teachers with experience and powerful abilities is one of the most important elements for the improvement of the overall strength of art design program in colleges and universities.

Certainly, a great number of famous teachers have been invited by many colleges and universities for offering courses at present. However, as for a systemic professional education, one or two fragmentary classes cannot fundamentally make a change to the current reality that the essence, experience and employment skills can't be learnt by the students. On the contrary, the too excessively expressed professional images at classrooms will make the students feel disappointed about making an improvement to their existing learning.

### *57.5.3 Strengthening the Construction of Hardware Facilities and Ensuring the Fullness of the Teaching Model*

The cost investment in art design program in a large number of colleges and universities is relatively very high. This cost not only refers to the tuition cost of the students studying in art design program, but also touches upon the hardware facilities cost of colleges and universities.

For example, in film and camera shooting programs, the prices of the relevant equipments are very high.

However, if colleges and universities are in shortage of these equipments, it is natural for students not to attain a practice chance with ease.

Therefore, the improvement of the professional skills of students is only an empty talk if there are no chances for them to make practices with equipments.

Besides, in the design program, the increase of the frequency for the students to draw, paint or sketch from nature is also a key to making an improvement to the professional quality of the students in a subtle influence.

### *57.5.4 Enhancing the Practice Ability of Students by Replacing Exercises with Actual Practices*

Unavailable market atmosphere makes a great number of colleges and universities as well as students confused greatly.

In this problem, school education seems to meet with a development bottleneck. This is just like the exercise state and the game state in a competitive sport item, and the two states are completely different.

However, some methods that are applied in the league of sports can be used as reference. In the professional basketball leagues of the United States, the players who cannot be included in the main list of team will often be assigned to play balls in a development league, and therefore development league changes into the best backup power of the NBA team in the United States.

In the strategies of Chinese colleges and universities to train the art design personnel, such a kind of model can be introduced as well, and a good cooperative relationship can be actively and positively maintained with the excellent enterprises at the market, so as to make the relevant programs in schools change into "development league teams" of enterprises and the students have chances for becoming the players of the "professional leagues".

Simply speaking, with the purpose of making full use of this model, it is necessary for colleges and universities to allow the students to make practices in enterprises, and train the social ability and professional practice ability with clear organization and plan.

In such a way, the cost of making a reform on courses can be reduced when the learning efficiency and better employment advantages of the students are ensured. In the mean time, sufficient personnel reserve can be attained by the relevant enterprises.

## 57.6 Conclusion

At present, art design program is increasingly growing in colleges and universities, and getting a real understanding of the market demand is the key for colleges and universities to develop art design program.

According to the market demand, therefore, it is a good choice for colleges and universities to carry out personnel training for developing the art design program.

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# Chapter 58
# Adaptation of Foreign Language Education in Higher Education System

**Lin Li**

**Abstract** Lifelong education has already been acknowledged as the fundamental principle to develop education in most developed countries. Learning to survive and develop independently and learning to learn all through life are set to be the ultimate goals for an individual's education. Thus, higher education is shouldered a decisive responsibility as the last section in conventional formal education system, aiming at bridging learning and living. Under such a context, foreign language education has to be adapted from the exam-oriented and instrument-targeted education to the application-and-practice-oriented education and to the education for all-round development, as it is the most influential platform of humanistic education in higher education system.

**Keywords:** Lifelong education · Foreign language education · Adaptation

## 58.1 Introduction

Everyone is pressed to follow the trend of the ever-changing knowledge system and economic structure in this Era of Knowledge and Information. The stress, in turn, drives the whole society to acknowledge the importance of education so as to learn effectively in one's whole life and realize oneself. Furthermore, data show that GDP increases by 1 % with one more year in average education length of citizens [1]. Hence, to advocate a lifelong education and learning is beneficial and promising.

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Foreign language education in lifelong education is critical in China because of its responsibility to train foreign language skills, communication skills, and most important of all, to carry on humanistic education [1]. All the skills are indispensable for citizens in a society aiming at lifelong education. In a global village and Time of Information, foreign language skills are not only an instrument to help students find a good job, but a necessity to guarantee interpersonal communication both in life and career to improve an all-around development of a human being and to appreciate wider and deeper about cultures.

## 58.2 Characteristics of Lifelong Education

Lifelong education and lifelong learning are the two sides of one coin, both of which propose learning and teaching last for a person's whole life, emphasize their comprehensive and wide-ranged knowledge and base them on society. In this paper, the two concepts are taken as same, namely, they both advocates that education is responsible for promoting an all-around development of human being, which in turn, advances society.

Lifelong learning system includes all the teaching and learning from cradle to grave and carry out the saying "never too old to learn". Conventional education includes training of reading and computing ability [2]. But it should not exclude foreign language ability, problem-solving skills, communicating ability, creativity, teamwork spirit and self-learning ability. Thus, approaches to those abilities and skills are not limited to school education. Internet, TV and other Medias are all available to offer learning resources. Take language learning for example, classroom teaching only takes up a modest part of learning. Learners aiming at improving their communicating skills and foreign language skills have to make full use of every opportunity.

Therefore, higher education is supposed to integrate school education, family education, society education, pre-career education and post-career education. Only in this way, lifelong learning is possible to be realized and a student can learn and still endeavors to learn after his graduation. To achieve it, teachers are shouldering the responsibility to apply lifelong education principles into their teaching, to cultivate students the ability and the habit to learn for lifelong [3]. To the end, our education may dump the label of mass production and focus on individualization and high-efficiency [2]. In a society of lifelong education, teenagers and young adults are still the major body of learners, but everyone in the society takes education as a means of self-development and self-realization. Correspondingly, higher education aims at setting up a stage, on which students find what they need, what they have to learn and learn it [3]. Hence, they become real members of problem-solving pool. Foreign language education functions an important role in it due to its training to language skills, communicating abilities and the only effective means of humanistic education in higher education system of China. Hence, a corresponding foreign language education system is to be established.

## 58.3 De Facto Situation of Foreign Language Education in College

College English Test 4 and 6 are the main targets for most students learning English. They admit the value of certificates rather that of language skills because the certificate more often than not guarantees a good job. But during work, they may find the fact that what they learned concerning foreign language in college has little to do with what they are using daily in their good jobs [4]. Thus, paradoxical embarrassment arises. Students work awfully hard on foreign language only to find it useless soon. The real meaning and value of learning and teaching foreign language puzzles everyone including teachers.

The following misunderstandings lead to the above mentioned phenomenon in higher education system.

Students' full and profound development has not been paid enough attention. Certificates and immediate rewarding are valued as achievements.

Mechanical memories to grammar and vocabulary have been overweighed to active appreciation to cultures and humanistic quality.

Teachers and administrators are dictating the whole education process from classroom teaching to assessment. Interactions between students and teachers and self-guidance of students have not been developed.

Exam is the only end of both learning and teaching. Formative assessment still stays in theory.

Book knowledge is taken superior to practical usage.

Foreign language is still considered a tool instead of a part of humanistic quality.

In China, foreign language education, mainly English teaching, can gain huge profit [4]. Under such impact, English education is market-directed, tool-oriented and all in all, utilitarian, which are all against and opposite to the principles of lifelong education.

In a lifelong education context, learners are the core of class design. What they are learning is integrated to society. The conventional school education is, thereof, as decisive as the unconventional, out-of-campus learning. It requires the interaction and the integration of the two even in one's higher education period. To be specific, communicating skills and appreciation to exotic cultures are to be valued, if not more than, as significant as certificates.

## 58.4 Opportunities Versus Challenges

Both education administrators and teachers have to rethink the following questions: what kind of knowledge is to be taught? While acquiring the knowledge, what are the new roles for teachers and learners to be adaptive to a lifelong education system?

With regard to English teaching and learning, we are to ponder upon the classroom teaching as the initial stage. The overwhelming position of classroom teaching is to be questioned and adjusted. Next to it, teachers are supposed to function as a model of an efficient lifelong learner. For example, they can attend the process of lifelong learning themselves to illustrate the influence and the achievement. Additionally, the inferior status of liberal arts courses are to be repositioned. The immediate return of science courses directs our education and learning, especially in higher education system. Today, the profound influence of liberal arts courses in long run deserves to be stressed. Finally, reflective and collaborative teaching is to be applied into practice. Questions, discussions, communications, and cooperation are more valuable because they encourage creativity and full development.

### *58.4.1 From Test-Oriented to Application-and Practice-Oriented Education*

Many problems may arise from applying such a lifelong education. They mainly fall into the two categories. First of all, the purpose of learning is not for lifelong development. Worse, our higher education system does have such a target, but renders it void in practice.

In English teaching practice, what students are learning is too formal and even fossilized to be useful in daily communication. Classroom teaching plays a much too decisive role in a course of skill-training and of humanistic cultivation. Accordingly, assessment is designed for the sake and the convenience of administrators. Teachers teach but don't assess. Administrators assess but don't teach. As a result, teaching and assessment are separated. To realize an application-and-practice-oriented English education, educators are supposed to, first, reposition them and, second, convert the target of assessing method. Knowledge concerning the English language is not the only content in classroom teaching. In a class of English aimed at lifelong education, a teacher endeavors to encourage and inspire students to learn enthusiastically and independently in order to be prepared for a society of lifelong education. Students are expected to be trained to find out what they need, to learn it, and to meet their needs.

Students are always afraid of exams. If our exams require students to remember the dead knowledge, then they will do it at the cost of the initial and prior purpose of learning. Students are trained to be experts in taking exams, which is absolutely against lifelong education. What English exams need last is the conclusive and once-for-all exam since English education is not for knowing a language but for doing with the language.

In practice, educators need to reform our teaching and assessing in the following ways.

Students should be involved to investigate their motives, expectations and attitudes so as to establish a set of course goals and assessment ends.

Society needs have to take into consideration, too. Skills and knowledge are supposed to be as practical as possible. For example, model cases, role plays and scenarios offer opportunities for students to learn to solve real problems with their language skills.

Universities are not cloisters. More experts with real and practical experiences are to be invited to demonstrate the application of what's learned in schools. Conversely, teachers have to walk out of campus to involve them with practical work to learn what kind of knowledge and skills are useful.

Educators can investigate alumni to find out problems and advantages with education.

Employers may also offer advice to help improve our higher education.

More approaches and methods may be worked out to help students and teachers to get adapted to a lifelong education system.

### *58.4.2 From Instrument-Targeted to Humanistic Education*

Under the context of lifelong education, college students are expected to be cultivated both scientific rationality and humanistic quality. Shortage of either one may cripple one's development. Now in China, scientific rationality has been stressed for too long. But it does not measure up to our standard. The main reason lies in the deficient cultivation of humanistic quality. College students are trained to bear in mind only one target, namely, a well-paid job. In higher education system, English education is among the few courses to cultivate humanistic quality in students. That is typically true in universities of science. English language teachers are shouldered the responsibilities of training language skills and of cultivating humanistic quality. The latter is particularly influential to innovative spirit. The ultimate goal language teaching is not to finish our pre-designed workload but to promote comprehensive development of our students. Only full-scaled human beings can adapt and realize them in a society aimed at lifelong education.

Accordingly, more extracurricular activities related to the course are to be designed and added.

Appreciation to both domestic and exotic cultures is to be demonstrated and discussed.

Teachers have to design more activities to initiate learning, such as group learning and peer-assessing. Teachers can offer direction instead of dictation through discussions to encourage self-guided learning in students.

To learn from peers is a useful approach to learn lifelong. Hence, the habit and method is to be encouraged and cultivated even when students are at schools.

Remote learning with Internet proves to be effective for busy employees, whereas on campus teachers are always available to offer help and answer. There

is a deep gap between the two ways of learning. Therefore, the bridging between the two has to be constructed even when students are at schools.

Volunteer work seems to have little to do with school learning, but it cultivates sense of responsibility which is as vital as major knowledge and is an indispensable part of humanistic quality. If volunteer work can be related to our classroom to apply students' writing or speaking skills, they will definitely benefit more from the practical work both in their progress in language skills and in their increasing sense of self-realization, sense of achievement and confidence.

To step into a society of lifelong education, learners are supposed to be strong-motivated, to learn independently and assess individually. Higher education system, the last stage of conventional school education, has to cultivate students the abilities adaptive to lifelong education. Compared to primary and secondary school education, English language education in colleges is expected to teach more than grammar and vocabulary but to show vivid culture and to cultivate humanistic quality.

## 58.5 Conclusions

Lifelong education is significant and critical both to individuals and the whole society. Higher education system has to practice its principles in teaching to illustrate its effect and set as a model. Foreign language teachers, esp. the English language teachers, should be involved, too. Through our hard work, we may develop a comprehensive humanistic cultivation course, through which, students are cultivated with the abilities to appreciate cultures, to do things with languages and to learn for their lives.

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# Chapter 59
# Study on Obstacles Encountered by Higher Vocational Colleges in Order-Oriented Education Mode

**Jianhua Tan**

**Abstract** As an important pattern of cooperation between school and enterprise in higher vocational education, the "order-oriented education" mode is carried out in vigorously increasing higher vocational colleges, but in the process of cooperation between school and enterprise, obstacles from government, school, enterprise, and students appear and negatively influence this mode of talent cultivation. Therefore, higher vocational colleges must take corresponding measures to eliminate these obstacles, so as to promote the steady development of the "order-oriented education" mode in China's higher vocational education.

**Keywords:** Higher vocational colleges · Order-oriented education · Cooperation between school and enterprise

## 59.1 Introduction

"Order-oriented education" mode means, to meet enterprise's demands for different types of talents and requirements about occupational ability for the posts, both parties of the school and the enterprise sign and enter into employment and talent education agreements and develop talent education plan together, which stipulates that the enterprise shall take part in talent quality evaluation and arrange students' employment in accordance with the agreements and cooperate with the school in teacher resources, technologies, and school running conditions, etc. The mode closely integrates the enterprise and the school through the "order" and

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combines school and enterprise, production and education into an interdependent and interactional "education community" [1]. As an important pattern of cooperation between school and enterprise in higher vocational education, the "order-oriented education" mode is thriving [2]. To implement "order-oriented education" mode in higher vocational education not only means to transform the school running mode but also means to bring about many obstacles and challenges in the aspect of systematic resources allocation and optimization, which will cause serious negative impact and restriction on the development of "order-oriented education".

## 59.2 Main Obstacles Existing in the Current "Order-Oriented Education" Mode of Colleges of Higher Vocational Education

### *59.2.1 Obstacles from School*

#### 59.2.1.1 Restriction of Traditional Teaching Model

In traditional teaching process, higher vocational colleges borrow the methods and concepts of university education in teaching which put much emphasis on subject systematic teaching and put less on training and strengthening vocational skills [3]. As a result, the higher vocational colleges are lacking in featured majors and cannot show the distinctive characteristics of higher vocational education in their teaching guiding ideology and specific teaching process, and students graduating from these colleges do not master strong operating skills and are far away from reaching enterprise's standards and demands for skilled talents.

#### 59.2.1.2 Shortage of "Double-Role" Teachers

The concept of "double-role" teacher is not equal to holding teacher's qualification certificate and industrial skill grade certificate at the same time or the simple combination of teacher and technician or engineer; instead, it means the integration of teacher and technician or engineer in the aspects of their knowledge, ability, and attitude, etc. At present, many teachers of higher vocational colleges graduate from or are introduced from ordinary institutions of higher learning; some colleges even employ retired professors to undertake the teaching tasks. These teaching resources are lacking in either solid theoretical foundation or rich experience of practice, which results in their incompetency and brings about the obstacles that are insurmountable for higher vocational education in a short time.

### *59.2.2 Obstacles from Enterprise*

#### 59.2.2.1 Enterprises are Not Very Enthusiastic About the "Order-Oriented Education" Mode

As competition among enterprises intensifies, enterprises realize that, human resources are the most important resources to support their survival, development, and expansion. Competition between enterprises is essentially the competition in the aspect of human resources. However, as the conditions and situations of different industries and enterprises vary, they may have totally different demands for talents and it is quite difficult for general talents cultivated by higher vocational colleges to satisfy enterprises' demands for specialized and individualized staffs. As a result, high-level enterprises would generally turn down the application by graduates from higher vocational colleges who are not willing to joint low-level companies. Moreover, there are numerous graduates from institutions of higher learning hunting for jobs, so, enterprises are reluctant to spend too much time in being engaged in "order-oriented education".

#### 59.2.2.2 Characteristics of Enterprise Operation Cause Difficulty in Sustaining the "Order"

In fierce market competition, enterprise has operation and development cycles, so, when enterprises are in depression, they will have to suspend the "order". In addition, enterprises' demands for talents in a specific specialized technological field are not infinite and will be fully satisfied through several years' "order-oriented education". Yet, as higher vocational colleges develop talent cultivation plans on a long-term basis and their major setting and teaching programs are not very flexible, it is impossible for them to adjust their cultivation products - "talents" anytime as required. Therefore, before cooperating with enterprises, higher vocational colleges must consider the issue of sustainable development.

## 59.3 Obstacles from Students

### *59.3.1 Students' Weak Consciousness of Integrity*

In accordance with "order-oriented education", colleges cultivate students by complying with the requirements of enterprises about knowledge and skills and students will be employed by the enterprises as long as they have finished learning the knowledge required and reached the expected technical level; in this way, school education will be closely integrated with enterprise demands. But students from higher vocational colleges have weak consciousness of integrity and consider

economic benefits as their first pursuit in career development and seek for more individual values, so their occupational choices are dominant by their thinking of pragmatism. Although higher vocational students engage themselves in "order-oriented education" to guarantee their employment after graduation, yet, they are not loyal to the expected employer company and look for other opportunities before they are employed. As a result, during the cooperation of "order-oriented education", enterprises suffer great negative influence because of their failure of employing students who are expected to work with them, but finally choose other employers. In turn, enterprises' worry about and dissatisfaction with higher vocational students will cause significant negative effect on the school running mode of "order-oriented education".

### *59.3.2 Students are Lacking in Professional Ethnics*

It is undeniable that, when higher vocational students receive "order-oriented education" in enterprises, as their alma maters do not pay much attention to cultivating their professional ethnics, they are not always in line with the company in their concepts of value. If their needs are not satisfied, they will even leave without notice, which brings much trouble to the cooperation between school and enterprise and affects further strategic cooperation between school and enterprise.

## 59.4 Countermeasures to Promote the Sustainable Development of Higher Vocational Colleges' "Order-Oriented Education"

### *59.4.1 Colleges Should Guarantee the Basic Conditions for the Implementation of "Order-Oriented Education"*

#### 59.4.1.1 Colleges Should Choose Right Majors and Enterprises

In our experience, it will be easier for deep cooperation between school and enterprise in majors under economic management category and more difficult in majors under equipment manufacturing category. When choosing cooperation units for the implementation of "order-oriented education", higher vocational colleges should select excellent enterprises that enjoy good reputations in the society and industry, have powerful strength and development prospects, are willing to cooperate in running school on the basis of integrity, and are able to offer some school running conditions. Moreover, colleges cannot seek quick success and instant benefits, only pursuing the scale and quantity of "order"; they

should guarantee the quality of cooperation projects and make both parties benefit from the project, so as to guarantee the continuous and smooth implementation of "order-oriented education". Therefore, higher vocational colleges must closely follow the trends of social development, dynamics of industrial development and market development demands, so as to establish adequate "menu" pools and have enough quantity of cooperative partners.

## *59.4.2 Build a Stable Team of "Double-Role" Teachers*

A high-level team of "double-role" teachers is an important condition for "order-oriented education". Colleges can cultivate "double-role" teachers in many ways, for example, organize backbone teachers or young and middle-aged teachers to take temporary posts for practice in enterprises and to participate in researching and developing enterprise products and updating technologies, and employ or invite experienced staffs of cooperation units who are competent for teaching to teach practical skills in colleges. Besides, colleges can also introduce advanced technicians and management who have rich working experience and solid theoretical foundation from enterprises and public institutions and add them to the team of teachers.

### 59.4.2.1 Develop Talent Cultivation Plan Centered on Cultivating Students' Professional Abilities

"Order-oriented education" is a type of employment-oriented education, the primary objective of which is to equip students with practical skills and knowledge for being qualified for certain jobs and becoming high-quality technical talents that can meet the requirements for working at production lines. During the development of talent cultivation plans, colleges should not only comply with the basic requirements about higher vocational student cultivation stipulated by the Ministry of Education but also take into account the enterprises' practical needs. With the cultivation ideas that center on cultivating students' professional abilities, colleges should link diploma program with national professional certificate system, determine cultivation objectives, develop cultivation plans, and establish course system together with cooperation units and allow the latter to participate in supervision and guidance of teaching.

### 59.4.2.2 Establish Complete Practice Training and Teaching Bases

On one hand, colleges should establish internal practice training base that is beneficial to the cultivation of students' technology application ability and their ability of solving practical problems through comprehensive application of their

theoretical knowledge and make strict skill training in the practice training bases available to students, so that students can really experience practical working environments; on the other hand, colleges should take full advantages of social education resources on the basis of mutual benefit, build some stable and all-round off-campus practice bases, carry out off-campus practical teaching, and improve students' practical operation ability.

## *59.4.3 Enterprises Should Change Ideas and Actively Participate in "Order-Oriented Education"*

### 59.4.3.1 Enterprises Should Take an Active Part in the Process of "Order-Oriented Education"

In the process of "order-oriented education", enterprise leaders should emancipate their minds, change their ideas, and fully realize the tangible and intangible earnings brought by "order-oriented education". For enterprises, "order-oriented education" is both input and investment. Provided that colleges have distinctive and remarkable advantages in higher vocational education and high-quality technical talent cultivation, enterprise should be more active in participating in "order cultivation" to reserve excellent talents for future development.

### 59.4.3.2 Enterprise Should Guarantee the Conditions for the Implementation of "Order Cultivation"

First, enterprise should provide sufficient posts for employees, so as to support the "order-oriented education" mode; second, enterprise should offer specific positions, otherwise, it will be difficult for talents cultivated by colleges to meet the demands for staffs at specific positions; third, enterprises should offer relatively high remuneration. Only when enterprises get good economic returns and offer high salaries, will students crowd to register for "order-oriented education" and enterprises recruit employees with high quality and reduce staff turnover rates.

### 59.4.3.3 Improve Students' Professional Ethics

Higher vocational students are active subjects with their own thinking. As some students practice in enterprises and understand their positions in the enterprises more, they might be tired of the enterprises and are not willing to work in the cooperative enterprises. Therefore, colleges and enterprises should put more emphasis on guiding students in the process of "order-oriented education", so that

higher vocational students and their parents can fully understand the "order-oriented education" and students will take part in "order-oriented education" actively. Also, colleges should put more emphasis on students' integrity education through the ways of moral theory education and club activities, stress on students' consciousness of loyalty and teamwork spirit in enterprises, so as to guarantee successful cooperation. Besides, higher vocational colleges should help enterprise and "order" students to exchange and communicate, reinforce their relation with enterprises, and strengthen higher vocational students' affiliation to the enterprises through some effective ways, such as low-interest loan, scholarship, paid internship, contraction or exemption of students' probation periods after graduation, and advance wages, etc.

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# Chapter 60
# Study on Hotel IEQ Based on the Theory of IPA

**Yan Hu, Zhong Hong Sheng and Yin Shi**

**Abstract** Human beings pay more attention to IEQ (indoor environment quality) which has an important impact on human health. Hotel is taken as a home away from home for travelers, so hotel IEQ is more and more concerned by travelers. Therefore, this study examines the travelers' satisfaction with hotel IEQ by applying (IPA) Importance-Performance Analysis, which takes Zhejiang high star-rated hotels as an example. The findings from 316 questionnaires show IEQ of Zhejiang high star-rated hotels does not meet the travelers' requirements well. Overall, travelers have lower satisfaction with hotels' IEQ. Findings also indicate the relatively superior six aspects in turn are the quality of indoor facilities, sanitation, ventilation, cotton supplies, toiletries, and tableware, and the relatively inferior three aspects in turn are indoor noise, indoor noise, and indoor air quality. Lastly, the study suggests Zhejiang high star-rated hotels should focus on the inferior aspects in their future development of IEQ, so as to improve travelers' satisfaction with hotel IEQ as well as enriching the connotations of hotel IEQ.

**Keywords:** Important-performance analysis (IPA) · High star-rated hotel · Indoor environment quality (IEQ) · Travelers satisfaction · Zhejiang

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## 60.1 Introduction

In the twenty-first century, the society transforms from industrial civilization into eco-civilization. Human being pays more attention to not only the outdoor ecological environment quality but also the indoor environment quality, which is closely linked with human being health. The indoor environment belongs to Atmospherics which includes the environment elements sensed by visual, hearing, smelling, and tactile [1]. Mary Jo Bitner [2] pointed out that indoor environment is a complicated environmental mixture, which includes all substantial material elements utilized by enterprises to regulate and restrain the staff and customer. The research in the year of 2000 showed that indoor environment quality (IEQ) has direct and indirect effects on human being, which together impact on human health [3]. In recent years, as the economy and industry develops, indoor environment pollution becomes more and more complicated [4]. Therefore, the IEQ becomes the highlight in human life. In the past time, the researches related to IEQ are limited in formulating the evaluation system macroscopically and detecting indoor environment quality objectively [5]. The empirical study on IEQ is rare as hospitality industry is booming all over the world. Travelers attach importance to hotel IEQ. Therefore, the study examines travelers' satisfaction with hotel IEQ by applying Importance-Performance Analysis (IPA), which aims to improve travelers satisfaction with hotel IEQ as well as enriching the connotations of hotel IEQ.

## 60.2 Related Literature

### *60.2.1 Indoor Environment Quality*

The study on indoor environment quality in the developed countries started in the 1960s. The research contents were derived from the serious indoor air pollution which has lead to great damage on human health in the developed European countries, such as feeble, headache, and memory fade. These typical symptoms were deemed to the SBS (Sick Building Syndrome) which is closely related to the organic gas in the architecture. The study on indoor environment in China began in the 1980s, emphasizing on the SBS. China published "indoor air quality standard" and drafted the indoor environment quality evaluation criterion on March 1, 2003. So it may be concluded that the earlier studies on indoor environment were focused on indoor air quality. However, indoor environment pollution becomes more and more complicated, indoor air quality is not enough to explain the SBS, caused by the multiple comprehensive factors. So the concept of IEQ is cited by the researchers at the beginning of the twenty-first century. IEQ was put forward by American National Institution For Occupational Safety And Health, whose connotation is wider than indoor air quality. IEQ is influenced by the factors of

indoor air temperature, indoor air relative humidity, the speed of indoor air convection color, and indoor natural lighting, noise, the overall layout of designing, indoor space, etc.

Nowadays, human being becomes sustained attention to the environment protection. So the environment qualities of both the dwelling and consumption places, such as the office, hospital, shopping center, and hotel are highly attached importance. Hotel is considered as a home away from home for travelers, whose IEQ becomes highlight for travelers. There is lack of an empirical study on hotel IEQ evaluated by travelers, so it is significant that the study examines travelers satisfaction with hotel IEQ by applying IPA.

### *60.2.2 IPA*

IPA is a kind of analysis to compare the importance and performance in order to help the enterprise relocate the resources and improve the competitiveness. Martilla J A and James J C first indicated IPA in 1977, who presented the importance and performance average score in a Two-dimensional matrix. The analysis result by IPA is good to do marketing strategy by hotel managers. Recently, IPA is used to analyze travelers satisfaction with the aspects related to hospitality industry. Therefore, it is an effective method that the study uses IPA to analyze travelers' satisfaction with hotel IEQ.

## 60.3 Research Methodology

### *60.3.1 Questionnaire Design*

A survey in the form of a questionnaire was used to collect the date. The design of the questionnaire was based on the relevant literature on indoor environment quality mostly reviewed in the study, which also referred to the suggestions from indoor environment management experts, hotel managers, and travelers. Before the survey, the questionnaire was sent to the hotel managers for review and a pretest was carried out with 80 travelers for clarity, practicability, and reliability. The pretest did not indicate any problems. The Cronbach Reliability Alpha value of the scale was 0.822 which was well above the acceptable level of 0.7. The questionnaire was designed into two parts:

Part one: the importance and performance evaluation on the factors impacting on hotel indoor environment quality, including 19 indoor environment factors.

Part two: social-demographical information, including gender, age, occupation, and education background, etc.

### 60.3.2 Data Collection and Analysis

The study takes Zhejiang high star-rated hotels as an example. Zhejiang province is the first province to carry out the project of establishing the Green Hotel after China tourism held the theme activities of "eco-tourism year" in 1999. In 2005, Zhejiang Tourism Administration and Environment protection Administration published Zhejiang eco-tourism planning. The planning indicated that the scenic pots, hotels, and travel agencies should have the certification awarded by Green Global 21. So taking Zhejiang high star-rated hotels as an example to analyze travelers satisfaction on hotel IEQ is representative in China.

During October to December in 2010, 240 questionnaires have been distributed in four high star-rated hotels (four and five star-rated hotel) in Hangzhou and Ningbo of China; 236 copies are valid, with the addition of 80 valid pretesting copies. The total amount of valid questionnaire is 316. The validity rate is 98.3 %.

The data analysis tool used in this study is the 17.0 version of SPSS, the analysis methods (used) include frequency (n) and percentage (%), IPA and paired-sample *T*- test.

## 60.4 Findings and Discussions

### 60.4.1 Demographic Characteristics of Travelers

Table 60.1 shows:

(1) Gender: male (48.1 %), female (51.9 %).
(2) Age: 20 and below age (3.8 %), 21–30 age (52.2 %), 31–40 age (30.4 %), 41–50 age (11.7), 50–60 age (1.3 %), and 60 and above age (6.0 %). The majority of travelers are young and middle aged.
(3) Occupation: Officials (14.2 %), Employee (38.0 %), Technician (9.8 %), Manager (16.5 %), Boss (11.1 %), Retired (0.3 %), and Travelers' careers are wide distribution.
(4) Education level: Primary (4.4 %), Secondary (16.8 %), college/university (72.5 %), Master and above (6.3 %). Most travelers have high education background.
(5) Monthly income: below and 3,000 RMB (32.6 %), 3,001–4,000 RMB (19.6 %), 4,001–5,000 RMB (25.9 %), 5,001–6,000 RMB (10.1 %), 6,001–7,000 RMB (7.0 %), and 7,001 and above RMB (4.7 %). The majority of travelers have a monthly income of below 5,000.

**Table 60.1** Demographical characteristics of respondents

| Variable | Frequency (*N*) | Frequency percent (%) | Variable | Frequency (*N*) | Frequency percent (%) |
|---|---|---|---|---|---|
| *Gender* | | | *Occupation* | | |
| Male | 152 | 48.1 | Officials | 45 | 14.2 |
| Female | 164 | 51.9 | Employee | 120 | 38.0 |
| *Age* | | | Technician | 31 | 9.8 |
| 20 & below | 12 | 3.8 | Manager | 52 | 16.5 |
| 21–30 | 165 | 52.2 | Boss | 35 | 11.1 |
| 31–40 | 96 | 30.4 | Retired | 1 | 0.3 |
| 41–50 | 37 | 11.7 | *Monthly Income* (RMB) | | |
| 51–60 | 4 | 1.3 | 3,000 & below | 103 | 32.6 |
| 60 & above | 2 | 6 | 3,001–4,000 | 62 | 19.6 |
| *Education level* | | | 4,001–5,000 | 82 | 25.9 |
| Primary | 14 | 4.4 | 5,001–6,000 | 32 | 10.1 |
| Secondary | 53 | 16.8 | 6,001–7,000 | 22 | 7.0 |
| College/ university | 229 | 72.5 | 7,001 & above | 15 | 4.7 |
| Master & above | 20 | 6.3 | | | |

## 60.4.2 IPA Analysis and Paired-Sample T- test

Figure 60.1 and Table 60.3 show:

(1) IP7 (indoor noise), IP15 (indoor noise), and IP16 (indoor air quality) are in the Quadrant I. The theory of IPA states that these three factors have more important impact on hotel IEQ; however, travelers lower perception of the three factors do not match their expectation. Analyzing the Table 60.3,

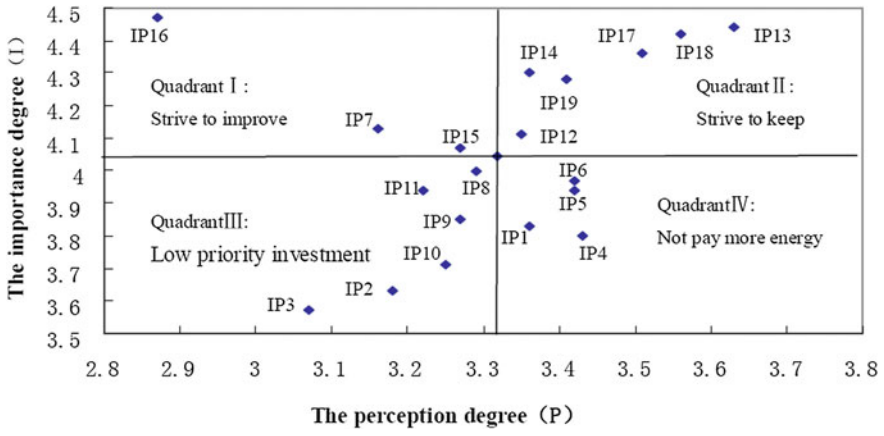


**Fig. 60.1** The IPA of travelers' satisfaction with Zhejiang high star hotels IEQ

*T*-values of IP7, IP15 and IP16 are, respectively, 14.544, 12.010, and 25.533 and P-values are 0.000 ($p < 0.05$), which obviously indicate that travelers are not satisfied with these three factors. Therefore, Zhejiang high star-rated hotels managements should strive to improve the three aspects which are in the inferior position.

(2) In the quadrant II, there are six variables which are IP12 (the quality of indoor facilities), IP13 (sanitation), IP14 (ventilation), IP17 (the quality of cotton supplies), IP18 (the quality of toiletries), and IP19 (the quality of tableware). The theory of IPA indicates that these six factors also have more important impact on hotel IEQ; at the same time, travelers has relative higher perception of these six aspects. So Zhejiang high star-rated hotels managements should strive to keep the six aspects which are in the superior position.

(3) In the quadrant III, There are six variables which are IP2 (indoor air relative humidity), IP3 (the speed of indoor air convection), IP8 (indoor space), IP9 (the overall layout of designing), IP10 (interior design and location of facilities), and IP11 (the quality of decoration/decorative material). The theory of IPA indicates that these six factors have less important impact on hotel IEQ; meanwhile, travelers have relative lower perception of these six aspects. Analyzing the Table 60.2, *F*-values of IP2, IP3, IP8, IP9, IP10, and IP11 are 0.000 ($p < 0.05$), which obviously indicate that travelers are not satisfied with these three factors. As a result, Zhejiang high star-rated hotels managements should take low priority investment on the six aspects in the quadrant III.

(4) IP1 (indoor air temperature), IP4 (indoor color), IP5 (indoor lighting), and IP6 (indoor natural lighting) are in the quadrant IV. The theory of IPA shows that these four factors have less important impact on hotel IEQ; however, travelers have relative higher perception of these four aspects, which indicates that hotel managements should not pay more energy on improving the four aspects in the quadrant IV.

(5) In Table 60.3, the 2-tailed sig of all factors is 0.000, which is less than 0.05. Therefore, in overall, travelers are not satisfied with Zhejiang high star-rated hotels IEQ, which indicate that hotel managements should pay more attention to hotel IEQ.

**Table 60.2** Illustrations

| | |
|---|---|
| IP1: Indoor air temperature | Ip11:The quality of decoration/decorative material |
| IP2: Indoor air relative humidity | Ip 12: The quality of indoor facilities |
| IP 3: The speed of indoor air convection | Ip 13: Sanitation |
| IP 4: Indoor color | Ip 14: Ventilation |
| IP 5: Indoor lighting | Ip 15: Indoor greening |
| IP 6: Indoor natural lighting | Ip 16: Indoor air quality |
| IP 7: Indoor noise | Ip 17: The quality of cotton supplies |
| IP 8: Indoor space | Ip 18: The quality of toiletries |
| IP 9: The overall layout of designing | Ip 19: The quality of tableware |
| IP 10: Interior design and location of facilities | |

**Table 60.3** Result of *t*-tests of mean difference on travelers expectation and perception of Zhejiang high star-rated hotels IEQ

| Hotel indoor environment variable | Importance mean | Performance mean | *t*-value | 2-Tailed sig |
|---|---|---|---|---|
| 1. Indoor air temperature | 3.83 | 3.36 | 7.675 | 0.000 |
| 2. Indoor air relative humidity | 3.63 | 3.18 | 7.923 | 0.000 |
| 3. The speed of indoor air convection | 3.57 | 3.07 | 7.658 | 0.000 |
| 4. Indoor color | 3.80 | 3.43 | 6.229 | 0.000 |
| 5. Indoor lighting | 3.94 | 3.42 | 8.098 | 0.000 |
| 6. Indoor natural lighting | 3.97 | 3.42 | 4.735 | 0.000 |
| 7. Indoor noise | 4.13 | 3.16 | 14.544 | 0.000 |
| 8. Indoor space | 4.00 | 3.29 | 4.075 | 0.000 |
| 9. The overall layout of designing | 3.85 | 3.27 | 8.730 | 0.000 |
| 10. Interior design and location of facilities | 3.71 | 3.25 | 7.163 | 0.000 |
| 11.The quality of decoration/decorative material | 3.94 | 3.22 | 10.877 | 0.000 |
| 12. The quality of indoor facilities | 4.11 | 3.35 | 11.399 | 0.000 |
| 13. Sanitation | 4.44 | 3.63 | 13.129 | 0.000 |
| 14. Ventilation | 4.30 | 3.36 | 13.651 | 0.000 |
| 15. Indoor noise | 4.07 | 3.27 | 12.010 | 0.000 |
| 16. Indoor air quality | 4.47 | 2.87 | 25.533 | 0.000 |
| 17. The quality of cotton supplies | 4.36 | 3.51 | 14.315 | 0.000 |
| 18. The quality of toiletries | 3.71 | 3.25 | 12.804 | 0.000 |
| 19. The quality of tableware | 3.94 | 3.22 | 13.909 | 0.000 |

*Note* 2-tail sig $\leq 0.05$ means there is significant difference

## 60.5 Implications and Conclusions

The study examines travelers' satisfaction with hotel IEQ by applying (IPA) Importance-Performance Analysis, which takes Zhejiang high star-rated hotels as an example. Overall, travelers have lower satisfaction with hotels' IEQ, the findings clearly show:

(1) Zhejiang high star-rated hotels IEQ are relatively superior in the following six aspects: the quality of indoor facilities, sanitation, ventilation, the quality of cotton supplies, the quality of toiletries, and the quality of tableware. Zhejiang is one of the earliest provinces to develop hotel industry, with the addition of its developed economy in China, therefore, the qualities of hardware facilities and customer goods which achieve international hotel standard are well recognized by travelers. Zhejiang province is also the first province to carry out the project of establishing the Green Hotel, which began in 1999. So the sanitation and ventilation in Zhejiang hotels have good performance. Based on the competitiveness of the above six aspects, Hotel managements should continue to pay more attention to the connotation construction of hotel IEQ in order to satisfy travelers.

(2) Zhejiang high star-rated hotels IEQ are relatively inferior in the following three aspects: indoor noise, indoor noise, and indoor air quality.

As the economy rapidly develops, noise becomes one of the main factors to affect human health. Hotel is one of the population intensive consumption places, so hotel managements should control hotel indoor noise in every many ways, such as hotel should establish perfect sound insulation system to isolate external noise when a new hotel is built up, production areas and consumption areas should be relative independent when designing hotel functions, which is good to reduce hotel indoor noise. In general, hotel indoor noise management should be corresponding with the standard of Chinese residents building indoor noise requirements from the regular of Indoor environment noise standards. In recently, Zhejiang high star-rated hotels have improved hotel indoor greening; however, travelers requirements develop faster than hotel improvements in the aspect of indoor greening. Therefore, on the one hand hotels managements should improve hotel indoor greening rate, on the other hand, hotel indoor greening plant variety and its functions should be more plentiful, which will not only embellish hotel but also purify hotel indoor environment. Indoor air quality is the key factor of measuring indoor environment quality which is also most keened by consumers. So hotels managements should pay much more attention to hotel indoor air quality, who should take some steps to improve hotel indoor air quality based on the Indoor air quality standards, such as durable ecofriendly materials utilization, keeping high fresh air rate, and good air-condition operation system, etc.

This study probes travelers subjectively comments on hotel IEQ and provides some suggestions for improving hotel IEQ from the micro angle. There are some limitations should be improvement, such as the factors affecting hotel IEQ should be further refined, valid dates should be enlarged, etc. It is a systematic and long-term process, future studies should be conducted to objectively test hotel IEQ, to combine these study findings and to make strategy to improve hotel IEQ.

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# Chapter 61
# Evaluation System of Tutorial System Based on Balanced Scorecard

**Jing Li**

**Abstract** In recent years, our colleges and universities have popularized the undergraduate tutorial system widely to improve the quality of undergraduate education. However, its effect is not ideal; one of the reasons is that the Tutorial System Implementation Effect evaluation system is not perfect. By using the Balanced Scorecard Model, the tutorial system for undergraduates will be established reasonably and comprehensive, which provides the basis for further improving the tutorial system for undergraduates.

**Keywords** System of undergraduate tutorial · The model with the balanced scorecard · Implementation effect evaluation system

## 61.1 Introduction

The system of undergraduate tutorial has been always widely emphasized by all colleges and universities, since its implementation in Peking University in 2002. However, seen from the implementation in recent years, the overall effect is not

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ideal and does not achieve the desired result. The reasons for this situation are various. Therefore, the author thinks that the fundamental reason is that there is no a reasonable and sound evaluation and incentive mechanism [1].

## 61.2 Current Situation of the Evaluation System for the System of Undergraduate Tutorial

Compared with the system of graduate tutorial, the system of undergraduate tutorial has been only implemented in China for a shorter time and also still in an exploring stage [2]. In most Chinese colleges and universities, the system of undergraduate tutorial is still in its initial stage of implementation. For example, tutors do not know well their own job duties, and therefore it is difficult to give an answer to the questions such as how to do, how many to do, and how about the effect. At present, the implementation of the system of undergraduate tutorial relies on a tutor's dedication and sense of responsibility much more. For the students, it is totally fuzzy. In most cases, in the system of undergraduate tutorial, tutor only holds a meeting among students for preliminarily knowing about the learning of students and simply assigning some tasks to the students. In addition, the compensation for an undergraduate tutor is relatively low in general, and also the evaluation system is with some shortcomings, thus making part of tutors short of enthusiasm.

## 61.3 Effect of the Application of the Model with the Balanced Scorecard in Evaluating the System of Undergraduate Tutorial Effectively

To promote the system of undergraduate tutorial to be continuously implemented and attain a development, it is necessary to establish a feasible evaluation system and also make it institutionalized. In this evaluation system, the work of a tutor has to be traced and evaluated with the comprehensive evaluation indexes, and subsequently relevant adjustments can be made. The purpose of applying this evaluation system is to make a comprehensive evaluation on the work of a tutor in guiding an undergraduate student, but not to make an evaluation by relying on work time, amount, and other single indexes.

### *61.3.1 The Model with the Balanced Scorecard*

The Balanced Scorecard (BSC) is a new idea in performance management. The value of BSC is that it can allow us to see the overall influence of those

nonfinancial means deciding the prospect of enterprise long-term earnings on financial performance. It helps us to comprehensively think over the fields of the strategic importance from four aspects (i.e. finance, customer, internal process, and learning and growth), for the purpose of ensuring daily operation to be consistent with the management strategies decided by top management personnel of enterprises.

From the above analysis, BSC can be defined as "proper strategic advantages and efficiencies are established and innovated only if what knowledge, skills and systems enterprise employees need can be clearly manifested by BSC, promoting enterprise bring specific values to market and hence ultimately realizing a higher shareholder value".

### *61.3.2 Establishing the Effect Evaluation System for the System of Undergraduate Tutorial Based on the Theory of BSC*

According to the shortcomings of the current evaluation system in Chinese colleges and universities for the system of undergraduate tutorial based on the theory of BSC and the advancement of BSC in theory and tools, BSC can be introduced to the evaluation of the system of undergraduate tutorial in colleges and universities, for the purposes of realizing an effective evaluation on the effect of the system of undergraduate tutorial, guiding tutors to work better, and promoting the quality of teaching undergraduate students to be improved comprehensively.

Colleges and universities, as nonprofit organizations, are not to purely pursue economic efficiencies. For this reason, it is necessary for colleges and universities to make appropriate adjustments when introducing BSC to the establishment of the evaluation system for the system of undergraduate tutorial. According to the principle of BSC, it is necessary to pay more attention to the comprehensive application of multiple indexes in the evaluation of the system of undergraduate tutorial. Also, the system of undergraduate tutorial in colleges and universities can be evaluated from four dimensions (i.e. quality control, students, internal processes, and innovation and learning), as shown in Fig. 61.1.

#### 61.3.2.1 Quality Control

Quality control is mainly to evaluate the work of tutors in the system of undergraduate tutorial, and its main purpose is to promote tutors to know well their own job duties. To achieve the comprehensive evaluation effect, the evaluation can be made from multiple aspects.

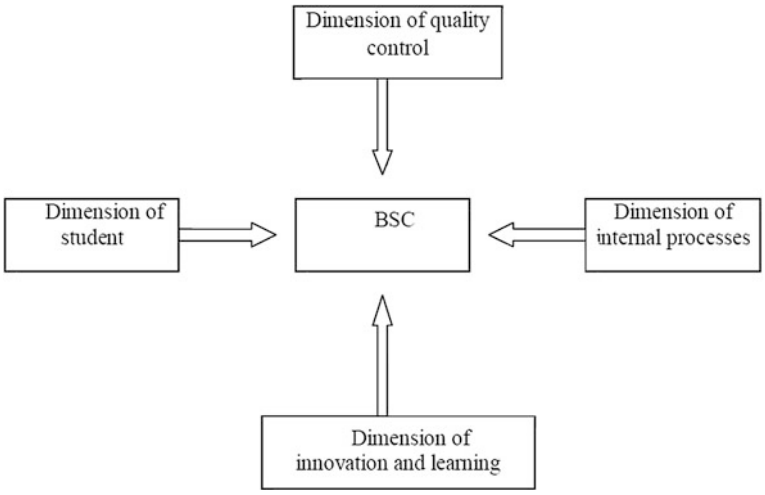


**Fig. 61.1** Composition of the evaluation system for the effect of the system of undergraduate tutorial in colleges and universities

### Evaluation on Work Attitude

Evaluation on work attitude includes (1) whether the work discipline can be strictly abided by, whether the tutor comes to classroom late, leave early, or is absent; (2) whether the tutor's work plan is implemented reasonably and completed on time; (3) whether the tutor is fully passionate in work and can propose rational suggestions for students; (4) whether the tutor encourages students to actively and positively make efforts to the assigned tasks; (5) whether the tutor takes initiative to learn knowledge related to their specialties, continuously improve professional skills; (6) whether the tutor is bold in undertaking, but never shirking from responsibilities.

### Evaluation on Work Amount

In the evaluation on work amount, the model (total workload = basic workload + extra workload) is applied. Basic workload is the work amount, which is necessarily completed by each tutor in this year; extra workload is the work amount that is added by a tutor based on the actual conditions of students, and its specific quantities and requirements can be appropriately adjusted according to the differences of different majors. Workload can be composed by concentrated class hours, discussion class hours, and class hours for the communication with students independently, and internship or social practice class hours, etc.

#### 61.3.2.2 Internal Processes

Evaluation on internal processes is mainly to know whether the guidance of a tutor for undergraduate students is implemented based on the preset processes. Therefore, knowing well the work processes can be much helpful for the smooth implementation of the system of undergraduate tutorial in colleges and universities. In terms of tutors, the job of a tutor can be done step by step in future if a clear guidance plan is formulated at the beginning of semester, and thus the efficiency of a tutor to guide students can be improved; in terms of students, the guidance contents from their tutors are necessarily known well for promoting them to be active and initiative in learning and also make a full preparation in advance, and ultimately the maximum benefit can be attained from the guidance of tutors. Specifically, the tutors are required to make a detailed guidance plan according to the actual conditions of students at the beginning of each semester, which will be evaluated. That is, the evaluation will be made on how to give targeted guidance to students, guide different students to complete the due duties based on a specific time arrangement, and require both the tutor and students to commonly make detailed guidance log; the evaluation on the implementation of job duties by a tutor includes whether the guidance to students is completed step by step according to plan, or specific completion and proportion.

#### 61.3.2.3 Students

Students are not only the direct beneficiaries of the implementation of the system of undergraduate tutorial, but also the direct reflectors of its results. Whether students are satisfied with the effect of being guided by a tutor has a close tie with the final result of the implementation of the system of undergraduate tutorial. The purpose of implementing the system of undergraduate tutorial is to carry out personalized instructions out of class according to the different characteristics of the students, and thus a road and direction that is most suitable for the learning of students can be opened for them. Therefore, it is necessary for the selection of the evaluation indexes to give top priority to the feelings of students as far as possible, and the main evaluation contents include (1) whether students are guided by the tutor according to their aptitudes and different methods are applied for different students; (2) whether the guiding methods selected by the tutor is suitable for students; (3) whether the questions raised by students in the guiding process are reasonably solved. Thus, it is necessary for a tutor to design guiding contents and apply different methods through knowing about the learning of students at the earlier stage. Also, it is necessary for students to make records and analyses on the guidance from tutors, and then propose suggestions and opinions. Meanwhile, it is necessary for a tutor to track the implementations of suggestions and opinions from students.

#### 61.3.2.4 Innovation and Learning

Innovation and learning are mainly to evaluate the results that are achieved by students from receiving the guidance from tutors. This is also an important part of the evaluation on whether the tutor fulfills his duties. The results that are achieved by students include (1) the papers written by students on the subjects they research; (2) the achievements made by students in participating in all levels of competitions; (3) the daily performance of students; (4) the completion of the assignments of students in the process of receiving guidance from guidance; (5) whether students get a full understanding of the learning contents of programs and put them into practices; (6) all sorts of performances of students in practices, etc.

The above is a brief introduction to the evaluation system for the effect of the system of undergraduate tutorial. Certainly, there are a great number of programs in colleges and universities, and also there are significant differences between different programs. Thus, different requirements are made on evaluation indexes, and different colleges and universities can design evaluation indexes applicable to them according to the actual conditions.

**Table 61.1** Specific Ways for Evaluating the System of Undergraduate Tutorial

| Evaluation way and its percentage % | Specific evaluation way |
|---|---|
| Self-evaluation (10) | Tutor concludes and evaluates his completed work; specific evaluation indexes have been mentioned above, so tutor is required to provide relevant evidences such as guiding log, student's result; full marks are 100 |
| Evaluation from students (30) | Student evaluates the work of his tutor; the focus of evaluation is on tutor's work attitude, workload, work plan implementation, applicability of guiding way to this own actual conditions; full marks are 100 |
| Mutual evaluation between tutors (20) | Tutors evaluate each other anonymously; the mutual evaluation between tutors is targeted at the tutor's work attitude and work plan implementation, etc.; not only the work of colleagues can be further known, and also the opportunities for mutual learning are increased; full marks are 100 |
| Evaluation from Leaders (20) | Evaluation can be made jointly by school educational administration department and leaders; the work of tutors is irregularly inspected according to the guidance plan provided by tutors; the direction group can participate in the guiding process of tutors; school leaders make a comprehensive evaluation on the guidance of tutors and the information feedback from students; full marks are 100 |
| Evaluation from experts (20) | External experts can be employed by school or departments to evaluate the guidance contents and methods of tutors; full marks are 100 |
| Overall evaluation | Ultimate evaluation is given based on the above methods; a weighted average is applied; full marks are 100 |

### *61.3.3 Ways for Evaluating the System of Undergraduate Tutorial*

To make an evaluation on the undergraduate tutors, the methods are also very important. Multiple evaluation methods are advisable to be applied, making the evaluation results comprehensive, objective and fair, and accurate and efficient. The specific evaluation ways are shown in Table 61.1.

Evaluation result is the foundation of rewards and punishments. Therefore, it is necessary to conduct a quantization processing on evaluation result. As shown in Table 61.1, a fair and objective evaluation result is provided for each tutor. The comparison on evaluation results will be greatly different because the specialties of the tutors are different. Thus, it is hard to make a comprehensive comparison in a wider range. Multiple programs in colleges and universities can be divided into several groups, and each group comprises of similar programs. Then, a comparison on the ranking of evaluation results can be made within a group. Rewards should be provided for tutors with good effect, but tutors with poor effect are required to make a modification within a time limit.

## 61.4 Conclusion

Evaluation is important for colleges and universities to implement the system of undergraduate tutorial. Therefore, the application of the model with the balanced scorecard can more efficiently promote management personnel in colleges and universities to examine the implementation effect of the system of undergraduate tutorial from a comprehensive and objective perspective. Subsequently, the quality of the quality-oriented education can be improved in colleges and universities. As an attempt for the development of China's higher education, the positive role of the system of undergraduate tutorial is getting significant with a gradual step. However, how to implement the system of undergraduate tutorial more effectively in practice is still necessary for us to continue to explore.

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# Chapter 62
# Study of Low-Income Housing System in China

**Qun Gao**

**Abstract** Low-income housing system in China provides three forms to raise funds for building affordable housing and low-cost housing, such as tax rebates, general transfer payments, and special transfer payment, in order to achieve the basic housing needs of low-income groups and to achieve a social fair in the domain of real estate.

**Keywords** Low-income housing system · Transfer payment · Safeguard people's livelihood · Social justice

## 62.1 Introduction

The low-income housing system means a series of system giving priority to the transfer payment system, and the concrete systems includes that the government provides the basic living houses for those low-income families, and provides the low-rent house for those lowest-income families by the power from the country [1], the local government, and the society, and provides the economically affordable house for low-income families, and provides the price-limit house and the commodity house for the middle and high-income families. The main target of the transfer payment system is the equalization of public services, and the equalization of the real estate means the fair sharing of the special public commodity, i.e. the real estate, which also could help the harmonious development of the real estate

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economy [2]. Since 2005, the housing policy of China had begun transforming from the market housing into the low-income housing, to solve the housing difficulty of low-income families [3, 4]. In the August of 2007, certain opinions about solving the housing difficulty problems of urban low-income families of the State Council of China indicated that the low-income housing policy of China needs to be perfected.

## 62.2 The Current Transfer Payment Policy of China

The finance transfer payment system is based on the tax distribution system of 1994, and it composes three parts, i.e. the tax rebates [5], the general transfer payment, and the special transfer payment, and it is the transfer payment system with Chinese characteristics that is given priority to the transfer payment from the central government to the local governments.

### *62.2.1 Tax Rebates*

Tax rebates is the main form of the finance transfer payment of China, and it is the important source of the local finance incomes, so whether the tax rebates is designed reasonably or not determines the reasonability of the whole system. But the tax rebates is still distributed based the base to maintain the local vested interests, and it embodies the policy that inclines to those regions with strong income ability, and it maintains the vested interests of rich regions, and runs counter to the intention of reducing the gap among regions. In addition, though the tax rebates belongs to the central finance income on paper, the local finance could determine these capitals finally.

### *62.2.2 General Transfer Payment*

The general transfer payment is the subsidy payout which is arranged by the central finance for local finances to compensate the financial gap of those regions with weak financial strengths. The general transfer payment is the important measure to reduce the financial gap among regions, and it is the main part of the finance transfer payment, and mainly includes many forms such as the common transfer payment, the adjusted wage transfer payment, the national region transfer payment, the rural taxation expenses reform transfer payment, and the year-end balance finance subsidy.

### *62.2.3 Special Transfer Payment*

The special transfer payment is the subsidy capitals established by the central finance to realize special macropolicies and development strategic targets, and it is mainly used in various public service domains about the people's livelihood. And local finances should use the capitals according to the regulated purpose.

## 62.3 The Transfer Payment of the Government Financial Capitals

Financial capital is one of the main capital sources of the low-income housing construction. In past local financial budget, the low-income housing construction capitals have not been arranged, and at present, the space to pay the low-income housing capitals in the local financial budget which is originally intense is very limited. For the west regions with difficult financial income, the central government could support the local governments by the forms such as the budgetary investment subsidy and the special subsidy capitals of financial low-rent housing. In addition, the property tax can be collected in the whole country, and part of the taxation could be used for the construction capitals of the low-income housing, which is deserved to be explored.

## 62.4 The Transfer Payment of the Added-Incomes of Housing Fund

According to the "Temporal Methods of the National Social Security Fund Investment Management" of the Ministry of Finance and the Ministry of Labor and Social Security, all net incomes of the social security fund should be brought into the social security fund which should be distributed and invested according to relative regulations of China. The "Methods" regulated that the housing fund was the "long-term housing savings fund", so the housing fund is the guarantee capitals which are specially used for solving the employees' housing problem, with the characteristics such as the specificity, the mutual assistance, and the security. These characteristics of the housing fund also belong to the content of social securities. The housing fund system should realize the mutual benefit, the mutual assistance, and the mutual association among subscribers, i.e. the added income of the housing fund except for the loan risk reserve and the relative management charges is used for the construction of low-rent houses. Since 1998, the construction capitals from the added income of the housing fund have achieved about 10 billion Yuan, which is one form of the mutual assistance, and it could not only effectively solve the

problem of difficult housing of low-income families, and accord with the essential attributes of the housing fund such as the mutual assistance and the security, but also embody the intention that China pushed the housing fund system, and promote the health development of the housing fund system.

The added income of the housing fund means the difference between the operation income and the operation payout of the housing fund. The operation income includes (1) the interest income of the personal housing loans of the housing fund, (2) the income of the bank credit, and (3) the interest income of purchasing the national debts. The operation payout mainly includes (1) the agent fees of banks, (2) the deposit interest of the employees' personal housing fund, and (3) other relative management charges. That is to say, the added income of the housing fund is composed by the deposit interest and the interest different between loans and deposits (i.e. the interest difference between the housing fund deposits and loans). In fact, the added income of the housing fund is generated in the process that the housing fund management center utilizes employees' personal housing funds to satisfy subscribers' demands of purchasing houses and adding values under the support of national policy, and implements many added value activities such as depositing, loaning, and purchasing national debts.

## 62.5 The Transfer Payment of the Land-Transferring Fees

Land is the basic resource for the human being to survive. The establishment of the land transfer system and the obtainment and distribution of the land transfer income are the basic guarantees for human being to live and develop. The formation of the land price accords with the economic development, the development course of city, and the durative of the land development, and only in this way, the security function of land could be exerted fully. As the important strategic resource of the country, the land is used for the country to obtain the durative profit by the land transfer, which is used for the public establishment service and the public management, and the construction of the low-rent houses. In the Economic Housing Application Procedures of China, the construction lands of the economic houses are provided by the form of administrative allocation, and brought into the yearly land supply plan of the current year, so the land cost of the economic housing construction is almost zero. At the same time, local governments are exempted from various administrative fees and governmental funds of the urban basic establishment expenses for the economic housing projects.

The central government has required the local governments to use more land transfer incomes in the housing construction of the low-rent houses and other security houses by the land income transfer payment, which could further solve the difficult housing for middle and low-income families in the economic regression. The proportion of the low-rent housing guarantee capitals in the new income of land transfer should exceed 10 %, and local governments could properly enhance this proportion according to the actual situations. The sharing of land income is the

biggest livelihood, and to realize this sharing, the land price will certainly rise with the maturing of the regions and the land price in the mature regions only ascend and present the tendency of increasing values. In 2009, the income of national funds was 1,833.504 billion Yuan, which equaled to 26.8 % of the national finance income in the same period. In the income, the most was the state-owned land sale revenue of use right. In this year, the income of national land transfer was 1,423.97 billion Yuan, 77.7 % of the income of national funds, and the contribution ratio of the land transfer income to the national finance income was about 21 %. The central and local governments increased the public finance income by obtaining the lands, and improved the difficult housing of low-income families by the transfer payment.

## 62.6 The Attempt That Enterprises Use their Own Lands to Develop the Economically Affordable Houses

Because the construction of the low-income housing belongs to the governmental function, and the construction scale is larger, the "land finance" of the government reduces more, and local governments could let some big enterprises with lands to participate in the low-income housing construction, so some governmental functions could be shared by enterprises, which could not only reduce the burden of the government, but also correspondingly reduce the instant loss of the "land finance". In this way, both the government and the enterprise could obtain their own profits, and at the same time, because the new competitive subject, i.e. the industrial enterprises with lands, will occur in the commercial housing development market, that means the house price may descend properly. According to relative reports, many big enterprises in Shanghai have large numerous of lands, and the positions of these lands are better than the lands from the governments. It is obvious that these enterprises would use their lands for the commercial housing development and construction, but that was forbidden by the state. On the contrary, without special policies, these enterprises will not use their own lands for the commercial housing development and construction. Though the government has attracted many big enterprises to use their own lands to participate in the low-income housing construction, the policies may be changed. According to the "The Low-income Housing Construction Land Supply Management Implementation Methods of Shanghai", "if the enterprises voluntarily use their lands to apply and participate in the construction of low-income house, the baseline proportion of the low-income housing construction is 50 %". That is to say, the other 50 % of lands could be allowed to construct the commercial houses. If this policy could be implemented, many enterprises would actively participate in the construction of the low-income house.

## 62.7 Horizontal Transfer Payment Among Governments

In the practice, the horizontal transfer payment of finance has not occurred in the low-income housing among same-level governments. The transfer payment among governments is mainly to balance the gap of the government income because of different geographical environments or economic development levels, and ensure that the local governments could effectively provide housing guarantee for difficult families according to the uniform standard of the state. Generally, the regions with developed economy and rich finance could transfer the finance to the poor regions, for supporting other regions each other, reducing the regional gap, balancing the finance, assisting the society, and supporting the minority. The capitals come from regions with rich finance, and the capital transfer is direct, transparent, and highly effective. With the encouragement of the central government, a nonformula and noninstitutionalized transfer payment occurs among provinces and regions.

In addition, the housing funds of different regions are extremely unbalanced, and the management of the housing funds in developed regions is reasonable, but the usably idle funds are less, and on the contrary, the housing funds in middle and west regions are rich, but the management is not standard relatively. The total idle housing funds of China are about 100 or 200 billion Yuan and the funds among different regions are not balanced, and if the uniform housing fund platform could be established in China, the funds in the rich regions could flow to those poor regions, and the low-income housing problem could be solved better.

## 62.8 Main Problems and Countermeasures

### *62.8.1 The Transfer Payment System of the Low-Income Housing is Not Perfect, and the Implementation Power is Not Sufficient*

At present, there are no complete and systematic implementation methods about the finance capitals, land transfer, financial support, and trans-regional utilization of housing fund of the low-income housing construction, especially the problem of how to carry out the capitals lacks in perfect measures. When the planning index has not been confirmed, some local governments negatively implement the financial payouts, which largely reduce the construction of low-rent houses.

The central government should require local governments to institute the low-income housing policies according to their local institutions for low-income families, and strengthen the supervision to local governments for the implementation of policies. At the same time, the construction of laws and regulations about the low-income housing should be quickened, and the local governments'

responsibilities about the residence right should be confirmed by the legislation, and the subject and object of the low-income housing should have relative laws and regulations to abide by.

### *62.8.2 The Construction Capital Source of the Low-Income Housing is Deficient, and the Proportion is Lower*

According to the "Urban Low-cost Housing Management Practices of China", the construction capitals of low-rent house should give priority to the public budget capitals of finance, but only a few cities establish the finance capitals supply plans from the system, and most cities depend on the added incomes of housing funds and the surplus of the low-income housing sales to collect the construction capitals of low-rent houses. This capital proportion is lower, and not stable, and the subsequent capitals could be guaranteed.

Therefore, the central and the local governments must strengthen the finance capital supply plan of the low-rent houses, fully and reasonably utilize the added income of housing fund, enhance the proportion of the land transfer income in the low-rent housing construction capitals, actively exert the social power, and collect the construction capitals of low-income houses from multiple channels. At the same time, the investment subsidy of the central budget and the special subsidy capitals of the central financial low-rent house should incline to the difficult regions in the middle and west of China.

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# Chapter 63
# Study on Development of Local Colleges

**Mei-liang Xiao**

**Abstract** Local colleges are the main bodies of Chinese higher education. Their proper and sound development will do well to the development of local economy and society. Compared with famous and key universities, their development is in inferior state and there are lots of problems. This article analyzes the problems during their development process and then it puts forward relevant strategies so as to provide reference for the development of local colleges.

**Keywords** Local colleges · Development · Problems · Strategies

## 63.1 Introduction

With the expanding of functions of universities, the traditional universities have been the center of the society instead of "the ivory towers" [1]. In China, in the course of popularization of higher education, the reform of management system is going thoroughly. The central government delegates the management power to local government, at the same time; the local governments are running higher education with more initiative so as to further the economic and social development [2]. Now among 1,000 universities, local colleges have take up 70 %. The development of local colleges is good. While compared with the famous and key universities, local colleges are in the dry tree. This chapter analyzes some development problems of local universities and then puts forward related solutions.

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## 63.2 Analysis of the Problems During the Development

### *63.2.1 Orientation is Going in for Greatness or Perfection*

Nowadays, every nation knows that higher education plays a critical role in the development of one's economy and society. The knowledge economy age is coming. In such background, people's needs for higher education are more urgent. The demanding standard of talents is gradually raised. People need higher level of education [3]. The shrinking of technical secondary schools and junior colleges and the intense competition of postgraduates examinations are typical examples. In order to survive and develop, the high tide of "upgrading" emerges among local universities: junior colleges are going to be undergraduate colleges or universities, undergraduate colleges are going to start master education. All the local colleges want to be "big" universities. In fact, however, the diversity for talents determines the variety of colleges and universities. Different colleges and universities are on different starting line. It is not necessary for them to develop hand-in-hand. The strategy of "do something and don't do something" is very important. Beijing University is Beijing University itself; Qinghua University is Qinghua University itself. They both have their long history and they have incomparable advantages. If local colleges go in for greatness without thinking of their present situation, they may decentralize their limited resources. Therefore, local colleges must think about their orientation according to their reality.

### *63.2.2 The Disciplines Have No Unique Features*

The disciplines are carriers for the colleges and universities to cultivate talents, to carry on scientific research, and to serve the society. The level of disciplines determines the quality of their talents, the standard of their scientific study as well as their capability of serving the society. To some degree, the disciplines determine the survival and downfall of colleges and universities. Thus, modern colleges and universities are going out of their way to start hot specialties in spite of their own reality. From the advertisements of different colleges, we can easily find that their disciplines are almost the same as those of famous universities. Local colleges start their disciplines at random, they do not think over the actual needs of the local society. Their disciplines are short of characteristics.

### *63.2.3 The Norms of Cultivating are Not Clear, the Graduates are Lacking of Competitiveness*

Due to the effect of orientation and setting of specialties, many local colleges try their best blindly to keep up with famous universities in cultivating talents.

Whatever the famous universities have, they want to have. They pay more attention to the education record of formal schooling, whereas they neglect cultivating practical professionals. Recently, the author made visits to several job fairs and found that the graduates from local colleges could not be well matched with those from famous universities. Many employing units are unwilling to take the resumes of graduates from local colleges. They have no clear norms of cultivating talents so the graduates are lacking of competitiveness.

### *63.2.4 Local Colleges are Short of Initiative of Serving the Society*

Serving the society is one of the functions of colleges and universities. The forms of service are different, such as educational training, technical advice and conduct, cultural service and so on. Serving the society is the best way of linking theory with practice; it is also the way of checking the level of transferring knowledge to practical force. At the same time, by serving the society they may get financial support. American colleges and universities set up good examples in creating income themselves by serving the society. For example, the percentage of money from service in America in 1990 was 21.7, while in China it was not up to 10. The percentage of money from service of local colleges is much lower than that of big universities.

### *63.2.5 The Quality of the Teaching Staff is Weak*

In order to seek chances for development, local colleges pay great attention to importing and training talents with high education. However, such talents are more likely to go to regions of advanced economy. What is worse, some of the teachers sent out to study further run off after they got their higher degrees. The outflow of talent intensifies the gap in talents. The quality of the teaching staff is obviously a big problem.

## 63.3 Developing Strategies for Local Colleges

As mentioned above, local colleges have lots of problems in their developing procedure. In the competitive society, if local colleges want to survive and improve, first they must know themselves. The saying “know yourself as well as the enemy, you can fight a hundred battles with no danger of defeat” is surely the premise for our strategies. The followings are what we suggest.

### 63.3.1 Local Colleges Must Have Clear Orientation

There are four meanings of orientation of running schools: hierarchical orientation (status among the higher education system); professional orientation; orientation of standard of talents, and characteristic orientation of their schooling. The outline of China's education reform and development has already put forward that related policies should be set for determining the taxonomy of higher education according to different regions, professions, and schools. By doing so, different colleges or universities may have their own clear aims and they can fully show their own features. Usually, there are four levels in classifying colleges and universities in China: Research University, teaching and Research University, teaching college, and junior college. The need of talents is various, so local colleges should be aware that different colleges have different functions. In hierarchical orientation, they must take "locality" as their basis. The undergraduate education and professional education should be their main roles. In professional orientation and orientation of standard of talents, local colleges may find out the needs of local communities, then start needed professions so as to train useful talents. For instance, Xiaogan city is a district with large population of agriculture. There is great potential in agriculture industrialization and urbanization. As the highest college in Xiaogan, Xiaogan University may focus on developing such professions as agriculture planting, landscape agriculture, city planning, architectural design and so on. In characteristic orientation of their schooling, local colleges should make their local features distinct to others. Every district has its typical geography, cultural environment, economic condition, and natural resources. From what we have discussed above, in the course of running schools, four principles should be followed: principle of demand, principle of feasibility, principle of locality, and principle of characteristics.

### 63.3.2 Keeping Local District as its Foothold, Contacting and Serving the Society Actively

Social and economic development of local district and development of higher education stimulate each other. Social and economic development is the base for the development of higher education. Higher education provides the development of social and economic development with talents and technology. Colleges and universities are the storage of knowledge. They should transmit knowledge from generation to generation and cultivate educated talents. Meanwhile, they should create new knowledge and make use of them.

Local colleges should also be the research center of culture and the base of talents training. By using their intelligence and science and technology, they may contact and serve the society in many ways. There are three main functions local colleges can perform: cultivating talents, providing advisory and training service, and promoting the integration of production, learning, and research.

### *63.3.3 Enhancing the Building of Teaching Staff in Local Colleges*

The twenty-first century is a very critical period for the strategy of rejuvenating the country through science and education. It is also a critical period for educational reform and development. The key of rejuvenating the country through science and education is talent; the key of cultivating talent is the teacher. Thus, to build a group of teachers with high quality and energy is the most important task in the development of a college.

First, we should lay more stress on the construction of teacher's professional ethics. The notions such as loving the school as dearly as one does one's own home, cherishing posts and devoting wholeheartedly to work should be established. The money consciousness nowadays occurs among the staff of colleges. Most teachers in local colleges go out after they get higher degree just for money in a developed district. To the colleges, harmonious and democratic environment should be built. They should try their best to provide good teaching and researching conditions for teachers and researchers. To the staff, they should consider fame and money properly while admiring knowledge more.

Second, we should pay more attention to the construction of discipline and backbone of teachers. The construction of academic pacesetter and backbone of teachers is the main task in the building of teaching staff. Local colleges are short of such academic pacesetters. Now many local colleges take resource sharing as their main ways of building their teaching staff. In fact, it is a way but it is not a reasonable way. We should cultivate our own academic pacesetters.

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# Chapter 64
# Study on Demand for Foreign Language Professionals in Economics and Trade

**Xuemei Sun and Zhonghui Jia**

**Abstract** In order to get information on the Demand for Foreign Language Professionals in Economics and Trade, help undergraduates to clear the gap between their work expectations and the reality, guide them in employment, and direct the personnel training in Higher Education, the task group made a half year research to find that the real gap lies in that personnel training does not match with social needs.

**Keywords** Demand · Employment · Foreign language professionals in economics and trade

## 64.1 Introduction

China Ministry of Education borrowed the color of traffic lights, "Red, Yellow, and Green" which are easy to reach consensus by the people, to label the employment of different professionals each year in order to provide professional reference for college graduates entering the workplace and to assist the volunteer candidates in selecting professionals after the National Entrance examination. Professionals labeled with "Red" means the top 10 ones with large amount of unemployment, continuously low employment rate, and low salaries. And professionals labeled with "yellow" means those with large amount of unemployment, continuously low

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employment rate, and low wages though they are not listed among the top 10. While those labeled with "Green" means salary and employment rate continued to rise, and unemployment rate is low in considering the amount of the professionals."Green" professionals are those of demand growth [1].

Among the professionals labeled with "Red and Yellow" published by China Ministry of Education in 2009 and 2010, English, International Economy and Trade are both the "Red" ones in Undergraduate Education, and Business English is in the "Yellow" in Higher Professional Education. All of whom are the human resources of foreign trade companies.

In order to track the employment, Chongqing City and Management College conducted an annual employment survey of graduates, the survey results are similar to those released by the Ministry of Education. At the same time, the relevance degree of employment and professional is not high, which is also in consistent of the survey published by Mycos [2].

From the above information, it seems that social demand on Foreign Language Professionals in Economics and Trade is saturated.

In order to learn more on the social needs for Foreign Language Professionals in Economics and Trade, to find a way out for graduates in employment and professional training, the task group and 89 students of Business English Major made a half year research through investigating 322 foreign trade companies in Chongqing.

## 64.2 Research

The research methods are questionnaire and interview. The questionnaire was designed on the aim of the survey, which mainly includes job demands, capacity, quality and knowledge needs. Dissatisfaction with the interns and graduates, and training desire from foreign companies are also included in the questionnaire. 530 questionnaires are distributed and 437 returned, with 82.5 % recovery rate. Among the questionnaires returned, 399 are valid, 75.3 %.

After the questionnaire, the task group interviewed 13 departments' managers, 5 from human resources and 8 from sales, to track the interns and graduates from Business English Professional there.

## 64.3 Results

### *64.3.1 General Research Statistics*

Job and capacity needs: statistics show that 75 % companies need merchandisers, 60 % of customs declaration employments, and 51 % of export sellers. Another 58 % companies needs graduates with capacity of doing full set of business.

Among the positions, they focus on integrated services capabilities. In descending order, they specially mentioned communication and interpersonal skills (90 %), ability to solve problems (35.5 %), foreign language skills (24 %), and professional competence in Economics and Trade (23 %).

Language needs: As for language, 96 % companies need graduates with English skills, among them, competency with interpretation and translation is stressed (91 %). 89 % companies especially value speaking ability, among them, 94 % stressed pronunciation. Companies valuing writing only take 16 %.

Quality demands: qualities that companies value include cheerful and enthusiastic character (67.5 %), creatively working (38.5 %), patience, determination, and calm (16 %).

Knowledge needs: in this part, enterprises concentrated on the following three aspects, communication (60 %), special field of study (35 %), and information (14 %).

Others: to the aspects of dissatisfaction, 69 % companies hold that the interns and graduates are not good at communication, 34 % consider they lack of persistence, and 17 % view they do not work seriously or dedicatedly.

On questioning their training desire, companies stressed enhancing student's ability in information obtaining (74 %) and quality (33 %).

### *64.3.2 Classified Statistics and Interviews*

The task group made a secondary statistic in accordance with the classification of management group and operational staff who deals with importing and exporting directly. In the classification, 60 questionnaires went to the management group and 205 to the operational staff. And the statistics show a clear difference between the two groups in some important aspects (see Table 64.1).

From the statistics, we can see the differences between the two groups. As with language, 38 % of the management group need Japanese graduates besides English. When staff absolutely tends to "speaking competency (89 %)", 60 % management group still values "Listening competency" and "Writing competency (58 %)".

On specific capability, management group favors the ability to complete specific tasks (62 %), while staff solely stresses communication (99 %) and obtaining information (87 %).

Among knowledge, capability, and quality, management group values quality the most.

The statistics also show that the needs of management group are more comprehensive and specific. In quality, for instance, the reason why patience, determination, and calm only takes 16 % is that only five staff choose this part, while 62 % of management value it much. While 62 % of management tend to the qualities of honesty, trustworthy, and credibility, no staff considers them so important. At the same time, management concerns more about company image.

**Table 64.1** Different opinions between management group and operational staff

| Content | Management group | Operational staff |
|---|---|---|
| Language needs | English (87 %), Japanese (38 %), Korean (37 %) | English (99 %) |
| Language skills | Speaking (88 %), Listening (60 %),Writing(58 %) | Speaking (89 %), Listening (8 %) |
| Focused ability | Integrated service (88 %), professional competence in Economics and Trade (67 %), handling special problems (45 %) | Integrated service (87 %), professional competence in Economics and Trade (10 %) |
| Specific ability | Completing specific tasks (62 %), Communication (60 %), Trading (57 %), obtaining information (57 %) | Communication (99 %), obtaining information (87 %), solving problems (33 %), Foreign languages (21 %) |
| Occupational characteristics | Good appearance (77 %), Good work ethic (63 %), Good professional capacity (60 %) | Good work ethic (78 %), Good professional capacity (19 %), and Good appearance (3 %) |
| Quality | Creative with different working methods (87 %), Cheerful, Generous, Sociable (70 %), Patient, determined, and calm (62 %), Honest, trustworthy, and credible (62 %) | Cheerful, Generous, Sociable (67 %), Creative with different working methods (25 %) |
| Dissatisfaction | Lack of persistence (75 %), not good at communication (48 %), not working seriously or dedicatedly (43 %) | Lack of persistence (73 %), not good at communication (22 %) |
| Training desire | Profession (87 %), Quality (70 %), Information obtaining (68 %) | Information obtaining (75 %), Quality (22 %) |

Another point that needs to be mentioned is that management concerns much about listening competency besides speaking and communication which are particularly valued by the staff.

After the analysis of the questionnaire, the task group interviewed five management and eight staff on the internship and working graduates. They mostly mentioned that students are more at a loss at the beginning because they do not know where to get the information of traders and manufacturers, and how to market their product, so they do not know how to turn their knowledge into productivity. Another point is that they lack of persistence for they quit or change jobs if they cannot make money within 2 or 3 months. When being asked, their most favored merits of the employment, they stressed quality which includes professional quality and morality, because no companies are willing to have outflow of resources after long time of training. Two managers even said it was not so important for graduates who did not know how to do business or whose English was not very well because they can give them hands-on training as long as the graduates are reliable.

## 64.4 Reflection

**The Main Reason of Demand Saturation on Foreign Language Professionals in Economics and Trade Is That Professional Training Does Not Match with Social Demand** There is a report from Chongqing Government Web: [3].

Foreign trade companies in Chongqing seized the momentum of economic recovery at home and abroad to increase international markets, and more than 800 companies implemented the nearly 2,000 international market development project which made the product marked with "Made in Chongqing" arrived in 195 countries and regions. At the same time, goods from 107 countries sustained the economic development of Chongqing. Enterprises with export and import performance reach 1929, with 215 newly increased. Among them, enterprises with billion assets reach 23, with 13 newly increased, and those with tens of millions 189, with 66 newly increased, millions 510, with 99 newly increased. This made Chongqing enterprises increased 57 % among the top 30 exporters nationally.

Cuntan two bonded port area of Chongqing is the only inland bonded port area in China, which rolled port operations, air services, foreign trade, export processing, commodity display, financial and business service functions into one. It will be the most versatile, efficient, and best special regulatory policy areas in West China, and change the inland port into open frontier.

West Wing Comprehensive bonded Zone of Chongqing is China's largest integrated Free Trade Zone in planning area, which will become the important platform for inland opening. According to the Municipal Foreign Economic and Trade Commission, Chongqing will be built into a major channel of International Trade, and has finished the "1144" Strategic Planning, which means "a Hub", "a Platform", "for international Channels", and "four auxiliary channels".

From the above information and the statistics, we can clearly see there is a strong demand for foreign language professionals in Economics and Trade. But jobs are relatively concentrated in such three positions as merchandising, customs declaration, and export sales. Meanwhile, the root cause of low salaries is not the industry itself. In foreign companies, salaries for merchandisers and export sellers come from basic wages and commission. Only those filling out documents and business assistant, who do not create so much profit, depend on their wages. So we can understand the reason of low salaries is that they are not in the important position.

With the establishment of export development strategy, and comprehensive free trade zone in Chongqing, the increase of foreign trade companies, especially the increase of private trade companies, demand for foreign language professionals in Economics and Trade will increase correspondingly. As far as social demand or position demand is concerned, professionals of foreign language and trade should not be labeled as "Red" or "Yellow". Under the premise of professional training matching with social demand, all the professionals are promising.

**Reflection on the Research** During the research, 89 students of English Major, who to be thankful of here, attended besides the task group. Two points are to be reflected in the process.

Students should go out to conduct communication with strangers actively. Even though the 89 students confronted many difficulties, they obtained abundant rewarding. They got to know the hardship of communication with strangers outside the ivory tower, and how to obtain information of enterprises which is helpful in developing their ability to obtain information. At the same time, they knew social demand on their professional.

Enterprises need to open their mind to help match personnel training and social demand, and take part in personnel training. During the research, some enterprises rejected the students indifferently, and they did not accept social practice of college students, however, social practice is a vital part for students to obtain practical ability.

## 64.5 Conclusion

The research took 6 months and covered eight regions, so there may be faults and one-sidedness. But the research itself is really rewarding to the students, and they work harder in the college to prepare for employment. Second, the dismal employment situation for Professionals of Foreign Language in Economics and trade calls for researchers to conduct field investigation to modify their training plan and model based on the statistic analysis in order to cultivate students as applicable and reliable personnel with high quality.

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# Chapter 65
# Study on Intercultural Teaching for EFL Teachers in China

**NianLiang Ding**

**Abstract** In today's practice of foreign language teaching, culture teaching in China still faces such problems as teachers' being less cross-culturally prepared, the absence of culture teaching syllabus and the shortage of interculture-oriented course books. To address these problems it is suggested that English Foreign Language (EFL) teachers should strengthen intercultural competence through training, further education abroad, and self-study; the syllabus, course books, and teaching methods should undergo some changes for the purpose of training interculturally competent students.

**Keywords** Culture · FLT · EFL teacher

## 65.1 Introduction

As various factors such as multiculturalism and globalization are making a continuous impact on foreign language teaching, foreign language teachers and curriculum researchers are becoming increasingly interested in cross-cultural teaching [1]. At home, cross-cultural teaching has a long history, and its importance has been generally recognized. "Syllabus for English Majors," presents the requirement of training students for "Intercultural Communication", i.e. in addition to the emphasis on the accuracy of student's use of language, it is also critical to cultivate their

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sensitivity to cultural differences, tolerance, and flexibility in dealing with cultural differences, so as to meet the growing needs of a wide range of international exchanges [2]. "College English Curriculum Requirements", issued by the Ministry of Education in 2007, also points out that college English teaching is a teaching system with English language knowledge, language application, learning strategies, and cross-cultural communication as its main content [3]. However, despite the acknowledged importance of culture teaching, it has been hovering at the edge of foreign language teaching, almost dispensable in schools. This directly affects students' ability in cross-cultural communication. The survey by Zhang Hongling shows that Chinese learners have poorer English cultural skills and cross-cultural communication abilities than their language skills [4]. Therefore, the analysis of this phenomenon and the corresponding measures is of a certain practical significance.

## 65.2 Barriers to Cross-Cultural Teaching

### *65.2.1 Ill-Prepared English Foreign Language Teachers of Cross-Cultural Teaching*

Influenced by the traditional thinking, content, and methods of English Foreign Language (EFL) teaching, EFL students in normal universities has a common defect: strong language knowledge and weak cultural abilities. This makes it difficult for them, after graduation, to be equal to cross-cultural teaching. Many EFL teachers still have an unclear idea about the concept of culture, unable to grasp the relationship between cultural elements. Thus, all they can do is listing some specific superficial cultural elements in EFL teaching, such as: people's daily life and customs, or a country's geography, history, religion, politics and so on. Other aspects of culture such as values, beliefs, and cultural characteristics as a meaningful system are involuntarily ignored by many teachers. The lopsided, superficial understanding of culture has hampered effective EFL teaching to a large extent.

As an important component of EFL teaching, culture teaching puts language teaching in a real cultural environment, greatly improving the efficiency of language teaching. However, in many places, culture teaching is only a slogan which has not been truly implemented, so the actual situation of culture teaching is worrisome. Although many teachers recognize the benefits about culture teaching for training students, they still find it difficult to abandon the traditional teaching philosophy and methods for language teaching. This seemingly contradictory, yet helpless practice has a lot to do with their inadequate reserves of cultural knowledge and the lack of relevant cultural training. No one can make bricks without straw. How deeply and broadly the EFL teachers learn the cultural knowledge of their native language and that of the target language will directly affect the proportion of culture teaching in EFL teaching. In addition, for lack of

formal training in cultural education, EFL teachers cannot have a systematic and comprehensive understanding of the significance, content, and methods of culture teaching; hence, the widespread fear of difficulty trying new things they are not sure of. The result is that the focus remains on language teaching, which is easier than culture teaching. So in fact culture teaching has not been given due attention. The content of "culture teaching" only remains the "explicit cultural behavior and fragmentary cultural information" [4].

### *65.2.2 No Intercultural Teaching Syllabus*

In the current practice of foreign language teaching, the importance of cultural education has indeed been recognized. For instance, courses like "American Profile" and "Intercultural Communication" are open for English students, and cultural import is also encouraged in the process of language teaching. But EFL teachers lack a deep understanding of the meaning and the purpose of culture teaching, internal motivation of culture teaching is not as strong. Consequently, the goal to cultivate student's cross-cultural communicative competence becomes dispensable. Still teaching content is composed of static culture like background knowledge, which primarily serves text comprehension, ignoring the dynamic nature of culture; and cultural knowledge involved are loosely structured, less systematic, with scattered shallow cultural information for students to learn. Teaching methods have not yet completely free from the restrictions such as teacher-centered or book-centered methods. The combination of the traditional grammar-translation method and the communicative teaching method has hampered culture teaching. Due to the limited number of cross-cultural courses and cultural comparison courses, students have little access to the cultural information of the target language, not to mention cross-cultural competence. Devoid of mechanisms of cultural evaluation and testing, EFL teachers feel at a loss in culture teaching. Therefore, the absence of culture teaching curriculum has a profound influence on cross-cultural EFL teaching. Without the guidance of culture syllabus, the training objectives, curriculum, teaching content, teaching methods, and assessment of teaching goals in particular are devoid of specific, clear, and detailed criteria, resulting in a disorderly state in which cross-cultural teaching is conducted in ways various from school to school. With no direction and operability, cross-cultural teaching will only end up in empty talk.

### *65.2.3 Scarcity of Cross-Cultural-Oriented Materials*

As the content of most textbooks in English are imported from abroad, the cultures of the English-speaking countries, particularly America, Britain, and other core English-speaking countries, have permeated these materials. Although other

English-speaking countries also use English as the language of communication, it is difficult to find in our textbooks the literary works from these countries, and naturally hard to find traces of their cultures. Although English is an international language, our teaching materials include only a few core English-speaking countries, no more than a tool for dissemination of American or British cultures. Culture teaching based on materials of this sort can only be a one-way input of English culture from related countries. In this sense, English has lost its proper role and value as an international language. In China, as the current English textbooks have failed to include Chinese culture, English majors have a poor access to Chinese culture through textbooks, a serious impediment to students' cross-cultural awareness and cross-cultural communication capabilities. A survey conducted by Zhang Weimin and Zhu Hongmei at Tsinghua University showed that college students cannot adequately convey cultural things with Chinese characteristics in English, which dues mainly to the scarcity of Chinese culture in English textbooks and English classrooms [5]. Many students feel frustrated in cross-cultural communication, for they cannot find the right English expressions, even though they know about the cultural stuff. Though this "cultural aphasia" cannot be attributed solely to the defects of English teaching materials, we have to admit the effect of EFL teaching materials on the competence for intercultural communication.

## 65.3 Methods and Recommendations

### *65.3.1 Teacher Training*

The goal of foreign language education today is to foster the compound talents with cross-cultural communicative ability. The goal can only be achieved by constantly improving the quality of the cross-cultural teaching staff. First of all, EFL teachers can be trained to grasp the methods of learning, exploring, and reflecting cultures in a short time, able to research cultural phenomena independently in future. After all, cultural awareness, cultural knowledge, and cultural competence are the premise of cross-cultural teaching. Second, personnel exchange mechanism can be established with foreign schools, through which EFL teachers can be sent to target countries to experience their culture in person, to increase the cultural sensitivity, accumulate cultural knowledge, and eventually improve cross-cultural communicative skills. Third, the teachers who cannot study abroad or accept cultural trainings, can make full use of multimedia tools and network resources to get access to the target culture (such as watching television programs, etc.), to enhance perception of that culture. Foreign language teachers are also encouraged to read widely on cultures to try to have a rational understanding of the target culture.

### *65.3.2 Syllabus*

Influenced by linguistics, early EFL teaching syllabus was rather scientific and systematic, with its focus on language knowledge; later communicative and humanistic syllabuses began to include cultural information of different sorts, but they failed to show the "value and independence of culture teaching per se" [4]. Thus cultural education is chronically dependent on foreign language teaching, which is not conducive to the training of cross-cultural EFL students. Therefore, it is necessary to formulate EFL cross-cultural syllabus, with clear cultural teaching objectives, content, principles, methods, teaching materials, and evaluation mechanisms. This effort can build the basis for the culture teaching to adapt to the new situation for training needs.

### *65.3.3 Reformation of Textbooks*

As foreign language education in the country is highly dependent on the teaching materials, the quality of teaching materials will greatly affect the quality of cross-cultural training. Selected from a broader cross-cultural perspective, the authentic and typical cultural corpus should be wide ranging and comprehensive, covering not just the English-speaking countries but the non-English-speaking countries. As Mckay has put it, "English language teaching materials should provide students with the necessary vocabulary to convey the native culture and information", not just with "the cultural content of English-speaking countries" [6]. Second, the materials should be selected with relevant cultural topics for students to discuss and explore, and can call for reflections on the Deep Culture, such as world outlook and values. At the same time, language content and cultural content of the foreign language teaching materials should be combined and mutually penetrated; cultural content in different stages of learning should follow a proper sequence and make advancement step by step. So that students in the learning of language knowledge can also thoroughly understand the cultural knowledge, develop cultural awareness, and master the universal law of culture.

## 65.4 Conclusion

The position of cross-cultural part in foreign language teaching is unquestionable, for the ultimate goal of foreign language teaching is to produce experts with cross-cultural communicative competence. To achieve this goal, foreign language workers and researchers should work on teacher training, syllabus, teaching materials etc. to establish mechanisms for cultural training of teachers and mechanisms for international exchanges, encourage teachers to improve their

quality concerning culture; formulate cross-cultural teaching syllabus to provide guidance for cross-cultural teaching, explaining in detail the standards of teaching content, methods, testing, and evaluation; prepare cross-culture-oriented teaching materials, and systemize cultural content to be combined with language content. Of course, cross-cultural foreign language teaching is a complicated systematic project, stratified and progressive. It needs time and the joint efforts required of educational institutions, education researchers and teachers as well.

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# Part VIII
# Communication Technology and Applications

# Chapter 66
# Multidimensional Evaluation Platform for Call Center Speech Service Quality Based on Keyword Spotting

**XinYu Zhou, DongLiang Dai, Bo Xie and XiaoJun Li**

**Abstract** Call center system has become an integral part of business operations and monitoring speech service quality is a vital work of the management in call center. Currently, main scoring approach is manual control mode. Its efficiency is not high and it is difficult to uniform standard. This paper presents an automatic multimode monitoring system for speech service quality of call center, and keyword spotting technology is applied to monitor the speech content automatically. In addition this paper designed a common set of evaluation algorithm and finally achieved the Multidimensional evaluation indicators to accurately and multidimensionally measure the operator's speech QOS.

**Keywords** Call center · Speech service quality · Keyword spotting

## 66.1 Introduction

Call center system is a system integrates telephone, computer, and other IT technology. It has become a platform which provides external services and customer marketing services for enterprise [1]. Call center management is a very complicated task, speech service quality is crucial to call center's performance. Therefore, service quality control is the particularly important work of call center management.

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Currently, the inefficient manual-mode control is a main method in service quality monitoring of call center. Because of the shortcomings of manual control mode (such as: the high cost, low efficiency, high repetition rate, and the lack of flexibility), it is not suitable for applying to the current call center operations monitoring system whose speech data increases in high-magnitude. In the face of the speech data surging, how to design an efficient automatic system of monitoring speech service quality is the problem to be solved in call center industry. This paper designed a common set of evaluation algorithm and Multidimensional evaluation indicators to measure the operator's speech QOS. At last the system achieves to monitor speech service quality accurately and efficiently.

Keyword spotting is a branch of speech recognition technology, it is very forward-looking and promising [2]. As the keyword spotting technology needs only recognize the specific keywords which user interested in. Compared to continuous speech recognition technology, keyword spotting technology is more efficient and less resource-intensive. Therefore, this paper presents a solution of call center speech monitor based on keywords spotting technology used in speech service quality monitor and assessment. This paper designed a common set of evaluation algorithm and Multidimensional evaluation indicators to measure the operator's speech QOS. This paper provides an effective solution for call center speech quality monitoring.

## 66.2 Keyword Spotting Technology

As shown in Fig. 66.1, a complete keyword spotting model consists of the following main modules: acoustic feature extraction, acoustic models, language model, and the decoder.

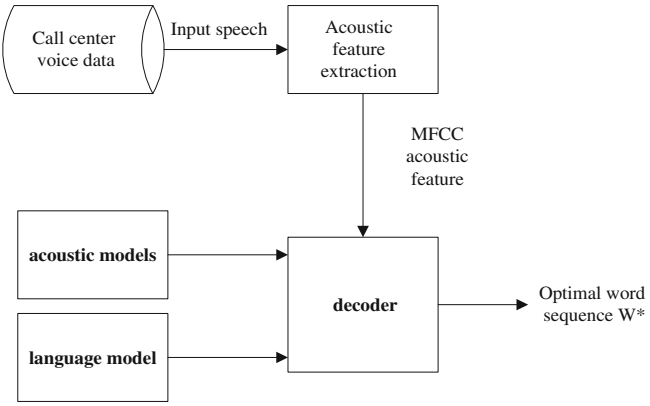


**Fig. 66.1** Keyword spotting model

### 66.2.1 Acoustic Feature Extraction

It needs to extract appropriate acoustic features before digitizing and storing analog speech signal on computer. In addition, the feature extraction is also a compression process to speech information. Good method of feature extraction has a critical influence on the speech recognition performance. Feature extraction is necessary to take into account the subsequent acoustic model parameters, and need to consider to remove the information that is not help to speech recognition, such as different channel, speaker, and environment in the process, namely it needs robust. As the speech signal has time-varying characteristics, feature extraction on a continuous speech can be analysis approximated smooth generally. It also needs to improve the high frequency components, and avoid short-term impact from the edge of the speech.

The most common methods used in acoustic features include the following aspects: the signal processing based on linear prediction coefficients, feature extraction based on cepstrum analysis. The speech signal is sampled with a frequency of 16 kHz, and 400 samples at a time are combined to frames with a frame period of 10 ms. A total number of 30 mel-filtered cepstral coefficients and their time derivatives of first and second order are calculated, giving a feature vector with 64 components. This vector is optimized by using of a linear discriminate analysis.

### 66.2.2 Grammar Recognition Network

There are many methods of keyword spotting. This paper introduces the method based on filler models [3], the recognition structure shown in Fig. 66.2.

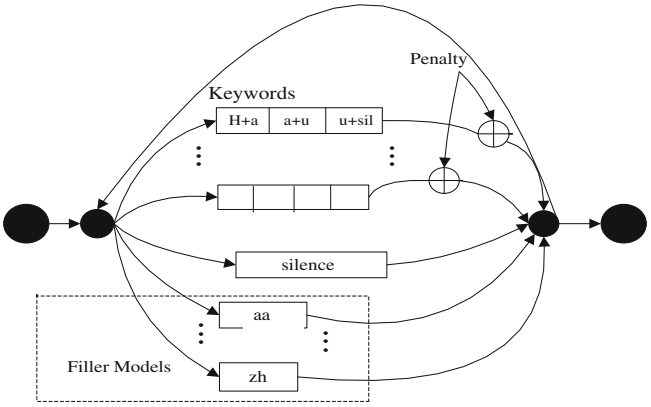


**Fig. 66.2** Filler pattern recognition network

The method was developed from the early template method proposed by Rbainer, and then it was developed to HMM. The basic idea of this method is that use one or more keywords templates and filler models to recognize. One or more keywords HMM models and filler HMM models also can be used to recognize. So the parallel network composes of HMM models and uses Viterbi algorithm to decode and search path in this network.

Filler models are used to recognize the non-keyword parts in speech. Filler models training have a great effect on the final keyword recognition performance. General training methods as followings:

(1) Using a lot of speech data to train one HMM (10 States,10 mixtures).
(2) Making phoneme models as filler models [4].

Keywords models denote the keywords that will to be detected in speech. There are two training methods:

(1) Training for specific keywords only. (Suitable for small vocabulary)
(2) Keyword model composites with phoneme models. It is suitable for most situations, including large vocabulary case.

Viterbi is used to decode on the recognition network and keywords spotter. System uses the two-passing algorithm of JULIUS to achieve Viterbi algorithm.

### *66.2.3 Acoustic Models*

The quality of the keyword model is an important role in recognized process. Since models will take up much memory and affect the recognition speed if use HMM to recognize one word in large vocabulary keyword spotting. This paper uses phoneme or syllable model to express the keyword model generally. Keyword model is expressed by one big HMM which composed of phonemes. In essence, it is still a HMM.

Chinese basic phonemes can be divided into consonant phonemes and vowel phonemes. A major feature of Chinese consonants is that Chinese do not have compound consonants. Chinese consonant phonemes correspond with mandarin consonant. (A total of 21). Chinese vowel phonemes are divided into vowels, complex vowels, and nasal vowel phonemes. There are a total of 19 the basic vowel phonemes in Chinese. This paper uses consonant and vowel phonemes to make the basic models.

### *66.2.4 Decoder*

After the working of acoustic features extraction, the acoustic model and language model, system needs to use the relevant search algorithm to find the optimal word sequence W* in the decoder. Search space is growth in the exponential relative to the size of vocabulary, if it has not any restrictions. Such a huge amount of search

space brings the operation is unthinkable. So it needs to use some effective optimization algorithm to compress the original large scale.

Viterbi algorithm based on dynamic programming [5] that the method of compressing search space is used in the mainstream decoder. As the Viterbi algorithm is a time synchronization method, it needs to synchronize and the rapid calculation in the decoding process.

## 66.3 The Multidimensional Evaluation Platform

The monitoring system judge whether a recording is good or not trough keyword's information, which based on the technology of keyword spotting [6]. So a good evaluation of speech quality algorithms is particularly important in the system. A keyword in the monitoring system has three attributes: The degree of a keyword's attention, a keyword's polarity, and area of concern. The degree of a Keyword's attention refers to the weight of keyword in the monitoring system, and finally participates in the calculation of the algorithm. Companies can custom the degree to adapt to their own situation. The polarity of the keywords is the classification results of the keywords by enterprises, such as positive words and negative words, sensitive words and nonsensitive words and so on.

We have developed a multidimensional evaluation indicators based on the technology of keyword spotting in order to comprehensively and accurately evaluate the speech quality. These indicators can be listed as follows. For single speech sample, we compute its score through the occurrence number of positive keywords and negative keywords in the sample. For a certain amount of speech samples, we use the occurrence number of positive keywords and negative keywords, the rate of plus-minus keywords appear and the rate of single plus keyword or minus keyword to judge whether a telephone operator performance appropriately.

### *66.3.1 The Design of the Platform*

This multidimensional speech quality monitoring system is a set of evaluation system used in the call center industry, thus the area of concern is the call center of a enterprise and the polarity of the keywords (class attribute) is set to positive and negative [6]. The system is a web application, and its users consist of operators and different levels of administrators. An operator can view his own evaluation results, while an administrator can set the evaluation mode (a mode contains a different set of keywords, the degree of keywords' attention, and keywords' polarity) and view the results of the evaluation results of all operators. The main system interface shown in Fig. 66.3. The system's evaluation dimensions including the trend of an operator's speech score within a certain amount of time, plus-minus keywords rate and single plus or minus keyword rate [7].

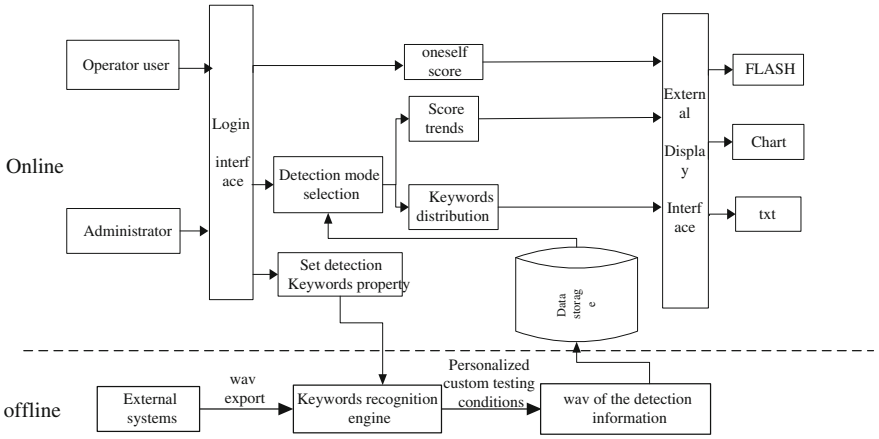


**Fig. 66.3** System architecture

The system platform consists two components of the online and offline. Keywords recognition engine imports the test wave speech from the call center recording system and other external systems in the offline part, and interacts with detection keywords defined by the administrator online. At last, Recognition engine outputs personalized custom detection information and stored in the database server. System platform Services the administrator and operator users. Administrators can select the detection mode for multidimensional targeted assessments. Finally, you can choose to display the external display interface.

### *66.3.2 The Operation and Analysis of the Platform*

The monitoring system gets the test results from the keyword spotting engine, and then has all the recording samples to rate. So far, every recording sample has a score $\xi$ (Evaluation algorithm such as Eq. 66.1). Finally, the system will draw a scoring trend diagram based on all the scores like Fig. 66.4. In the figure, the horizontal axis is the occurrence time of a recording sample; the vertical axis is the score of the recording sample. Administrator can understand the score fluctuation of telephonist, summarize its regularity and make appropriate work schedule for the telephonist.

$$\xi = \theta\varphi + \gamma \tag{66.1}$$

In Eq. 66.1, $\xi$ is the score of a recording, and $\theta = \frac{c_1}{1+c_0}\sqrt{b^2 - 4ac}$, $c_0$ and $c_1$ represent the occurrence number of negative keywords and positive keywords in each recording sample, respectively. And $\varphi = \omega_0 c_0 + \omega_1 c_1 + \omega_2 e$, $\omega_0$ and $\omega_1$ is the degree of a keyword's attention. $e$ is the emotional coefficient, here we set the weight of $\omega_2$ to 0. $\gamma = \frac{c_1(a_0 c_0 + a_1 c_1)}{t}$, and represents the duration of the recording sample.

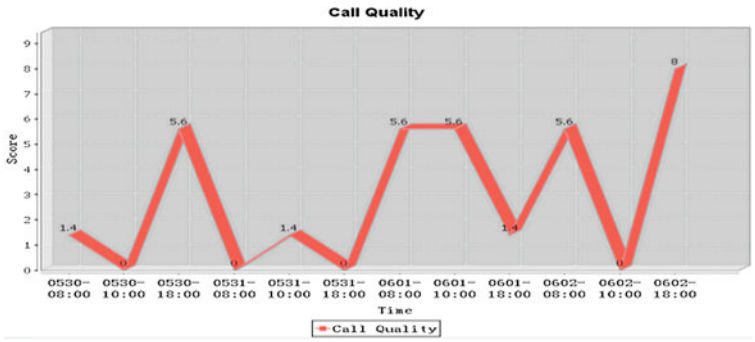


**Fig. 66.4** The trend of scores

The system makes use of the Eqs. 66.2 and 66.3 to calculate the rate of plus keywords and minus keywords in total keywords, respectively. $\eta_0$ is the rate of minus keywords, while $\eta_1$ is the rate of plus keywords.

These two keywords make a clear reflection of the operator's speech quality and service characteristics. It is necessary for a good operator that the using of plus keywords should be much more frequent than minus keywords. While when they reach a balance, we should train the operator to improve the traffic quality. As shown in Fig. 66.5, in this operator's all recordings, the rate of plus keywords far weigh the rate of minus keywords, so we can safely draw the conclusion that he is a good operator.

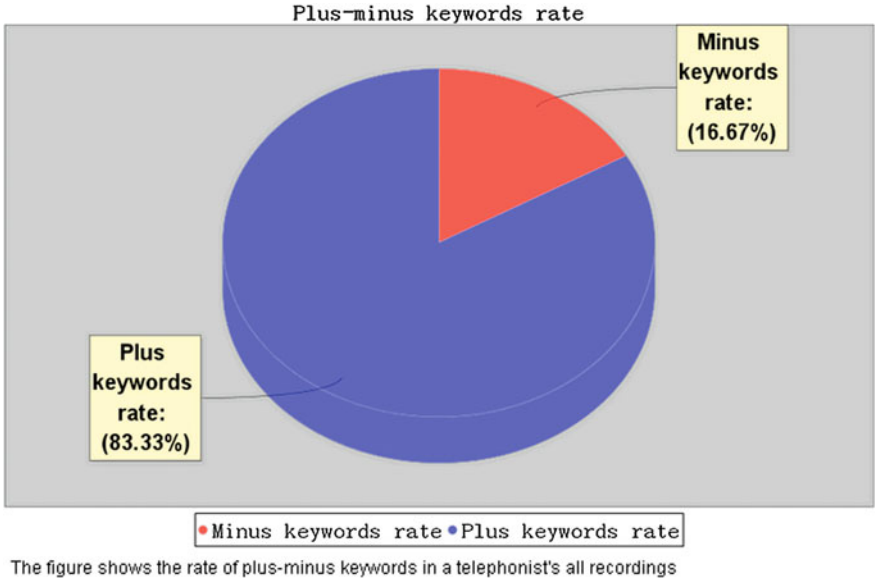


**Fig. 66.5** Plus-minus keywords rate

$$\eta_0 = \frac{C_0}{C_0 + C_1} \tag{66.2}$$

$$\eta_1 = \frac{C_1}{C_0 + C_1} \tag{66.3}$$

In these two formulas, $c_0$ and $c_1$ represent the occurrence number of negative keywords and positive keywords in all recording samples, respectively.

For a more comprehensive evaluation, the system will make use of the Eqs. 66.4 and 66.5 to calculate the rate of single plus or minus keywords. The administrator is able to see whether the language operators used is appropriate or not according to the results. At the same time, the system also shows the distribution of impolite language use, which makes it possible for a targeted training among operators. And it will be reasonable to deal with those operators who held bad speech quality [8]. As shown in Fig. 66.6 and Fig. 66.7.

$$\lambda_0 = \frac{k}{C_0} \tag{66.4}$$

$$\lambda_1 = \frac{k}{C_1} \tag{66.5}$$

$\lambda_0$ is the rate of single minus keyword, while $\lambda_1$ is the rate of single plus keyword. $k$ is the occurrence number of a keyword.

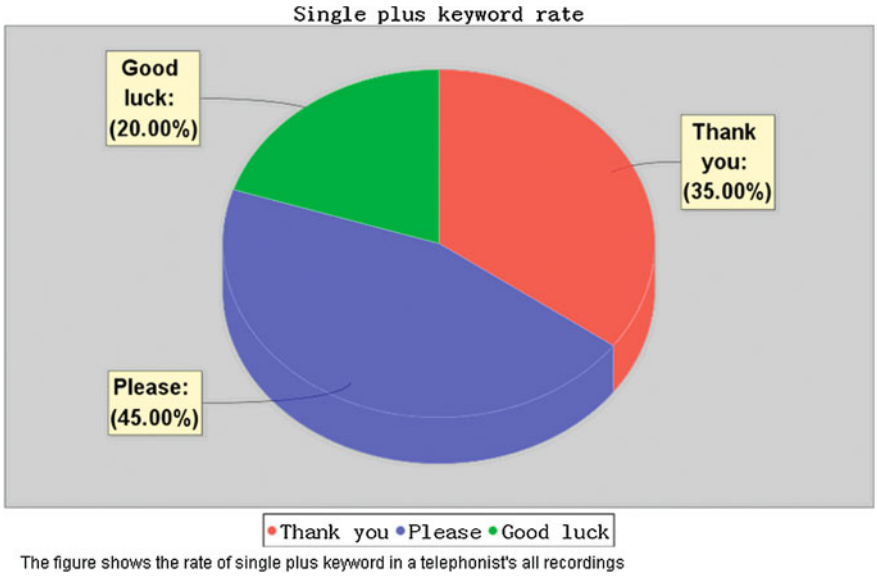


**Fig. 66.6** Single plus keyword rate

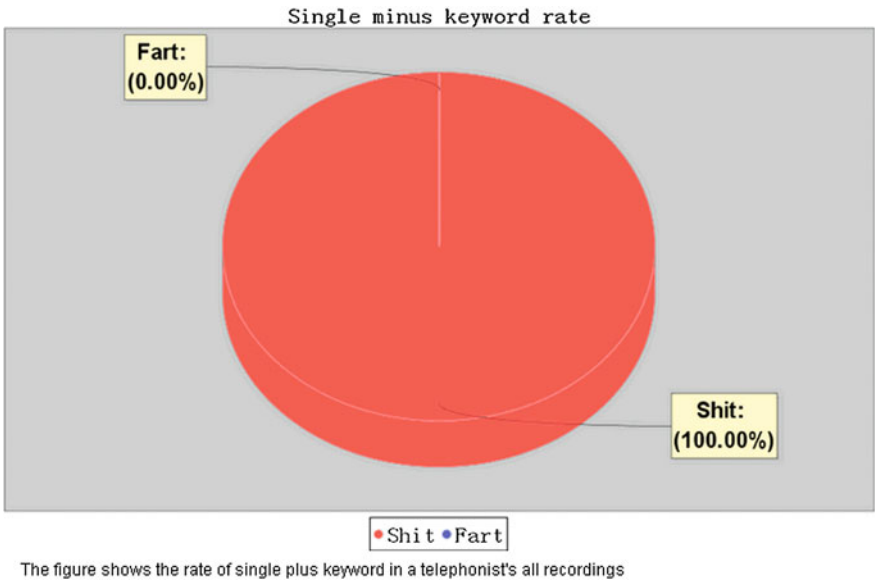


**Fig. 66.7** Single minus keyword rate

## 66.4 Conclusion

This paper presents the multidimensional evaluation platform for call center speech service quality based on keyword spotting, and this paper designed a common set of evaluation algorithm and Multidimensional evaluation indicators to measure the operator's speech QOS. Finally achieved to evaluate the service quality accurately and multidimensional [9]. In order to improve the monitoring performance, this paper uses Multidimensional evaluation indicators to compensate the defects of single-mode keyword spotting. System achieves multimode parallel monitoring of scoring the results and next research will focus how to optimize multimodal interaction mechanism.

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# Chapter 67
# Wireless Node Design in Smart Home System

**Baorong Zhan and Xichang Yu**

**Abstract** To solve the problems in exist product, new wireless network node for smart home system was developed based on wireless communication chip nRF24L01. The wireless network node adopted 51 series single chip microcomputer STC89C52RC as Micro Control Unit, and used nRF24L01 chip as communicator with main controller. Data Encryption Standard arithmetic is utilized as encryption method to overcome the security flaws. The designs of hardware and software were discussed in detail, as well as DES arithmetic. Finally, a system test and its performance report were given. Compared to the traditional products, the wireless network node has the advantages of cheapness, high efficiency, and security, and can be widely used in smart home system.

**Keywords** Smart home · NRF24L01 · Wireless network · DES

## 67.1 Introduction

Smart home system includes smart home control subsystem, home networking subsystem, and burglar alarm and monitoring subsystem. It has functions of security, monitoring, communication, and management [1]. In traditional smart

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home system, the connection between main controller and wireless network node is wired and bus-based, such as CAN, Ethernet, or power line. These wiring ways are high-cost, difficult to maintain and extend. The wireless communications technology is able to overcome the shortcomings of the wired connection, because it does not depend on environmental conditions [2]. As the technology evolves, the energy consumption of wireless communication chip become smaller and smaller, and its resource requirement for hardware and software is less and less. That makes it more and more mature in the application field of smart home system.

According to the characteristics of the smart home system, a new wireless network node for smart home system was developed based on wireless communication chip nRF24L01. The network node uses cost-effective 51-series MCU, which effectively reduces the cost of the whole smart home system. At the same time, the DES algorithm is introduced to encrypt the information, which improves the security of wireless communications. Experiments show that the wireless network node is able to meet the transmission requirements of low power, high accuracy for the smart home system.

## 67.2 Wireless Smart Home System

Wireless smart home system is made up by the main controller and wireless network node, its system structure is shown in Fig. 67.1. The wireless network node is responsible for information collection, status monitoring, and action output. It may be a transcriber for ammeter, temperature monitor, or lighting controller, which usually cooperate with the ammeter, digital thermometer, or light and work as the smart home terminal equipment. The main controller is the system core of communication and control, which is responsible for the control of

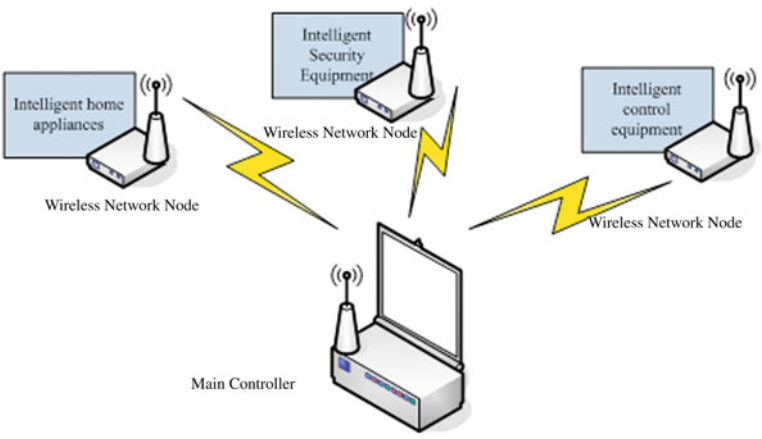


**Fig. 67.1** Wireless smart home system diagram

information collection from the wireless network node, the analysis of sample data, and the judgment of output action. In addition, users can set the system parameters or view the system status by touch-screen operation on main controller.

The system works as follows: The main controller sends control commands to the wireless network nodes via the wireless communication module. After receiving control command, the MCU in wireless network node will drive the smart appliances correspondingly. While the wireless network nodes shall feedback the operating status of smart appliances to the main controller, so that users can monitor them.

Being the link between the main controller and wireless network nodes, the wireless communication module plays an important role in the wireless smart home network system. The wireless transceiver chip nRF24L01 is adopted as wireless communication module in this smart home system, which has the following features [3]: (1) it has 125 channels in the 2.4 ~ 2.5 GHz ISM band, so it can meet the multihopping requirement; (2) it works with high data throughput, which reaches 1 Mb/s or 2 Mb/s transmission rate and up to 10 Mb/s SPI rate; (3) it owns built-in power amplifier, crystal oscillator, demodulator, and other functional modules, so complex peripheral circuit is not required; (4) auto-negotiate and auto-retransmit feature are included in it, as well as generation of packet header and CRC check code automatically; (5) its working current of receiver is only 12.3 mA, and it will be less when entering low-power mode. So it is conducive to energy-saving design. Thus, nRF24L01 will be able to meet the design requirements of wireless smart home system.

## 67.3 Hardware Design for Wireless Network Node

Being the terminal of the smart home system, the wireless network node is responsible for information collection, status monitoring, and action output. Because there are a large number of wireless network nodes in smart home system, and they do not require powerful data processing capability. So, from a cost perspective, 51 series microcontroller shall be chosen as its MCU. The chip of STC89C52RC is selected, because of its low cost, high speed, and low power consumption [4]. The hardware circuit of wireless network node is shown in Fig. 67.2.

The figure shows that the wireless network nodes include the control output interface, the sensor input interface, and the wireless communication module interface. The MCU controls the household electrical appliances and monitoring equipment, etc. through the control output interface. The control output has four relay outputs usually, but they also can be combined to fit some special multi-input equipment. The principle for the control output is: when the pins of P12, P13, P15, and P16 are set to low, the optoelectronic isolator is turned on, which turn on the relay and complete the control output action. The pins of P00 ~ P07 in MCU read the sensor information collected through the sensor input interface. Different appliances require different sensor circuit.

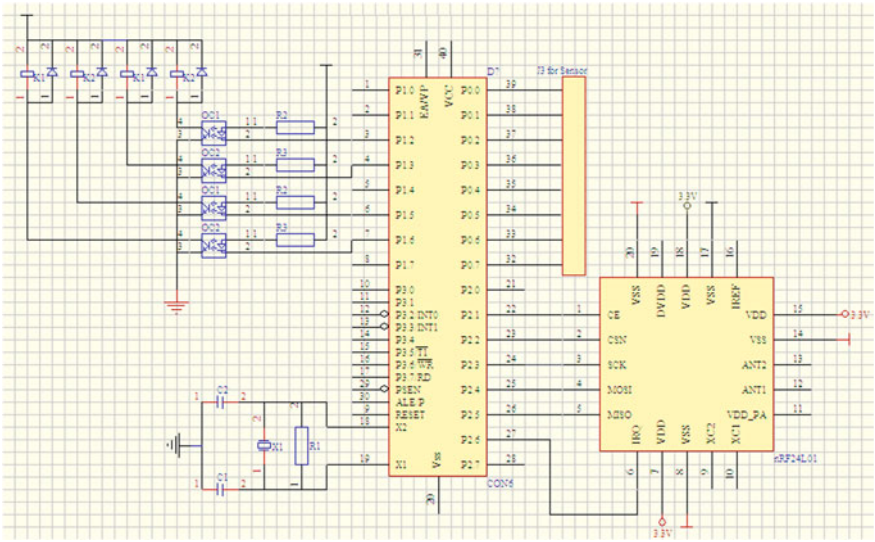

**Fig. 67.2** Circuit schematic of wireless network node

## 67.4 Software Design for Wireless Network Node

A 51 series SCM do not have SPI controller, so a simulation program for SPI bus is needed when it wants to communicate with nRF24L01. In general, SPI bus includes four PINs, which are MOSI (Master out Slave In), Master In Slave Out (MISO), SCK (clock), and Chip Select (CS). CS PIN connection can be ignored if the design is only for single master with single slave. The master completes the data exchange with slave by controlling the SCK frequency. The advantages of SPI include [5]: data is transmitted by unit of bit, and pause action is allowed during transmission process; data input and output are independent, so full-duplex communication is allowed; and its exchange transmission has higher transmitted efficiency compared to other ways.

In order to simulate SPI process, the program of SCM must include the serial clock, data input, and data output. SCM generates the clock pulse by controlling SCK output periodically. MOSI outputs data when SCK is at the rising edge, while MISO inputs data when SCK is at the falling edge. One data exchange is completed after eight cycles of SCK is done [6]. The chip of nRF24L01 shall be first initialized by SCM, before it can send or receive signal. Its initialization process is shown in Fig. 67.3.

In order to utilize the SCM hardware resource more effectively and real-time, assembly language is used for software design of wireless network node. The software process is shown in Fig. 67.4. In the figure, the main process is in the left side, and the right branch is for interrupt handler. After system is powered up, SCM will do initialization and configure the wireless communication module, then

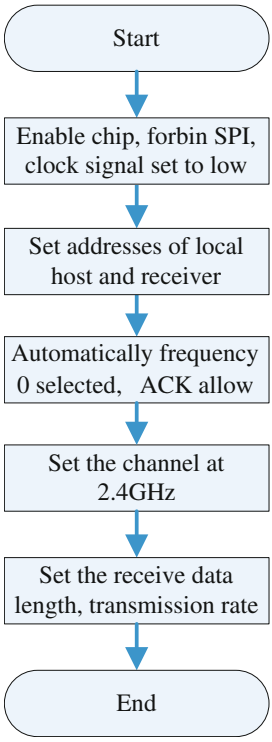


**Fig. 67.3** Initialization process for nRF24L01

it enters the port scan state. If there is signal input, SCM will do analysis and processing about it. If there is data need to be sent to the main controller, SCM will do the data packaging operation, and then call the wireless communication module to send them out. If there is interrupt signal, the SCM will indicate the wireless communication module to receive the data, and then do analysis. Finally, it determines if it is necessary to return the process result to the main controller.

## 67.5 Encryption Technology

Security is a shortcoming in wireless communication system, because hacker may intercept user data easily in open environment. To overcome the shortage and prevent user private information and security information from interception, encryption technology is adopted in the system. Because 51 series SCM is chosen as MCU, which is weak in computing field, so the encryption algorithm must be efficient, so that data encryption will not affect system performance. Finally, the DES encryption algorithm is adopted in the wireless network node.

Data Encryption Standard (DES) is developed by IBM in 1977, and widely used in applications of ATM, magnetic card, and smart card. DES belongs to a block

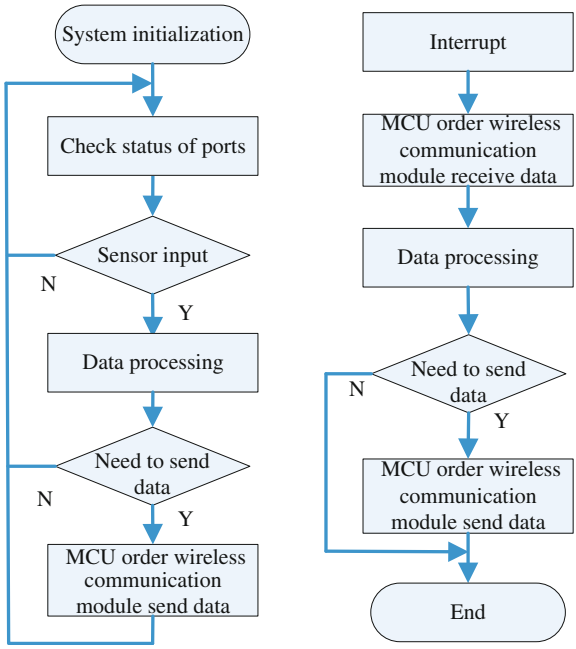


**Fig. 67.4** Software process for wireless network node

cipher, which means that if the plaintext is made up by a string contains 64 bits, its cryptograph will be made up by a string contains 64 bits too [7]. The process of DES algorithm is shown in Fig. 67.5.

The initialization of plaintext is the process of its bits regroup and segmentation. It will be separated into two parts, called 'L0' and 'R0'. Each part has 32 bits. And the initialization of the key has the same process. After iterative calculation with the initialized plaintext and the initialized key, a sub-key will be produced. And the cryptograph is finally generated after the sub-key is processed by the E-Transform, the S-Box Transform, and the P-Transform [8]:

The two communication parts have an agreement with the same key first. The plaintext is encrypted with the key by DES algorithm, and then it will be sent out in the form of cryptograph. When receiving the cryptograph data, the receiver can decrypt it to obtain correct information by the same key.

## 67.6 System Test

System testing includes performance testing for receiver and sender. Under performance testing for receiver, 10,000 packets with 32-bytes are produced by wireless signal generator, and then sent to wireless network node. The received packets will be compared and counted. While under performance testing for sender, wireless network node will generate and sent out 10,000 packets with

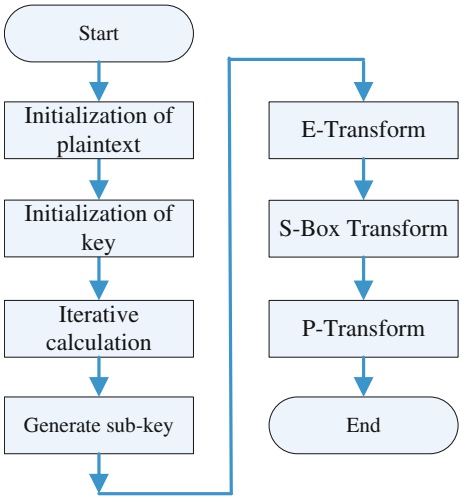


**Fig. 67.5** Encryption algorithm of DES

**Table 67.1** Data of performance testing

| Distance (m) | Error rate of receiver (%) | Error rate of sender (%) | Power consumption (mA) |
|---|---|---|---|
| 5 | 0 | 0 | 1.02 |
| 10 | 0.0003 | 0.0002 | 1.08 |
| 20 | 0.0030 | 0.0025 | 1.15 |
| 50 | 0.0063 | 0.0056 | 1.23 |

32-bytes. The wireless signal receiver will receive, compare, and count the packets. Its statistics report is shown in Table 67.1. The report shows that the design of wireless network node meet the requirements of low power consumption and high accuracy under indoor environment.

## 67.7 Conclusion

A wireless network node for smart home system is designed, which uses nRF24L01 wireless chip as its communicator and adopts 51 series SCM STC89C52RC as its MCU. The DES encryption algorithm is used in the system to ensure user information security. Compared to other similar products on the market, it owns advantages of low cost, low power consumption, high degree of accuracy, and high security. System testing shows that its performance meets the requirement of smart home system. So it shall have a good prospect of application on the market.

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# Chapter 68
# Study on Weak Signal Detection Methods

**Shikun Zhu**

**Abstract** Weak signal detection technology refers to a technology which analyzes the noise's production laws and researches the characteristics and correlation of signals with relevant electronics, physics, information, and computer knowledge and techniques, to detect the weak signals that are submerged by noises. In this paper, the basic principle of weak signal detection is discussed from the improvement of Signal-to-Noise Ratio (SNR) of signal processing system, and also the principles and methods of relevant detection, sample integral, time domain averaging, frequency domain detection, and time-frequency analysis are emphatically analyzed, expecting that different methods can be applied by people in detection according to the signals of different characteristics.

**Keywords** Weak signal detection · Relevant detection · Sample integral · Time domain averaging · Frequency domain detection · Time-frequency analysis

## 68.1 Introduction

At present, the studies that are conducted by people on the acquisition, analysis, and processing of all kinds of information get increasingly deeper. Especially, high attention has been paid to detecting useful weak signals from strong noises. Also, this has changed into an emerging subject (weak signal detection) with a gradual step. Weak signal detection technology refers to a technology, which analyzes the noise production laws and researches the characteristics and correlation of signals with relevant electronics, physics, information, and computer knowledge and techniques, to detect the weak signals that are submerged by noises. The basic

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principle of weak signal detection is reducing noise through the compression of systematic noise and suppressing noise through the application of signal average technology [1, 2].

## 68.2 Principle of Weak Signal Detection

The key of weak signal detection is to suppress noise and recover, enhance, and extract useful signals, namely to improve signal-to-noise improvement ratio (SNIR). SNIR is defined as follows.

$$\text{SNIR} = \frac{(S/N)_o}{(S/N)_i} \tag{68.1}$$

In Eq. (68.1), $(S/N)_o$ is the output SNR; $(S/N)_i$ is the input SNR. The larger the SNIR is, the more powerful the ability to process noise and the higher the detection will be. The principle of the weak signal detection is discussed from the perspective of SNIR of the signal processing system. If noise is with a constant power spectral density in a very wide frequency scope, it is called as white noise. The so-called spectral density refers to the noise per a unit bandwidth; if noise power spectral density has been known, the noise power can be expressed as follows.

$$p_n = V_{no}^2 = \int_0^\infty S_n(f)\mathrm{d}f \tag{68.2}$$

Equivalent noise broadband can be expressed below.

$$B_e = \int_0^\infty K_{vo}\mathrm{d}f \tag{68.3}$$

In above, $K_{vo} = \frac{V_o}{V_s}$ is the transfer function from the amplifier's input end to output end.

Assume a system's input noise is white noise, and the signal processing system's the input and output signal voltages are $V_{si}$ and, $V_{so}$ respectively, and input and output noise voltages are $V_{ni}$ and, $V_{no}$ respectively, and the input noise is the bandwidth white noise (the noise bandwidth is $B_i$, and noise power spectral density is $S_{ni}$), and thus the mean square value of the input noise is $V_{ni}^2 = S_{ni} \times B_i$. If the voltage gain of the system is $K_V(f)$, the noise equivalent broadband of the system is $B_e$, and thus the mean square value of the output noise is as follows:

$$V_{no}^2 = \int_0^\infty S_{ni}K_V^2(f)\mathrm{d}f = S_{ni}\int_0^\infty K_V^2(f)\mathrm{d}f = S_{ni} \times B_e \times K_{vo} \tag{68.4}$$

In Eq. (68.4), there is $K_{vo} = V_{so}/V_{si}$, and the system's SNIR is as follows:

$$\text{SNIR} = (V_{so}^2/V_{no}^2)/(V_{si}^2/V_{ni}^2) = K_{vo}S_{ni}B_i/K_{vo}S_{ni}B_e = B_i/B_e \tag{68.5}$$

Therefore, it can be seen that the SNIR of the signal processing system is equal to the ratio between input white noise bandwidth and system's noise equivalent bandwidth, and the reduction of the system's noise equivalent bandwidth can help improve the system's output SNR [3].

## 68.3 Weak Signal Detection Methods

The methods of detecting the signals submerged deeply in noise background can be concluded as follows:

### *68.3.1 Correlated Detection Method*

The essential difference between signal and noise is that signal has laws. Noise cannot be described with a definite time function. Therefore, signals can be found with the signal's own laws. Correlated detection method is a technology to compress bandwidth to the maximum and suppress noises according to the principle of correlation and through self-correlation or mutual-correlation operation for the purpose of detecting signals [4].

Correlation function $R(\tau)$ is the main physical quantity of correlation analysis. The values of determinate signals at different time are generally of strong correlation, but the values of interference noise are generally of poor correlation because of its higher randomness. Using this difference, determinate signal and interference noise can be differentiated.

Correlated detection method includes self-correlation method and mutual-correlation method. Compared with the self-correlation method, the mutual-correlation method can suppress noises more thoroughly if stronger signal is extracted by it [5]. The mutual-correlation function expression is as follows.

$$R_{xy}(\tau) = \lim_{T\to 0}\frac{1}{T}\int_0^T x(\tau)y(t-\tau)\mathrm{d}t \tag{68.6}$$

Assume the signal to detect is $x(t) = S(t) + n(t)$, in which $S(t)$ means characteristic signal and $n(t)$ is noise. $y(t)$ is reference signal, and $R_{xy}(\tau)$ is the correlation function of signals $x(t)$ and $y(t)$, and thus the mutual-correlation function.

$$\begin{aligned} R_{xy}(\tau) &= E\langle x(t)y(t-\tau)\rangle = E\langle S(t)y(t-\tau)\rangle + E\langle n(t)y(t-\tau)\rangle \\ &= R_{Sy}(\tau) + R_{ny}(\tau) \end{aligned} \tag{68.7}$$

If $n(t)$ and $y(t)$ are uncorrelated, there is $R_{ny}(\tau) = 0$.

Therefore, there is $R_{xy}(\tau) = R_{Sy}(\tau)$, in which $R_{Sy}(\tau)$ is the mutual-correlation function of signal $S(t)$ and reference signal $y(t)$. Obviously, $R_{xy}(\tau)$ contains the characteristic signal carried by the input signal. That is, the characteristic signal to detect can be detected.

When $x(t)$ and $y(t)$ of the mutual-correlation function are equal to each other, mutual-correlation changes to self-correlation. Therefore, compared with self-correlation, mutual-correlation is of more general significance. Correlation detection is based on the nature of the correlation function; mutual-correlation is better than self-correlation in the ability to detect and suppress noises, but needs to apply the reference signal synchronous with $x(t)$, thus making the application of mutual-correlation restricted to a certain extent [6].

### *68.3.2 Sample Integral and Digital Averaging*

Sample integral is a signal averaging technology. The sample integral process is implemented with artificial circuit, and the digital averaging process is implemented with the computer digital processing method [7–9].

The sample integral technology includes two consecutive processes (i.e. sampling and integral), and its basic principle is as shown in Fig. 68.1a. Assume $r(t)$ to be the reference signal with the same frequency to the detected signal $x(t)$. Sampling pulse is formed after a delay of $t_o$. Then, the sampling of the input signal $x(t) = S(t) + n(t)$ is realized if the sampling pulse acts on the sampling switch $S$. Sampling is conducted every period $T$, and thus the voltage on the capacitance $C$ gains the accumulation of sampling signals. It is necessary to process storage signal in the condition that $C$ is replaced by the memory of computer. Figure 68.1b shows the waveform of sampling integrator.

Assume the sampling period to be $T$, and then the output is as follows after accumulation and average of $n$ times.

$$u_o = \frac{1}{n}\sum_{k=0}^{n-1} x(t_0 + kT) = \frac{1}{n}\sum_{k=0}^{n-1} s(t_0 + kT) + \frac{1}{n}\sum_{k=0}^{n-1} n(t_0 + kT) \tag{68.8}$$

If the form of noise is white noise, the following expression can be established because different noise values at different time are uncorrelated.

$$\frac{1}{n}\sum_{k=0}^{n-1} n(t_0 + kT) \approx 0 \tag{68.9}$$

Thus, its output is as follows.

$$u_0 \approx \frac{1}{n}\sum_{k=0}^{n-1} s(t_0 + kT) = s(t_0) \tag{68.10}$$

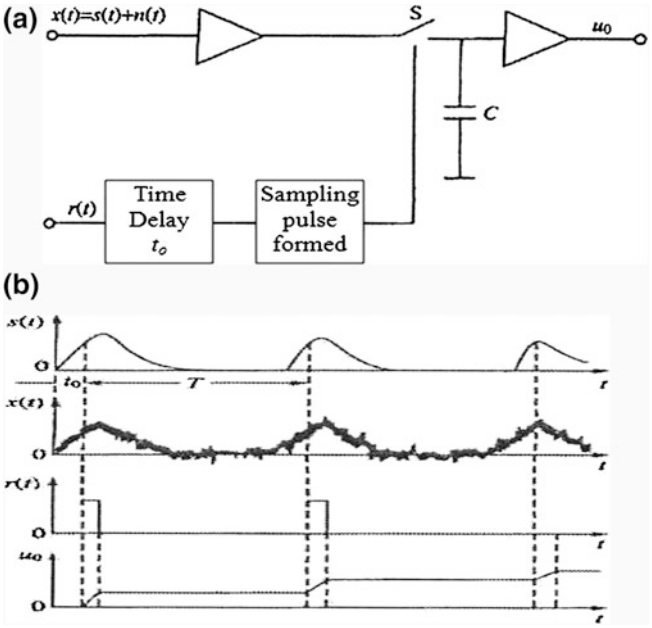


**Fig. 68.1** The basic principle of sample integral **a** The circuit principle of sample integral, **b** The waveform of sample integrator

Sample integral and digital averaging are effective methods for detecting known frequency signals, and also are applicable to signals with complex spectrum. For any repeated signal with noises, it is repeatedly sampled for $n$ times and also its integrals are accumulated or averaged in the period of its appearance, and the output SNIR is proportional to the $\sqrt{n}$. The higher the averaging times $n$ are, the greater the SNIR will be.

### *68.3.3 Time Domain Average*

Signal time domain average processing is to extract effective periodic components from the complex periodic signal mixed with noise interference. It can suppress the random interference mixed in signal, and also get rid of the periodic signal related to a given frequency. Therefore, it can work in noise environment and improve the SNR of analyzed signals [10, 11].

Assume $\Delta$ to be sampling interval for sampling signal $x(t)$, gaining discrete sequence $x(n), (n = 0, 1, 2, \ldots)$. Relevant periodic signal is extracted according to the frequency $f_0$ of effective periodic components; $x(n)$ is continuously cut into $n$ sections with equal length $t$, and each section is corresponding to the period $(T = \frac{1}{f_0})$ and the points number of each section is $M$, and thus the sequence is gained as follows.

$$y(n) = \frac{1}{N}\sum_{i=0}^{N-1} x(n - iM) \tag{68.11}$$

In Eq. (68.11), $n = (N-1)M, (N-1)M+1, \ldots, NM-1$ is called as new sequence gained from $x(n)$ processed by time domain average processing. The $y(n)$ length of the sequence is M ($M = \frac{T}{\Delta} = \frac{1}{f_0\Delta}$).

$Z$ transformation is made on Eq. (68.12), and the following can be gained according to the time shift characteristics of $Z$ transformation.

$$Y(Z) = \frac{1}{N}\sum_{i=0}^{N-1} Z[x(n - iM)] = \frac{1}{N}\sum_{i=0}^{N-1} X(z)z^{-iM} = \frac{1}{N}X(z)\frac{1 - z^{-MN}}{1 - z^{-M}} \tag{68.12}$$

Order $z = e^{j2\pi/\Delta}$ and the frequency response function of the average time domain after simplifying is as follows:

$$\begin{aligned} H(f) &= \frac{1 - e^{-j2\pi f\Delta MN}}{N(1 - e^{-j2\pi f\Delta M})} = \frac{1 - e^{-2j\pi fN/f_0}}{N(1 - e^{-j2\pi f/f_0})} \\ &= \frac{e^{-j\pi fN/f_0}\left(e^{j\pi fN/f_0} - e^{-j\pi fN/f_0}\right)}{Ne^{-j\pi f/f_0}\left(e^{j\pi f/f_0} - e^{-j\pi f/f_0}\right)} \end{aligned} \tag{68.13}$$

The amplitude frequency and phase frequency characteristics of time domain averaging are shown below, respectively.

$$|H(f)| = \frac{1}{N}\left|\frac{\sin N\pi f/f_0}{\sin \pi f/f_0}\right| \tag{68.14}$$

$$\phi(f) = \frac{(N-1)\pi f}{f_0} \tag{68.15}$$

When the averaging times $N$ are bigger, pass band is very narrow. Therefore, the periodic components related to frequency $f_0$ can be effectively extracted.

### 68.3.4 Frequency Domain Method

Spectrum analysis method is a common frequency domain detection method and used for extracting characteristics frequency components from background noises. It is applied in the detection of weak periodic signal more frequently [12].

The principle of spectrum analysis is to transform complex time history waveform into several single harmonic components through Fourier transform for studying, so as to acquire the frequency structure of signal and the relationships of all harmonic amplitudes, phase, power, and energy with frequency.

The resolution $\Delta f$ of frequency spectrum analysis is a very important parameter, and depends on the time length $T$ ($T \times \Delta f = 1$) of analyzed signal; weak signal

detection performance is proportional to the observation time. Assume the observed sine signal $S(t) = A\sin(\omega t)$ is submerged in the white noise with a variance of $\sigma^2$, and thus detection performance is proportional to $A^2/(2\sigma^2\Delta f)$, and frequency domain resolution $\Delta f$ divides the whole frequency band into small frequency bands with a bandwidth of $\Delta f$. When the noise is white noise, the noise energy in each small band is equal and declines with the decrease of $\Delta f$, and the constant energy in bandwidth containing the frequency of signal is $A^2/2$ and does not depend on $\Delta f$. Therefore, if the time length $T$ is longer, $\Delta f$ will be smaller and frequency resolution will be higher. Then, sine signals determined by small frequency can be detected.

In applications, the statistical properties of signal are likely to change in a long time. Therefore, Fourier transform has some limitations in resolution.

### *68.3.5 Time-Frequency Analysis Method*

In time-frequency analysis, time-frequency joint is used for expressing signal, and the only time signal is mapped to a 2D time-frequency plane and signal is analyzed within the time-frequency domain, comprehensively reflecting the time-frequency joint characteristic of observed signal. At the same time, not only the time domain and frequency domain information and also the law of signal frequency to change with time can be clearly known. The basic task of time-frequency analysis is to establish a distribution function, requiring this function not only to describe signal's energy density simultaneously with time and frequency, but also to calculate the energy distribution within a specific frequency and time, frequency density at specific time, and each moment of this distribution function.

## 68.4 Conclusion

As studies on weak signal detection become deeper and deeper gradually, new theories and methods have been found. The traditional spectrum analysis, correlation detection, sample integral, and time domain averaging and the newly developed wavelet analysis theory, neural network, chaotic oscillator, higher order statistics, and stochastic resonance have been widely applied in weak characteristic signal detection.

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# Chapter 69
# Study on Theory of Signal and System in Modern Communication Technology

**Yandi Li, Zheng Ma and A'hui Yang**

**Abstract** Signal and System is a very important fundamental course in electronics and communication program, and its important knowledge is the theoretical foundation of the communication field. However, it has been obvious that the reform of teaching materials cannot keep pace with the development of information technology, and some theories having lost their roles, still occupy a large proportion of the teaching contents. In this paper, from three perspectives (scientific research project, postgraduate entrance exam, and national electronic design contest), the parts necessary to be enhanced and weakened in the teaching material of Signal and System are analyzed, and also some specific suggestions on the reform of teaching materials are proposed.

**Keywords** Signal and system · Scientific research · Questions in postgraduate entrance exam · Electronic design contest · Reform of teaching materials

## 69.1 Introduction

Signal and System is a core fundamental course in electronics and communication program, and its important theories, analysis methods, and signal processing ways have been widely used in the fields such as communication, automatic control, signal and information processing, and circuits and systems.

At present, the teaching system and main contents of the course Signal and System in the majorities of the colleges and universities at home and abroad are

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relatively stable, and also are changed little. Therefore, in this paper, based on the material An Introduction to Signal and System compiled by Junli Zheng, the development and abandoning of the traditional theoretical system of Signal and System in the modern communication technology are analyzed in details from three aspects (scientific research project, postgraduate entrance exam, and national electronic design contest) [1].

In consideration of the application of important theories in every field, important theory analyzed specifically from one perspective will not be repeatedly introduced from the other two perspectives.

## 69.2 Analysis of Signal and System from the Perspective of Scientific Research

An article named as Narrowband Shortwave Channel Simulation and Its realization based on Watterson model about the modeling of the shortwave communication channel is quoted in this paper [2].

Before the channel modeling, it is necessary to know well the expression way of the channel. In shortwave channel, ionized layer is used as communication medium. Obviously, shortwave channel is a typical wireless parametric channel. The most simple high frequency channel model of it is as shown in Fig. 69.1.

In Fig. 69.1, $x(t)$ is the input modulated signal; $K(t)$ is multiplicative interference; $n(t)$ is additive noise. $N(t)$ and $x(t)$ have no dependent relationship, but $k(t)$ and $x(t)$ have.

In general, all channel models are calculated and refined on this basis. The theoretical foundation applied above is included in the second paper (time domain analysis) of An Introduction to Signal and System. $X(t)$ is the incentive; $y(t)$ is the complete response from the system. $Y(t) = x(t)*k(t) + n(t)$ is the transfer function of the system. Therefore, it is said that getting an in-depth understanding of the significance of the transfer function of the system and the modeling methods is a solid cornerstone of the researches on channel. However, the key points in the textbook are placed in the LTI system, but the model of shortwave channel is a time-varying system. The ionized layer is radiated by the sun light during the day, but is acted by the ionization effect of the cosmic rays. Thus, its physical properties are time varying, and also are in fast motion. Obviously, the explanation to the transfer function of the time-varying system is too short, which will certainly play an effect on the scientific research in the future [3].

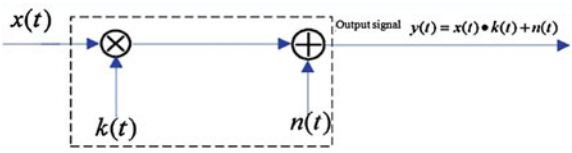


**Fig. 69.1** The most simple high frequency channel model

The tapped time-delay line structure of the Watterson model constructed in this paper is as shown in Fig. 69.2.

From the tapped time-delay line structure of the Watterson model, it can be known that its frequency response is time varying and can be expressed as follows.

$$H(f,t) = \sum_{i=1}^{n} \exp(-j2\pi\tau_i f) G_i(t) \tag{69.1}$$

From the analysis and transfer function in the teaching material, Watterson transfer function is to decompose a signal into the signals on multiple paths via different channels and also make operations on them differently, and finally solve their sum. Obviously, the solving method for the multipath channel is unavailable in the book An Introduction to Signal and System, but the thought prototype of this method is clearly embodied in it. The first paper in the book gives an explanation to signal decomposition method (decomposing signal into the sums of multiple pulse components). Specifically, the repeated addition of the decomposed rectangular narrowband pulse components with the decomposed phase-step signal components is explained [4].

Therefore, it can be seen that signal decomposition is the basic idea and common method of signal processing. However, for scientific research, the most important is to know well the processing idea, but not to master a method (certainly, the decomposition of impact signals may be applied more widely); in research, the most convenient decomposition is conducted according to the specific characteristics.

## 69.3 Analysis from the Perspective of the Questions in Postgraduate Entrance Exam

The questions in the postgraduate entrance exams of all colleges and universities can undoubtedly give a reflection to the knowledge points that each school pays the most attention. Therefore, through a comparative analysis on the questions in the postgraduate entrance exam 2010 of Tsinghua university, the questions in postgraduate entrance exam 2007 of Graduate University of Chinese Academy of Sciences and the questions in postgraduate entrance exam 2008 of Beijing

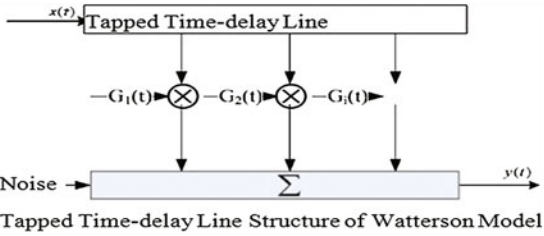


**Fig. 69.2** The tapped time-delay line structure of the Watterson model

University of Post and Telecommunications, the knowledge points of signal and system theory that colleges and universities attach particularly high importance to are known.

After the analysis of the questions in above three exams, it is easy to find that system incentive and response are necessary in the postgraduate entrance exams, but do not depend on whether they are not involved or emphasized in the textbook. The incentive mainly explained in the textbook comprises of impulse signal and phase-step signal, but response involves many knowledge points including zero-input response, zero-state response, free response, forced response, transient response, steady-state response, and system's complete response. In the questions in above three exams, free response, forced response, and transient response are not involved; steady-state response only appeared in the third item of the second question of the postgraduate entrance exam of Tsinghua University. Therefore, it can be known that these knowledge points are not so important, and only need us to understand. For zero-input response, clear solution requirements were available in the second question of Tsinghua University and the seventh question of Beijing University of Post and Telecommunications. Thus, it can be seen that this part of knowledge was still tested by these two universities. However, no related questions appeared in the questions of Graduate University of Chinese Academy of Sciences, and also the authors think that this is a trend.

In addition, it is obvious that impulse response is more important than phase-step response. For example, impulse response was involved in the second and third questions of Tsinghua University, the seventh and eighth questions of Beijing University of Post and Telecommunications and the second and seventh questions of Graduate University of Chinese Academy of Sciences. However, in the questions of the three exams, phase-step response was only involved in the seventh question of Graduate University of Chinese Academy of Sciences. Besides, in the questions of postgraduate entrance exams, it is worth noticing that contents related to Laplace transform did not appear in the major questions, but occupy a large proportion of the teaching material.

## 69.4 Analysis from the Perspective of the National Electronic Design Contest

Let us first take a look at the Question A in the national electronic design contest 2007 for college students. It required students to design and make an analyzable audio signal frequency component measuring the instrument of distorted sine signal, namely an audio frequency signal analyzer. In the following, the first prize works of the School of Electronics and Information of South China University of Technology is taken as an example.

In the designed analyzer of this works, a 32-bit MCU was used as main controller; through AD transform, audio signal was sampled, continuous signal was

discretized, and then the indexes such as all frequency components and power of audio signal in time domain and frequency domain through fast fourier transform (FFT), and then signal spectrum are displayed through high-resolution LCD. Generally, it can be seen that the entire instrument is based on discrete signal, and therefore it is necessary to discretize continuous signal. The first important knowledge point applied in the works is the famous sampling theorem, which is the cornerstone of discrete digital signal processing. From the questions in national electronic design contest and related scientific researches, it can be seen that the application of digital signal in the current communication technology is significantly more common than that of analog continuous signal. Therefore, the importance of the sampling theorem is self-evident. However, after signal is discretized, related signal processing involves the Fourier transform of sampling signal (the Sect. 69.10 in Chap. 3) and the relevant analysis of discrete time system (Chap. 7 and Chap. 8). After signal is analyzed, the discretized signal is necessarily recovered to be continuous time signal many times, and this involves the specific applications of the Fourier transform in Chap. 5. Therefore, for those students who are eager to attend national electronic design contest, it is necessary to pay especially higher importance to this part of knowledge of Signal and System.

Another important knowledge in the Question A is FFT.

Then, let us take a look at the Question F in the national electronic design contest 2009 for college students and make a comparison with the above Question A. In the Question F, students were required to design and make a power amplifier of digital amplitude-frequency equalization. Here, the national first prize works of Hebei University of Science and Technology is analyzed. The framework of the designed amplifier is as shown in Fig. 69.3.

The first step of processing signal was transforming the signal via resistance network into digital signal by using audio A/D converter, and then acquiring signal spectrum through FFT transform. Obviously, the step is generally the same with the way of solving the Question A, proving the importance of digital discrete signal, and FFT transform in contest. However, the D/A transform after the amplifier, like mentioned above, needs to change digital signal back to analog signal; relatively, enough attention is necessarily paid to the continuous signal in time domain transformed from sampling signal.

In this result, an innovative point was that extraction and interpolation processing methods were applied.

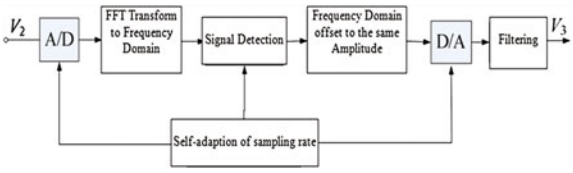


**Fig. 69.3** The framework of the designed amplifier

## 69.5 Analysis and Conclusion of Teaching Contents

After the analyses from postgraduate entrance exam, scientific research and national electronic design contest, the conclusion below can be drawn up comprehensively.

First, transfer function and signal decomposition are the most fundamental in the fields of signal research and processing. All sorts of researches develop on this basis. However, transfer function related to time varying is more frequently applied than time-invariance.

Second, digital discrete signal is mostly applied in the modern signal processing, and analog signal is rarely involved. Therefore, related A/D and D/A transforms have been widely applied.

Third, in the Fourier transform, Fourier transform of discrete sequence is more widely applied than the positive and negative Fourier transforms. In basic properties, sum property, time-shifting property, and scale-variation property are more important than other properties. Especially, the application of FFT in spectrum analysis is very important.

Fourth, in signal processing, real signal is often transformed to complex signal. Therefore, relevant Hilbert transformation cannot be neglected.

Fifth, zero-state response is more widely applied than zero-input response, and also impulse response is more widely applied than phase-step response. Other types of responses are rarely applied.

Sixth, the application of Laplace transform tends to continuously decrease.

## 69.6 Conclusion

In this paper, through the detailed analyses on the scientific projects and questions in postgraduate entrance exam questions and national electronic design contest, the influences of communication technology on the course System and Signal are analyzed in the new technical background, and the theories strengthened and weakened are listed. Meanwhile, the aspects necessary to notice in the reform of teaching materials are concluded. All these are of practical reference value for the reform of System and Signal.

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# Chapter 70
# Algorithm of the Realization of High Frequency Channel Simulator Based on Simulink

**Yandi Li, Yu Chen and Xun Zhang**

**Abstract** According to the characteristics such as multipath, Doppler frequency shift, and Doppler frequency spread that the communication channel exerts on the signal, we create a high frequency channel simulator based on the Watterson Model using the simulink software. Besides that we put up with a method to widen the communication frequency of the model creatively. And we use the signal of single frequency to check the validity of the model. After checking the result in time domain and frequency domain, we demonstrate the validity of it. The algorithm of this simulator is very simple with little parameters, which has great value in the domain of application.

**Keywords** HF channel · Multipath · Doppler shift · Doppler frequency spread · Communication band spread

## 70.1 Introduction

High frequency communication is an important method to realize the communication of long distance, which has wide application in the modern communication system. Although satellite communication takes most part of the communication for the civil use for its unique advantages, the easy destruction of the satellite makes it important to develop the high frequency communication. However, the high frequency channel is time varying and dispersion channel, so we need to take a lot of experiments outside the room to determine the parameters of the channel,

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which means huge amount of money [1]. The birth of the channel simulator is to solve this problem. The simulator could build the model of the channel on the condition of experiment according to certain data so that we could estimate the influence on the signal. Among the current channel models, the influential models are Watterson Narrowband Channel and ITS Channel that is useful in both narrowband and wideband. The simple algorithm and the validity on most of the conditions of the Watterson Model make it used widely, but the narrowband also obstruct its application in the communication area [2, 3].

This article uses the simulink software to build the HF channel based on the model of Watterson. First, we state the theory way of model and how to build it through the software. Then we give out the method to simulate the center characteristic of the channel, after which we put up with the way to widen the communication frequency band of the model according to the ITS channel. Finally, we offer the results of simulation. Through analyzing the result of simulation, we demonstrate the validity of the model [4].

## 70.2 The Theory of the Channel Model and the Design of the Software

### *70.2.1 The Mathematic Model of the HF Channel*

HF channel is time varying in both time domain and frequency domain. So it would be difficult to build the model that highly accords with the real channel. Nonetheless, after research and study as long as 5 years, Watterson found that if we define the frequency at a narrow band limited time, most of the channels are stable and could be expressed by a adequate static model. That is the Gaussian scattering channel model at ionized stratum, which is also called Watterson Model. Its transport function is

$$H(f,t) = \sum_{i=1}^{n} \exp(-j2\pi\tau_i f) G_i(t) \tag{70.1}$$

where $i$ is the serial number of the path, $n$ is the number of the paths, $\tau_i$ is the delay time of the path $i$, $G_i(t)$ is the modulating function that the channel exerts on the path, which is also called path gain. Our simulator is based on such mathematic model [5].

### *70.2.2 The Design of the Software in General*

According to the mathematic model of the HF channel, we could conclude that the way to build the channel is to realize the transmission in multipath and achieve the

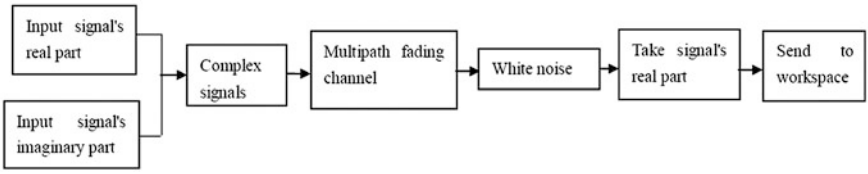


**Fig. 70.1** The steps of one path

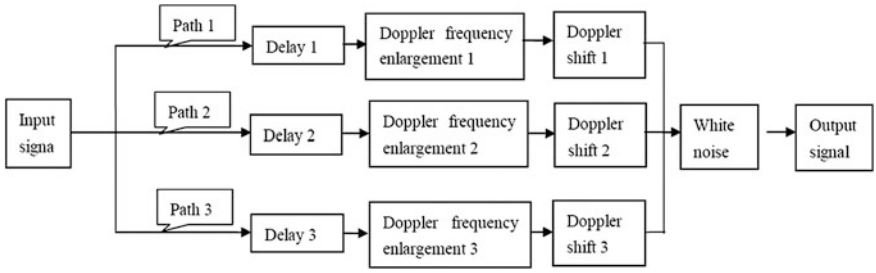


**Fig. 70.2** The whole software

simulation of the channel characteristic, including Doppler frequency shift, Doppler frequency spread, and noise and so on. Finally, we add all the paths together.

In the model, to each path we first transform the signal by Hilbert conversion to separate its real part and imaginary part. After the signal enters the simulator, we combine it into the complex signal. The steps of one path are given by (Figs. 70.1, 70.2).

And the whole software is given by

## 70.3 The Key Technical Implementation

### *70.3.1 Multipath Transmission Realizations*

In order to simulate the short wave signal in the channel transmission of the multipath effect, we must first make a real signal conversion into complex signals. Due to the limit of causality, the signal's real part between imaginary part and meet some corresponding relation, Hilbert transformation in the form reflected. We will signal the negative frequency part of the phase of transformation, to create each other with the original signal and odd function signal. There are various ways to produce the analytical signal; commonly used is the method of using filter.

The realization of Hilbert filter is as follows.

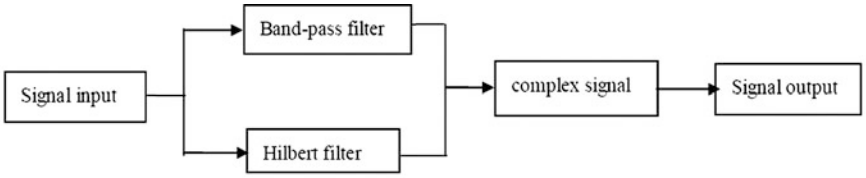


**Fig. 70.3** Specific system realization method

(1) Design a FIR low-pass filter, its band pass is half of the band-pass filter.
(2) Use formula 70.2 to convert designed low-pass filter coefficient into band-pass FIR filter coefficient of $I$ road and $Q$ road.

$$\begin{aligned} h_{IBP}(n) &= 2h_{LP}(n)\cos\left(2\pi f_0\left[n-\frac{(N-1)}{2}\right]T\right) \\ h_{QBP}(n) &= 2h_{LP}(n)\sin\left(2\pi f_0\left[n-\frac{(N-1)}{2}\right]T\right) \end{aligned} \tag{70.2}$$

From the appeal mathematical theory, we can use the FDA digital filter simulink to realize a real signal to the transformation of complex signals. Specific system realization method is as shown in Fig. 70.3.

After completing the signal conversion later, we began to realize multipath produce method. Set the input signal $S(t) = a\cos(\omega_0 t + \theta)$, the double linear Hilbert filter signal change into a complex signals $S_0(t)$, the components of $I$ and $Q$ road are $I_{in0} = a\cos(\omega_0 t + \theta)$, $Q_{in0} = a\sin(\omega_0 t + \theta)$, $S_0(t) = I_{in0} + jQ_{ino}$ is a plural form the original signal. By delaying the two components at the same time we can get different path, so it can realize the multipath simulation. Such as: delay $\tau$ to get another path $S_1(t)$. $S_1(t) = I_{in1} + jQ_{in1}$ is the original signal's delay signal which is also called multipath signal. The multipath effect of Shortwave Channel generates for the reason that the input signal experienced different delays. A large number of statistical data shows that nearly 98 % of delay in Shortwave Channel is between 0 and 20 ms. Therefore, in the simulation of delay in Shortwave Channel, set the scope of the delay path between 0 and 50 ms and choose four paths, in order to ensure the channel simulator's practicality. Method is as shown in Fig. 70.4.

### *70.3.2 Doppler Frequency Expansion Realization*

Due to the existence of the Doppler Effect, sending a signal will produce the Doppler frequency enlargement. We launch a single frequency of the signal, the transfer of the process by shortwave channel is affected and the amplitude and phase change over time, the signal has become a spectrum of the signal having certain width. This, in the frequency domain stretcher, is equivalent to the

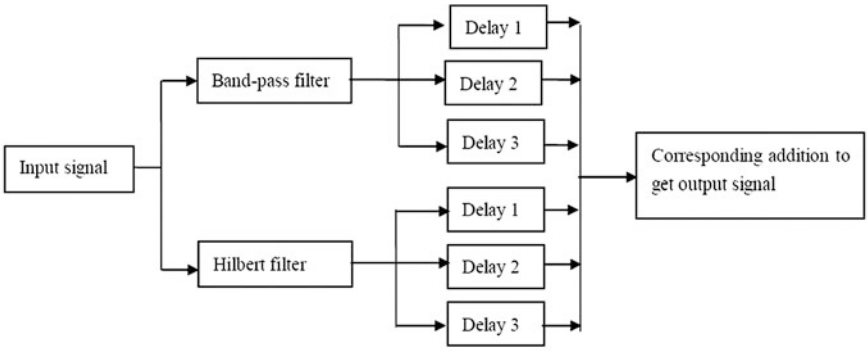


**Fig. 70.4** Method

ionosphere properties with the change of time, so it is necessary to channel the simulator to the characteristics of the simulation. So we need to implement the channel model according to the channel parameters, and realize the output signal's expansion in frequency.

In Watterson model, Doppler frequency extended power spectrum met Gaussian distribution; so we just need to multiply the signal after delay and modulate Gaussian noise whose bandwidth matches with the signal and has Gaussian spectrum; after that, we can get a frequency enlarged signal. And modulated Gaussian noise can be generated through FIR low-pass filtering the Gaussian white noise whose probability density obeys the Gaussian distribution. Here, the filter should choose Gaussian low-pass filter. The size of Doppler frequency extension is decided by the shock response length of selected Gaussian low-pass filter and the variance of Gaussian white noise produced by random signal generator. So we can realize the Doppler frequency expansion by using the method as shown in the Fig. 70.5.

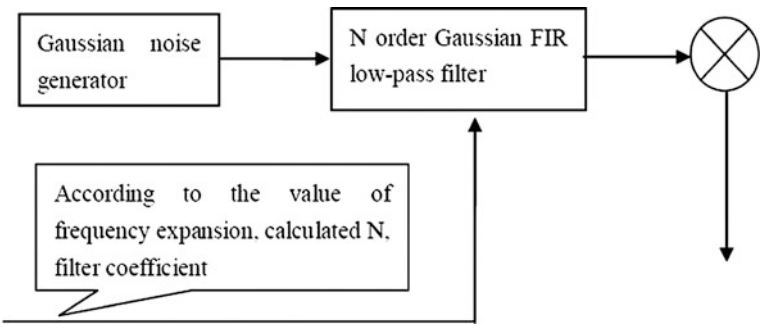


**Fig. 70.5** The doppler frequency expansion by using the method

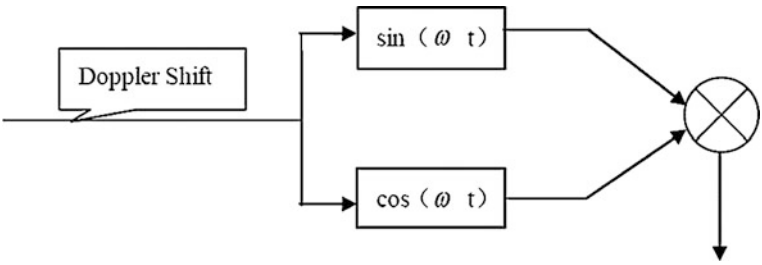


**Fig. 70.6** Method

### *70.3.3 Doppler Frequency Shift Realization*

Doppler Effect can cause frequency offset on both side of the communication carrier. We can achieve a channel simulation of the frequency shift effect through mathematical calculation. By Fourier transformation, frequencies shift that nature; If it is to be the center of the signal frequency moving to $f_0$, we just need to multiply it and $e^{j2\pi f_0 t}$ in the Time domain. Set the signal after frequency enlarging for $S(t) = I(t) + jQ(t)$, the signal after frequency shifting for $S'(t) = I'(t) + jQ'(t)$, we can get: Then by using the Euler formula, we can get: $S'(t) = S(t)[\cos(2\pi f_0 t) + j\sin(2\pi f_0 t)]$ Separating the real part and imaginary part, we can get:

$$I'(t) = I(t)\cos(2\pi f_0 t) - Q(t)\sin(2\pi f_0 t) \tag{70.3}$$

$$Q'(t) = Q(t)\cos(2\pi f_0 t) + I(t)\sin(2\pi f_0 t) \tag{70.4}$$

Through the two formulas (70.3), (70.4), we can achieve the purpose of frequency shift. Method is as shown in Fig. 70.6.

## 70.4 Channel Performance Improvement Strategy

Watterson model has a wide spread use because of its simple algorithm and the effective simulation in certain frequency band. But its band can only reach to 12 kHz and far from meeting the requirements of modern communications. In 1993, ITS organization in the United States puts forward a more comprehensive broadband shortwave channel modeling method, which is the best model so far. However, because of its complexity of the algorithm, it still cannot completely replace the Watterson model. In this paper, according to the core ideas of the frequency enlargement of ITS model, we improve Watterson model to make the simulator meet the demand for both the simplicity of the algorithm and frequency enlargement to a certain degree, which makes the simulator has higher practicability than previous.

ITS transmission function is as follows:

$$h(t,\tau) = \sum_n h_{pn}(t,\tau) = \sum_n \sqrt{p_n(\tau)} D_n(t,\tau)\psi_n(t,\tau) \tag{70.5}$$

$p_n(\tau)$ Says Delayed power spectral distribution.

The delayed power spectrum distribution of broadband shortwave channel transmission model is Gamma distribution.

$$P(\tau) = A\frac{\alpha^{\alpha+1}}{\Delta\Gamma(\alpha+1)} z^{\alpha} e^{-\alpha z} \tag{70.6}$$

After careful analysis of ITS model, we found that the core of realizing broadband channel simulation is that we give different weights to different delay path according to the distribution of power spectrum. Therefore, we can apply the ideas in Watterson shortwave channel model. In each signal path, we multiply different weights to make the simulator maintain high availability among a wide range of band.

## 70.5 The Simulation Results

We use the single sine signal whose frequency for 2,000 Hz, sampling rate for 8,000 Hz to simulate.

(1) Add 20 dB SNR of white noise in the channel. The time domain and frequency domain output results are as shown in the Figs. 70.7 and 70.8.
(2) Input signal unchanged and add 10 Hz Doppler frequency enlargement. The time domain and frequency domain output results are as shown in the Figs. 70.9 and 70.10.
(3) Input signal unchanged and add a path whose Doppler shift is 20 Hz. The time domain and frequency domain output results are as shown in the Figs. 70.11 and 70.12.

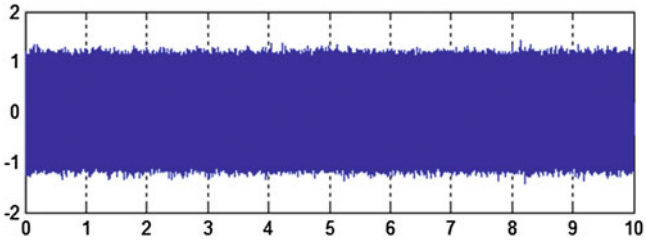


**Fig. 70.7** The time domain and frequency domain output results

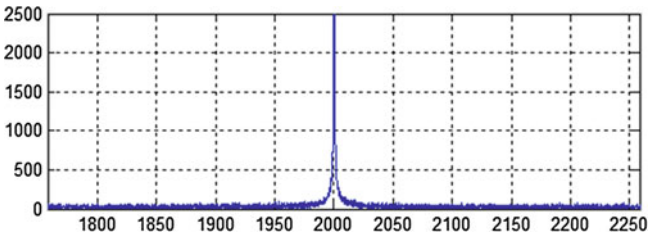


**Fig. 70.8** The time domain and frequency domain output results

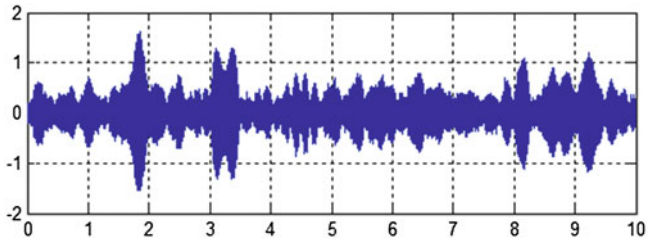


**Fig. 70.9** The time domain and frequency domain output results

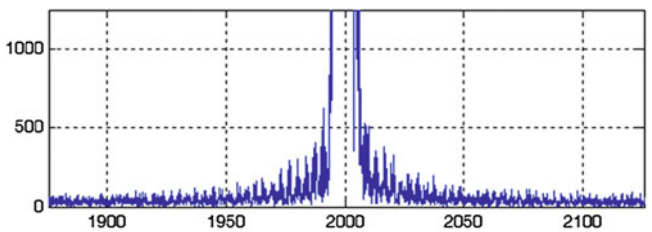


**Fig. 70.10** The time domain and frequency domain output results

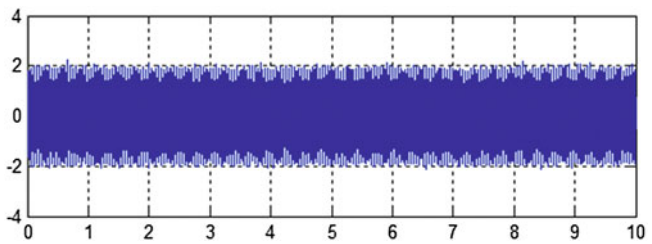


**Fig. 70.11** The time domain and frequency domain output results

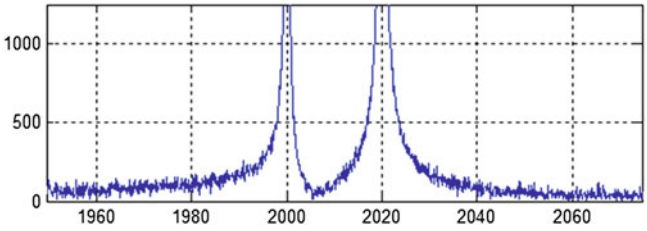


**Fig. 70.12** The time domain and frequency domain output results

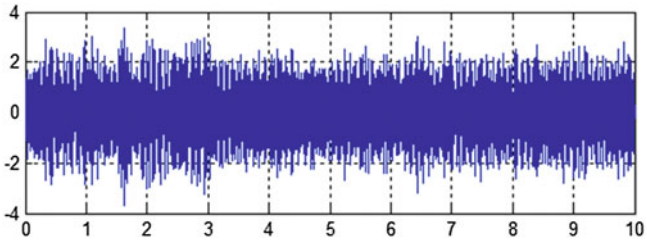


**Fig. 70.13** The time domain and frequency domain output results

We can see from the graph above, after adding a path whose Doppler shift is 20 Hz, frequency move appeared. In addition to the original 2,000 Hz signal outside, in the place of 2,020 Hz also appeared frequency pulse.

(4) Input signal unchanged and the number of multipath is 2. Multipath delays for each path are 5 and 10 ms. Doppler Shifts are 10, 20, and 40 Hz. Doppler frequency enlargements are 0, 4, and 10 Hz. Then add 20 dB SNR of white noise in the channel. The time domain and frequency domain output results are as shown in the Figs. 70.13 and 70.14.

From the graph above, it can be seen that the received signal produced frequency enlargement and frequency shift. Because the multipath effect frequency selective decline, decline phenomena can also be seen in time domain. Meet the transmission characteristics in short wave signal channel and verifies the short-wave channel simulator practicality.

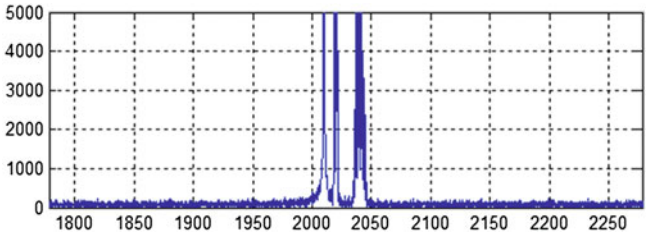


**Fig. 70.14** The time domain and frequency domain output results

## 70.6 Conclusion

A method of realizing the HF channel simulator using Simulink Software has been described. We demonstrated the correctness of the model and give the concrete method of achieving the critical characteristic of the channel. Also we provide a way to broaden the communication frequency band creatively. Finally, we demonstrated the validity of the simulator by checking it with a signal of single frequency. This software simulator has the advantage of simple algorithm, easy manipulation, and a wider band than before which has great value in application.

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# Chapter 71
# Fast Handover Scheme Named ESMIPv6 for Mobile Wireless Network

**Liqiu Pei and Lixun Zhu**

**Abstract** To solve the problems which happened in Mobile IPv6 fast handover such as handover latency, high packet loss and other, we propose a mobility management model called ESMIPv6. The model in SMIP basis is based on the user moves; the model created the user moves curve to forecast the user mobility model, while simplifying the structure of the SMIP. The design goal is to reduce the handover latency by forecasting the user moves, so as to eliminate the connection is interrupted and the signaling load minimum.

**Keywords** MIPv6 · Fast handover · SMIP · ESMIP · Mobile profiles

## 71.1 Introduction

With the arrival of the age of 3G, 4G is about to step into the daily life of people all over the world. However, with the gradual exhaustion of the IPv4 resources, the wide application of IPv6 has been officially put on the agenda. At present, in the development of IPv6, a problem, which is urgent to solve, is about the quick switching in the wireless network switching process. The seamless switching, under the premise that the quality of communication is not affected, is an important guarantee of the large-scale promotion of IPv6.

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## 71.2 Analysis of the Current Research Situations at Home and Abroad

Many solutions for realizing the mobile IPv6 fast switching have been proposed by people, such as MIPv6, HMIPv6, F-HMIPv6, and S-MIP.

According to the realization mechanisms, these solutions can be divided into fast switching solution, hierarchic management solution, combination solution, and solution based on MPLS and flow labels, as shown in Table 71.1.

In all switching solutions, s-MIP (seamless handoff Architecture for Mobile IP) is comprehensively optimal [1]. S-MIP belongs to the combination solution of FMIPv6 and HMIPv6, and its design idea is introducing decision engine (DE) in the combination solution of the two for realizing intelligent switching. However, S-MIP is designed very complexly, because the engine entity is additionally necessary to be judged and a large amount of information needs to be collected for maintaining network link status in real time and making intelligent judgment.

The structure of the SMIP system is complex, and mobile model forecast algorithms are not perfect enough. Therefore, it is improved and a mobile management model named as enhanced seamless mobile IPv6 (ESMIPv6) is established.

**Table 71.1** Comparison on mobile IPv6 switching solutions

| Type | Solution name | Switching delay | Packet loss | Signaling load | Complex rate |
|---|---|---|---|---|---|
| MIPv6 | MIPv6 | Poor | Poor | Poor | Very good |
| | FMIPv6 | Very good | Good | Very Poor | Average |
| Fast switching | EFWD | Good | Good | Poor | Good |
| | Switching solution based on router | Good | Good | Poor | Average |
| | HMIPv6 | Average | Average | Very good | Average |
| Hierarchic management | Hierarchic management MAP discovery protocol | Average | Average | Very good | Very complex |
| | F-HMIPv6 | Very good | Very good | Very good | Very complex |
| | FF-HMIPv6 | Very good | Very good | Very good | Very complex |
| | S-MIP | Very good | Very good | Very Poor | Very complex |
| Combination | Fast switching solution enhancing cache management | Very good | Highly Good | Good | Very complex |
| MPLS and flow label | W-MPLS | Good | Good | Very good | Average |
| | FFHMIPv6 | Poor | Good | Poor | Average |

## 71.3 Basic Principles of ESMIPv6

In ESMIPv6, the system structure defined in S-MIP is still applied, mainly aiming at reducing the switching delay through forecasting the mobile ways of users.

ESMIPv6 forecasts the position of next switching by using the mobile curves of users. Based on this idea, all mobbing nodes need to send their new addresses to all their opposite end nodes before going to leave the current network and preparing to access new network. However, through the information at data link layer, ESMIPv6 can also forecast the exact time of switching to happen. In addition, the generation of addresses is also a heavy task. In order to reduce the burden of system, ESMIPv6 uses the duplicate address detection (DAD) method to automatically generate the only new address, thus preventing the only uniqueness detection process of new address [2].

## 71.4 ESMIPv6 Mobile Management Model

### *71.4.1 Mobile Model*

In life, the daily life of most people has laws to follow, and these laws will be abided by in a few days or hours of a week [3].

In the following, an access route network covering a large geographic area is simulated. This network can be divided into several hexagon honeycombs, and each honeycomb contains a base station. Figure 71.1 shows this network comprising of 17 hexagon honeycombs; each honeycomb is labeled with a pair of array $(x, y)$, in which $x$ is row label and $y$ is column label. This kind of label gives a reflection to the adjacency relationship between network nodes; the position change of a mobile node moving from $C_1(x_1, y_1)$ to $C_2(x_2, y_2)$ can also be expressed with a pair of array $(dx, dy)$, in which $dx = x_2 - x_1$ and $dy = y_2 - y_1$ are established. When the mobile node leaves a given unit, it will certainly enter an adjacent access route network. Based on this simple principle, the moving of each mobile node can be expressed through $dx$ and $dy$, and its possible value is the integers 1, 0, and 1 [4].

To further explain the principle of the moving pattern of mobile nodes, the typical moving behavior of a mobile user is studied. Figure 3.1 shows the moving behavior from home to work unit, and a typical workday moving pattern can be established through this example. The residence of the mobile user is located in (1, 1), labeled with R; his work unit is in (1, 5), labeled with W. If the user leaves home for work at 7:00 am every morning, he will finally arrive at the work unit (1, 5) after going by (2, 1), (3, 1), and (3, 2), (3, 3), and (2, 4). To make this example closer, the user can be supposed to eat lunch at (1, 4) at 12:00 am, and finish his work during the day and go home reversely along the same route of the morning about at 5:00 pm. Therefore, in the whole process, the user leaves (1, 5),

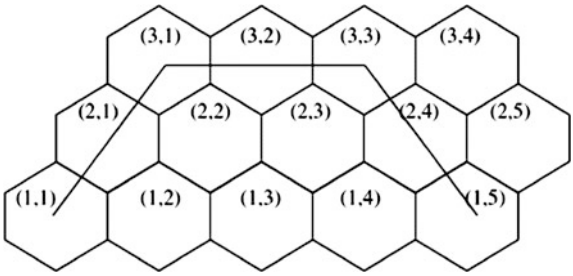


**Fig. 71.1** Example for the network moving pattern of hexagon honeycombs

and gets back to home (1, 1) after going by (2, 4), (3, 3), and (3, 2), (3, 1), and (2, 1). At a few nights of a week, the user gathers with his friend at the friend's home (2, 2), or goes shopping at a small supermarket (1, 2) nearby his own home.

If the user repeats the above moving pattern for multiple times in the 7 days of a week, the moving pattern of his workday can be supposed to be a two-dimensional hexagon topology structure. In addition, it can be assumed that an only 64-bit EUI identifier is given to each mobile user and his subnet address is broadcasted by each base station, and also the address is received by a mobile node through RA. Thus, the position of the subnet is always known by the mobile node at any time.

In Table 71.2, an example for the roaming history of a user is presented; the main contents for learning the system programs have to include (1) repeated moving has to be identified if exists; (2) the concrete possible roaming location of a user has to be shown by the system at a moment of a day; (3) if the roaming habit is changed by user, the system has to detect the change and also can automatically learn new roaming patterns.

### *71.4.2 Mobile Management Model*

ESMIPv6 mobile management model is based on the user moving curve generated by pattern learning module, and the moving pattern of a user is stored in the memory of mobile nodes. From the time the pattern is stored in memory, mobile nodes can use it for sending binding update information to the opposite-end nodes; each piece of binding update information contains the next positions of mobile nodes relative to the present moments and positions, and also mobile nodes have to send this information before entering new network. In addition, if the network conditions are allowable, this model can detect the existence of new access point and also estimate the possibility executing the switching task by using the information at the data link layer.

**Table 71.2** Example for the roaming history of a user

| No. | Time | The first day | | The second day | |
|---|---|---|---|---|---|
| | | Position | Moving | Position | Moving |
| 1 | 0:00 | (3, 4) | (0, 0) | (2, 5) | (+1, −1) |
| 2 | 0:01 | (3, 4) | (0, 0) | (3, 4) | (0, 0) |
| 3 | 0:02 | (3, 4) | (0, 0) | (3, 4) | (0, 0) |
| 4 | 0:03 | (3, 4) | (0, 0) | (3, 4) | (0, 0) |
| 5 | 0:04 | (3, 4) | (0, 0) | (3, 4) | (0, 0) |
| 6 | 0:05 | (3, 4) | (+1, +1) | (3, 4) | (0, 0) |
| 7 | 0:06 | (4, 5) | (0, 0) | (3, 4) | (0, 0) |
| 8 | 0:07 | (4, 5) | (+1, 0) | (3, 4) | (+1, 0) |
| 9 | 0:08 | (5, 5) | (−1, −1) | (4, 4) | (0, 0) |
| 10 | 0:09 | (4, 4) | (0, 0) | (4, 4) | (0, 0) |
| 11 | 0:10 | (4, 4) | (0, 0) | (4, 4) | (0, 0) |
| 12 | 0:11 | (4, 4) | (0, -1) | (4, 4) | (0, 0) |
| 13 | 0:12 | (4, 3) | (0, 0) | (4, 4) | (0, 0) |

### *71.4.3 User's Moving Curve*

The system structure of ESMIPv6 moving pattern as well as related moving curve concepts and the forecast mechanism used in switching are introduced in details below.

There are no learning modules for the following contents. Therefore, for a wide range of moving pattern, the mobile nodes described here may have many mobile curves. In fact, however, once the user's roaming history is analyzed, it can be found that there are a few mobile curves representing the main roam habits of user. According to the results in the Reference, a regular user has about six different curves in general [5]. The information contained in the curve is as follows: the access router user goes by when roaming, and the time of commonly-accessed network and user to enter and leave theses networks.

In Table 71.3, a typical example is described. The user leaves the home (1, 1) at 7:00–7:10 am and arrives at the work place t(1, 5) at 7:50–8:00 am every day. In this section, he needs to go by (2, 1), (3, 1), and (3, 2) and (2, 4). Each piece of information in the pattern contains the instruction of time interval for expressing the user may be in the position at that time. For example, on the way from home to work unit, the user may go by (2, 1) at 7:10–7:15.

### *71.4.4 Switching Forecast*

ESMIPv6 uses moving pattern for forecasting the next subnet that a mobile node will go by, and can trigger the switching of the network layer needless to wait for RA. In other words, the information of units and subnets are contained in the

**Table 71.3** Example for the user's moving curve from home to work unit

| Access router | Subnet prefix | Start time | End time |
|---|---|---|---|
| (1, 1) | AC-DE-48-23-45-67-AB-11 | 8:00 | 8:10 |
| (2, 1) | AC-DE-48-23-45-67-AB-21 | 8:10 | 8:15 |
| (3, 1) | AC-DE-48-23-45-67-AB-31 | 8:15 | 8:22 |
| (3, 2) | AC-DE-48-23-45-67-AB-32 | 8:22 | 8:35 |
| (3, 3) | AC-DE-48-23-45-67-AB-33 | 8:35 | 8:40 |
| (2, 4) | AC-DE-48-23-45-67-AB-24 | 8:40 | 8:50 |
| (1, 5) | AC-DE-48-23-45-67-AB-15 | 8:50 | 9:00 |

moving pattern (see Table 71.3). Therefore, mobile node can execute the switching at the network layer once receiving a new access point.

### *71.4.5 Detailed Explanation to Pv6 Address Generation and Switching Process*

When a mobile node roams between two different networks, its current CoA can be changed if necessary. However, a part of the new address of the mobile node is related to the prefix of the subnet it will access.

The stateless address auto-configuration (SAA) method provided in the reference can generate IPv6 address for each mobile node. To use this method, manual configuration is unnecessary, and it is only necessary to configure router in initialization according to needs. With SAA, mobile node can generate its own address by jointly using the current position information and the access router's routing broadcast information. The access router broadcasts its subnet prefix, and then mobile node generates the identifier, used for network communication, and therefore SAA generates the address of the mobile node by combining both sides.

The ESMIPv6 switching process is as follows. The switching at the network layer after the triggering of the data link layer received will be executed. Triggering includes some identification information such as MAC address or EUI-64 address of new access points. Based on these identifiers, mobile node can detect whether this access router is within its moving curve. If it is within the curve, next CoA based on subnet prefix can be generated without waiting for the RA from AR. After the address is generated, mobile node sends the binding update information containing its new CoA to all its opposite-end nodes and home agencies, and simultaneously FBU is sent to the PAR of mobile node. This stage is necessary, so as ensure all packets, going to mobile node, forwarded to NAR. Figure 71.2 shows the information exchange process in the ESMIPv6 switching.

Once FBACK is not received in a given period of time, an ordinary MIPv6 switching is enabled between two access points. Mobile node will generate a new CoA after receiving the information of new subnet prefix, and also the BU

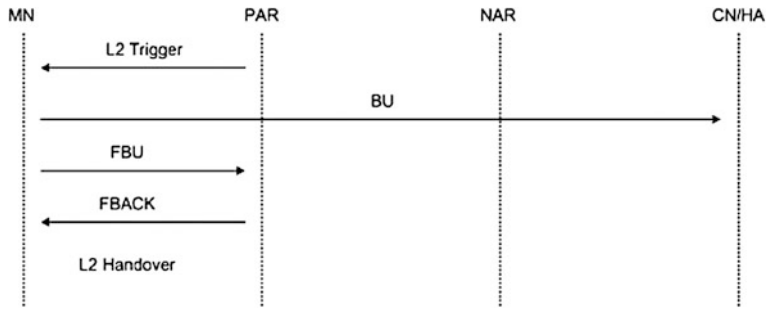


**Fig. 71.2** The information exchange in the ESMIPv6 switching

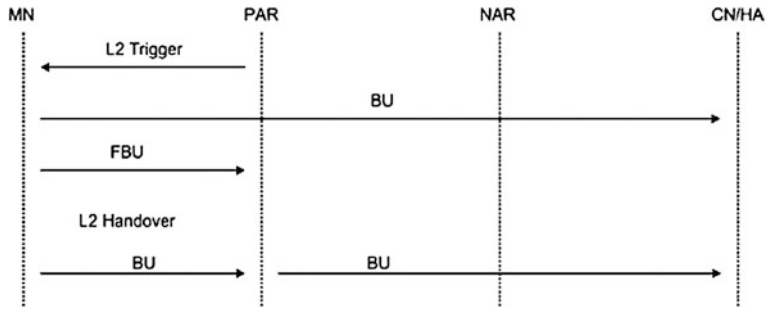


**Fig. 71.3** The information exchange process when ESMIPv6 switching fails

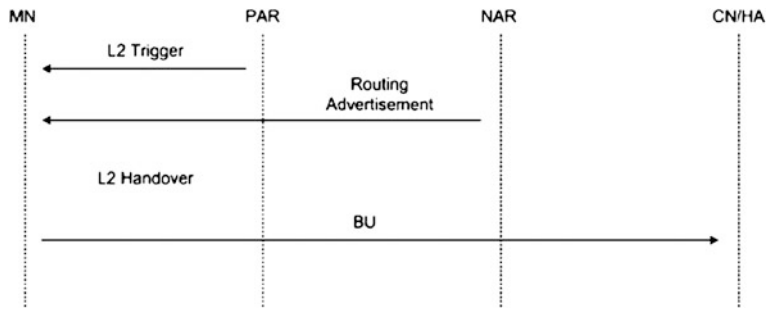


**Fig. 71.4** The information exchange process in ordinary MIPV6 switching

containing this new address will be sent to home agency, previous access router, and all opposite-end nodes. Figure 71.3 shows the information exchange process when ESMIPv6 switching fails.

In addition, if new access points are not in the moving curve of the mobile node, CoA cannot be generated even if the subnet prefix is known by the mobile node. At this moment, the mobile node waits for the RA coming from new access router and

also executes an ordinary MIPv6 switching. Once the new address is generated, the mobile node will send the binding update BU to all its opposite-end nodes and home agency. Figure 71.4 shows the information exchange process in ordinary MIPv6 switching.

## 71.5 Conclusion

In ESMIPv6 solution, the fast switching speed, low packet loss rate, and small signaling cost of SMIP continue to be used, and also the concept of user's moving curve is introduced, aiming at improving the forecast of user's moving curve in SMIP and simultaneously simplifying the design structure of SMIP. Therefore, the fast switching problem of mobile wireless network is solved well.

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# Chapter 72
# Physical Layer Network Coding Transmission Technique in Unidirectional Linear Flow Networks

**Kaiming Qu and Peilu Fu**

**Abstract** In this paper, the technical properties of the launch in one-way flow PNC network, and will it with the traditional transmission technology. We arrived at her expression one-way end-to-end flow in PNC transmission scheme. We have deduced the end-to-end throughput, one-way flow can realize in each research plan. The results show that, PNC transmission scheme to achieve higher overall flow than in traditional throughput implementation, a under consideration to the high signal-to-noise ratio.

**Keywords** High data rate · PNC · Unidirectional linear flow networks

## 72.1 Introduction

The exchange of information on the wireless network has prompted the researchers believe that the new and efficient technology needs higher data rate and faster connection speeds through the efficient use of available wireless resources. The physical network coding (PNC) is a technology of great potential which improves throughput end-to-end pass through the effective use of resources and the development of wireless [1]. The idea of network coding is first introduced in 2000 Ahlsweda [2], and then used in many other work (for example, [3] and [4, 5]) and shows hope in improving traditional transmission technology throughput. Later, PNC development is a promising technology, which has been shown to improve the performance of three-node two-way network.

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At the physical layer, data transmission through the electromagnetic (EM) waves, PNC using nature of the arrival of the additive was carried out at the same time more than the electromagnetic wave. Through the use of appropriate modulation, the addition of electromagnetic signal can be mapped to CF (2 n) add digital a flow [2] and [5]. Symbol-level and carrier-phase synchronization and use power control in order to receive two signals of the same phase and amplitude.

Figure 72.1 illustrates the traditional transmission scheme in a unidirectional flow network. Here, node 1 and node 4 can both transmit their signals at the same time without interfering with one another, but node 1 and node 3 cannot transmit simultaneously, due to interference.

Figure 72.2 illustrates the unidirectional PNC transmission scheme. Unlike the case of the traditional transmission scheme, node 1 and node 3 here can transmit concurrently (i.e., node 1 sends $X_1$, while node 3 is sending $X_3$), and provided that node 2 has already received $X_3$, it can then perform PNC to recover the intended signal/packet coming node 1, even in the presence of the signal coming from node 3. In this case, the performance gain of the PNC scheme over that of the traditional scheme lies in the fact that the number of transmissions to deliver a packet successfully is expected to be lesser under the PNC scheme than under the traditional one. However, due to interference, the bit-error rate (BER) under the PNC technique is, on the other hand, expected to be worse than that under the traditional one. The objective of this paper is then to investigate whether the degraded BER due to interference pays off by reducing the number of needed transmissions, thereby leading to an increased overall end-to-end flow throughput.

## 72.2 Bit-Errors Rate

In this section, we won the BER one-way end-to-end flow use of the PNC transmission scheme, and will it with the traditional transmission scheme. We assume that additive Gaussian white noise and power density not/2, and assume that received signal energy a bit (Eb) is unity. We also assume perfect synchronization and shy; Carrier-phase organization, and consider using modulation technology.

Let us refer to the example of Fig. 72.2 again to illustrate the derivation of the BER of the PNC transmission scheme. Using the PNC scheme, both nodes 1 and 3 are allowed to transmit concurrently; i.e., at a given time slot, node 2 receives, at the same time, two signals: $X_1(t)$ coming from node 1 and $X_3(t)$ coming from node 3, although intended for node 4. As a result, the combined band pass signal $r_2(t)$ received by node 2 during one symbol period is


**Fig. 72.1** Traditional transmission on a unidirectional flow network

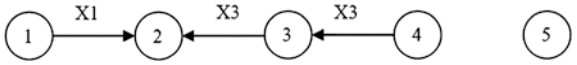


**Fig. 72.2** PNC transmission on a unidirectional flow network

$$r_2(t) = X_1(t) + X_3(t) \tag{72.1}$$

which can also be expressed as

$$r_2(t) = [i_1 \cos(wt) + q_1 \sin(wt)] + [i_3 \cos(wt) + q_3 \sin(wt)] \tag{72.2}$$

where $i_j$ and $q_j$ are the QPSK modulated information bits of node $j$, and $w$ is the carrier frequency. Thus, node 2 receives two baseband signals, in-phase ($I$) and quadrature phase ($Q$):$I = i_1 + i_3$ and $Q = q_1 + q_3$.

Here, node 2 encodes the combined bit, $(X_1 + X_3)$, with the already received (stored) bit, $X_3$, to recover the intended bit, $X_1$; i.e., $(X_1 \oplus X_3) \oplus X_3 = X_1$. Note that $X_3$ was already received by node 2 at an earlier transmission time, i.e., when $X_3$ was transmitted from node 1 to node 2.

The QPSK data stream can basically be considered as two BPSK data streams [6]: an in-phase stream and a quadrature-phase stream. In Fig. 72.3, we illustrate the PNC mapping, where $X_j \in \{0, 1\}$, and $i_j \in \{-1, 1\}$ represents the in-phase data bit.

As shown in Table 72.1, there are three possibilities of the in-phase space, $\{-2, 0, 2\}$, with corresponding probabilities of 0.25, 0.5, and 0.25, respectively. Applying the maximum posterior probability criterion and using the table shown in Fig. 72.3, $i_2 = -1$ for $i_1 + i_3 = -2$ or $i_1 + i_3 = 2$. Since the error occurs when this criterion is not met, the average probability of error is calculated for all possible cases, and the BER can be written as follows [7].

$$\begin{aligned} \mathrm{BER_{PNC}} = & \frac{1}{4}\int_{\alpha_1}^{\alpha_2} \frac{1}{\sqrt{\pi N_o}} \exp\left(-\frac{(r+2)^2}{N_o}\right) \mathrm{d}r \\ & + \frac{1}{2}\int_{-\infty}^{\alpha_1} \frac{1}{\sqrt{\pi N_o}} \exp\left(-\frac{r^2}{N_o}\right) \mathrm{d}r \\ & + \frac{1}{2}\int_{\alpha_2}^{\infty} \frac{1}{\sqrt{\pi N_o}} \exp\left(-\frac{r^2}{N_o}\right) \mathrm{d}r \\ & + \frac{1}{4}\int_{\alpha_1}^{\alpha_2} \frac{1}{\sqrt{\pi N_o}} \exp\left(-\frac{(r-2)^2}{N_o}\right) \mathrm{d}r \end{aligned} \tag{72.3}$$

When the received signal is less than $\alpha_1$, $i_1 + i_3$ is declared to be $-2$, and when it is more than $\alpha_2$, $i_1 + i_3$ is declared to be 2. Otherwise, it is assumed to be O. After

**Table 72.1** PNC mapping illustration

| Modulation mapping at $N_3$ and $N_1$ | | | | Demodulation at $N_2$ | | |
|---|---|---|---|---|---|---|
| $X_1^{(1)}$ | $X_3^{(1)}$ | $i_1$ | $i_3$ | $i_1 + i_3$ | $X_2$ | $i_2$ |
| 1 | 1 | 1 | 1 | 2 | 0 | −1 |
| 0 | 1 | −1 | 1 | 0 | 1 | 1 |
| 1 | 0 | 1 | −1 | 0 | 1 | 1 |
| 0 | 0 | −1 | −1 | −2 | 0 | −1 |

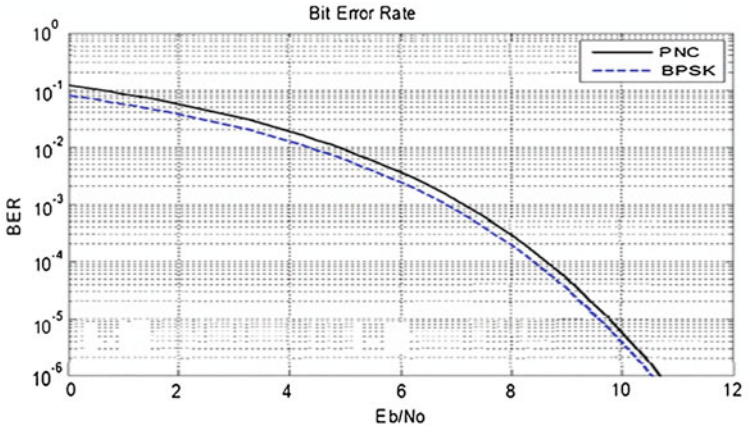


**Fig. 72.3** BER of PNC and traditional transmission schemes

some algebraic manipulations, the optimal values of $\alpha_1$ and $\alpha_2$ are derived, respectively, as

$$\alpha_1 = -1 - \frac{N_o}{4}\ln\left(1 + \sqrt{1 - \exp - \left(\frac{8}{N_o}\right)}\right) \tag{72.4}$$

$$\alpha_2 = 1 + \frac{N_o}{4}\ln\left(1 + \sqrt{1 - \exp - \left(\frac{8}{N_0}\right)}\right) \tag{72.5}$$

In Fig. 72.3, we show the BER of both the PNC and traditional transmission schemes under various values of the signal-to-noise ratio (SNR). The figure shows that the BER of PNC scheme is slightly worse than that of the traditional transmission scheme. However, even though the BER gets worse under PNC, as will be shown and illustrated in the following section, the PNC technique is expected to improve the performance of the system in terms of the overall end-to-end flow throughput by reducing the number of transmissions needed to successfully send packets along the end-to-end flow.

## 72.3 Unidirectional Flow Throughputs

In this section, we evaluated the end-to-end process sides of the traditional and PNC transmission projects in the one-way flow. Consider a one-way linear network has $n$ node. Nodes have been dubbed the node 1, 2 nodes, Node $n$ where nodes 1 and node $n$ is source node and goal node, respectively. We assume that the source node has infinite bag, need to send to the target node. We also call the success of the packet destination when all received one received correctly, any error packet is to transmit and again, until it is correct to receive. This is based on per-link to complete.

### *72.3.1 Traditional Transmission Scheme*

The flow of packets in the traditional transmission scheme when $n = 5$ nodes is illustrated in Fig. 72.4. Assuming that the packet success probability over a link is $p_c$ and that a packet is to be resent repeatedly until it is delivered successfully, the average number of needed transmissions until a packet is successfully delivered is $1/p_c$. The average transmission time over a link is then $L/(p_c \times C)$, where $C$ is the capacity of the wireless link and $L$ is the length of the packet. Throughout this work, we assume that each packet transmission occurs in one time slot, and hence the length of a time slot is $L/(p_c \times C)$.

Now in order to avoid interference, under the traditional transmission scheme (as shown in Fig. 72.4), node 1 cannot transmit concurrently with node 3. But when

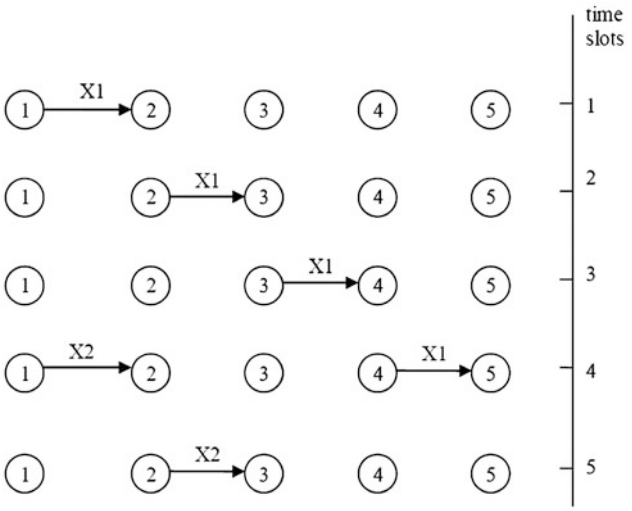


**Fig. 72.4** Unidirectional traditional transmission in a linear network

node 4 starts forwarding packet $i$, node 1 can then transmit packet $i + 1$ concurrently with node 4's transmission. This leads to a packet reception rate at the destination node of one packet every three time slots, resulting in a long-term average achievable end-to-end flow throughput of where $p_c^t$ is the packet success rate over a link when the traditional scheme is used. For a packet of length $L$ bits, the packet success rate $p_c^t$ is $\left(1 - p_e^t\right)^L$ where $p_e^t$ is the BER under the traditional scheme.

$$\mathrm{Th}_i = \frac{1}{3} p_c^t C \tag{72.6}$$

### 72.3.2 PNC Transmission Scheme

PNC one-way transmission scheme Fig. 72.5 shows. In this case, the node 1 and 3 can also send node, as the preceding section, the nodes 2 will enforce the recovery package to node PNC book 1, there is even the signal from node 3/interference. Also, even if the experienced PNC under the plan because of concurrent transmission degradation (see chart 4), performance gain PNC transmission scheme, the traditional approach because it requires less than the number of transmission of traditional plan is really successfully delivered a bag. As shown in Fig. 72.5, the concurrent transmissions lead to a packet reception rate at the destination of one packet every two time slots, resulting in a long-term average throughput of where $p_c^{\mathrm{PNC}}$ is the packet success rate over a link when the PNC scheme is used. For a packet of length $L$ bits, the packet success rate $p_c^{\mathrm{PNC}}$ is $\left(1 - p_e^{\mathrm{PNC}}\right)^L$, where $p_e^{\mathrm{PNC}} = \mathrm{BER}_{\mathrm{PNC}}$ is the BER under the PNC scheme, and is given by Eq. (72.3).

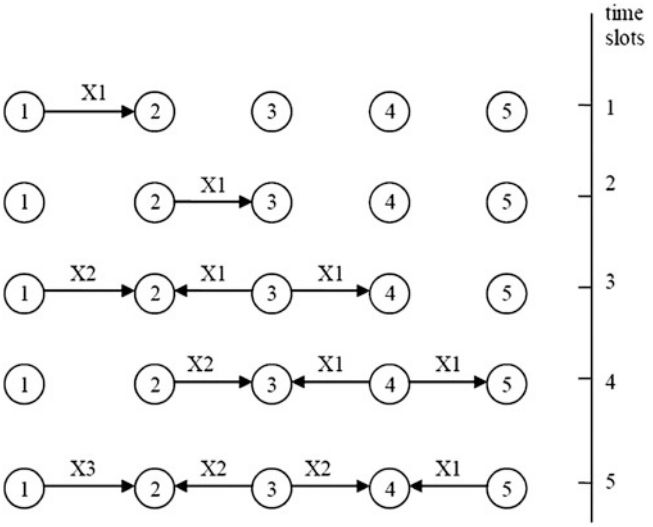


**Fig. 72.5** Unidirectional PNC transmission in a linear network

$$\mathrm{Th}_{\mathrm{PNC}} = \frac{1}{2} p_c^{\mathrm{PNC}} C \tag{72.7}$$

## 72.4 Conclusion

In this paper, we study the transmission scheme, compare the PNC performance and traditional way to consider a one-way end-to-end process generally to explain, we consider five nodes in a one-way flow, each node is equipped with an omni-directional antenna. Wireless communication channel hypothesis is half duplex operation, this means that transmission and receiving must occur in different period. In addition, we think the decode-and-forward relaying method in this work.

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# Chapter 73
# Performance Analysis of Mobile Communication in Picocell and Femtocell

**Lili Tang**

**Abstract** In this paper, we considered only the two low layers of the hierarchical cellular network i.e. picocell and femtocell. Mobile subscribers are divided into two classes, with low mobility and high mobility. Femtocells are used to address the originating and handoff calls of both slow and fast mobile subscriber. Picocells are overlaid over the femtocells and used to serve originating and handoff calls for slow and fast mobile subscribers. Furthermore, blocking probability of picocell and femtocell decreases when the number of channels is increased. It is shown that this scheme can provide better quality of service to both slow and fast mobile subscribers, maintaining the total spectrum bandwidth constant.

**Keywords** Mobile communication · Picocell · Femtocell · Handoff scheme

## 73.1 Introduction

Mobile Communication is widely established throughout the world and has a very rapid expansion of the number of subscribers to the various cellular networks, over the past few years [1–3]. Increasing demand and the poor quality of existing services motivated mobile service providers for doing research in this field in order to improve the quality of service and to support more users in their system. Efficient use of required frequencies was needed for mobile cellular coverage. Further, present cellular system is required to have rural and urban regions division according to specific provisions included in the guidelines.

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Deployment parameters, such as amount of cell splitting and cell sizes, are determined by cellular system architecture [4]. Splitting cells into smaller cells can reduce the frequency reuse distance to improve network capacity within a certain area. However, besides increasing the cost of the fixed infrastructure, cell splitting also causes the problems of increasing handoff rate and even the handoff failure rate when high speed users roam in the network [5]. To meet this problem, larger cells are overlaid on the smaller cells to provide service to different classes of users (usually classified by speed) and are assigned to the proper types of cells (i.e. proper tiers). We call this kind of cellular network a Hierarchical Cellular Network (HCN) [6]. In HCN, mobile users with different mobility are assigned different tiers. The upper most satellite network covers a much larger area. The main four layers in HCN are: macrocell; microcell; picocell; and femtocell.

## 73.2 Model Description

The available spectrum of bandwidth is to be shared optimally between the femtocell layer and picocell layer. Total spectrum bandwidth is $W$ (Total no. of traffic channels available for the system) [7]. $W_F$ bandwidth is allocated to femtocell layer, and $W_P$ bandwidth is allocated to picocell layer. Thus, $W = W_P + W_F$

Frequency reuse factors of cells in femtocell and picocell layers are denoted by $K_F$ and $K_P$, respectively. Therefore, we have, $W = W_P + W_F = C_P K_P + C_F K_F$

The arrival rate of originating traffic to the area $\Omega$ covered by femtocell, is denoted by $\lambda_0$. Originating traffic is generated by slow mobile station in the area $\Omega$ according to a Poisson process with parameter $\lambda_{s0F}$ and originating traffic generated by fast mobile station is also assumed to be Poisson process with parameter $\lambda_{f0F}$. Hence we have, $\lambda_0 = \lambda_{s0F} + \lambda_{f0F}$

Furthermore, it is assumed that the call duration (call holding time) of calls of mobile subscribers obey a negative exponential distribution with parameter $\mu$. The call duration is the time for which a call will continue if it is not forced into termination.

We assume that the cell dwell time of mobile subscribers is a random variable that has a negative exponential probability density function (pdf). For picocell, the parameter of the exponential pdfs for fast and slow mobile station are denoted by $\eta_{fP}$ and $\eta_{sP}$, respectively. For femtocell, $\eta_{fF}$ and $\eta_{sF}$ are denoted by fast and slow mobile station, respectively.

## 73.3 Performance Analysis

The whole service area of the system is covered by both femtocell and picocell seamlessly [8, 9]. The model assumes a uniform density of users through out the area and also assumes that a user is equally likely to move in any direction with respect to the same boundary. For a two dimensional model, we know that the

outgoing rate $\eta$ of the mobile user is given by $\eta = \frac{VL}{\pi A}$ Where $L$ is the length of the parameter of a cell and $A$ is the area of the cell. In this paper, we assume that the cells are in circles with radius $R$; hence, we can write the outgoing rate $\eta = \frac{2V}{\pi R}$.

Using the fluid flow mobility model, the outgoing rate of fast and slow mobile subscribers from a picocell can be derived as follows, assuming that the cells are circles with radius $R_P$.

$$\eta_{\mathrm{fP}} = \frac{2V_f}{\pi R_P}, \quad \eta_{\mathrm{sP}} = \frac{2V_s}{\pi R_P} \tag{73.1}$$

where, $V_f$ and $V_s$ are the average speed of fast and slow mobile subscribers, respectively. We define $P_{\mathrm{hsP}}$ and $P_{\mathrm{hfP}}$ as the probabilities of slow and fast mobile subscribers going out of the current picocell without completing their sessions, respectively [10], we have

$$P_{\mathrm{hsP}} = \frac{\eta_{\mathrm{sP}}}{\mu + \eta_{\mathrm{sP}}}, \quad P_{\mathrm{hfP}} = \frac{\eta_{\mathrm{fP}}}{\mu + \eta_{\mathrm{fP}}} \tag{73.2}$$

It should be noted that $P_{\mathrm{hsP}}$ and $P_{\mathrm{hfP}}$ are not the handoff request probabilities, but the probability of a mobile station's leaving the coverage area of the overlaying picocell (including the case that it is using a channel in a femtocell covered by the picocell).

Similarly for femtocell, we have.

$$\eta_{\mathrm{fF}} = \frac{2V_f}{\pi R_F}, \quad \eta_{\mathrm{sF}} = \frac{2V_s}{\pi R_F} \tag{73.3}$$

where $R_F$ is the radius of femtocell. The probabilities of slow and fast mobile stations going out of the current. Femtocells without completing their calls are

$$P_{\mathrm{hsF}} = \frac{\eta_{\mathrm{sF}}}{\mu + \eta_{\mathrm{sF}}}, \quad P_{\mathrm{hfF}} = \frac{\eta_{\mathrm{fF}}}{\mu + \eta_{\mathrm{fF}}} \tag{73.4}$$

The average session duration (average channel occupancy duration) of slow and fast mobile station in a femtocell are given by

$$\frac{1}{\mu_{\mathrm{sF}}} = \frac{1}{\mu + \eta_{\mathrm{sF}}}, \quad \frac{1}{\mu_{\mathrm{fF}}} = \frac{1}{\mu + \eta_{\mathrm{fF}}} \tag{73.5}$$

Similarly for picocell, the average session duration of slow and fast mobile station are

$$\frac{1}{\mu_{\mathrm{sP}}} = \frac{1}{\mu + \eta_{\mathrm{sP}}}, \quad \frac{1}{\mu_{\mathrm{fP}}} = \frac{1}{\mu + \eta_{\mathrm{fP}}} \tag{73.6}$$

In order to calculate the average session duration of slow and fast mobile station, we define $P_{0\mathrm{p}}$ as the conditional probability of mobile station's going out the coverage area of the current picocell given that it goes out of the coverage area of a femtocell.

That is, for a mobile station, if it goes out of the current femtocell, it will go into the area covered by neighboring picocells with probability $P_{0P}$, it will go into another femtocell covered by the current femtocell with probability 1-$P_{0P}$. Then the average session duration of the slow mobile station in a picocell can be given as

$$\frac{1}{\mu_{sP}} = \frac{1}{\mu + \eta_{sF}P_{aP} + \eta_{sF}(1 - P_{aP}(1 - P_{bF})} = \frac{1}{\mu + \eta_{sF}[1 - (1 - P_{aP})P_{bF})} \tag{73.7}$$

where $P_{bF}$ is the blocking probability of the originating calls in femtocells. From Eq. (73.7), we can see that a call of a slow mobile subscriber being served by a picocell releases its channel under one of the following three circumstances:

call completion;
comes out of the coverage area of the current picocell;
comes out of the coverage area of the current femtocell, and is taken back to an adjacent target femtocell without leaving the coverage area of the current picocell, that is, the call is taken back successfully from picocell layer to femtocell layer.

Further, from Eqs. (73.4) and (73.7), we have

$$\mu_{sP} = \mu + \eta_{sF}[1 - (1 - P_{0P})P_{bF}] = \frac{\eta_{sF}[1 - (1 - P_{0P})P_{bF}P_{hsF}]}{P_{hsF}} \tag{73.8}$$

Similarly, the average session duration of a fast mobile subscribers in a picocell is

$$\frac{1}{\mu_{fP}} = \frac{1}{\mu + \eta_{fF}P_{aP} + \eta_{fF}(1 - P_{aP}(1 - P_{bF})} = \frac{1}{\mu + \eta_{fF}[1 - (1 - P_{aP})P_{bF}]} \tag{73.9}$$

From Eqs. (73.4) and (73.9), we have

$$\mu_{fP} = \mu + \eta_{fF}[1 - (1 - P_{0P})P_{bF}] = \frac{\eta_{fF}[1 - (1 - P_{0P})P_{bF}P_{hfF}]}{P_{hfF}} \tag{73.10}$$

Moreover, we can obtain $P_{0P}$. The probability $P_{hsP}$ defined in Eq. (73.1) can be obtain as follows:

$$P_{hsP} = \sum_{i=0}^{\infty} P_{hsF}P_{0P}[P_{hsF}(1 - P_{0P})] = \frac{P_{hsF}P_{0P}}{1 - P_{hsF}(1 - P_{0P})} \tag{73.11}$$

We can obtain, $P_{0p}$ using Eqs. (73.1), (73.2), (73.3), (73.4), and (73.11) as

$$P_{0P} = \frac{\eta_{sP}}{\eta_{sF}} = \frac{R_F}{R_P} = \frac{\eta_{fP}}{\eta_{fF}} \tag{73.12}$$

In order to obtain the performance measures of the fast and slow mobile station, we have to consider four motivate traffics with the following rate:

$\lambda_{sF}$ Arrival rate into a femtocell due to slow mobile stations
$\lambda_{sP}$ Arrival rate into a picocell due to slow mobile stations

$\lambda_{sF}$ Arrival rate into a femtocell due to fast mobile stations
$\lambda_{fP}$ Arrival rate into a picocell due to fast mobile stations

Again, we assume that the above processes are Poisson. Note that the probability of handoff failure is the same as that of blocking of originating calls, since no priority is given to handoff traffic. Using Erlang loss formula.

We can obtain $P_{bF}$ and $P_{bP}$ as follows:

$$P_{hsF}[(1-P_{bF})P_{FTSF}+P_{bF}(1-P_{bP})P_{FTSP}+P_{bF}P_{bP}]P_{bF}=\frac{\frac{(\frac{\lambda_{sF}}{\mu_{sF}}+\frac{\lambda_{fF}}{\mu_{fF}})^{C_F}}{C_F!}}{\frac{\sum_{i=0}^{C_F}(\frac{\lambda_{sF}}{\mu_{sF}}+\frac{\lambda_{fF}}{\mu_{fF}})^{l}}{l!}} \quad (73.13)$$

$$P_{bP}=\frac{\frac{(\frac{\lambda_{sP}}{\mu_{sP}}+\frac{\lambda_{fP}}{\mu_{fP}})^{C_P}}{C_P!}}{\frac{\sum_{i=0}^{C_P}(\frac{\lambda_{sP}}{\mu_{sP}}+\frac{\lambda_{fP}}{\mu_{fP}})^{l}}{l!}} \quad (73.14)$$

Where, $P_{bF}$ and $P_{bp}$ are the blocking probabilities for slow and fast mobile subscribers of pico and femtocell.

## 73.4 Numerical Results and Discussions

The total arrival rate of originating traffic is $\lambda_0$ which is covered by a femtocell and the fraction $\lambda_s/\mu_s=\rho_s$ of this traffic for slow mobile subscribers. $\rho_s$ is set to be 0.5. We assume that total bandwidth $W$ of the system to be constant. Radius of femtocell $(R_F)=20$ m. Radius of picocell $(R_P)=200$ m. Average speed of slow mobile subscribers is assumed to be velocity of slow femtocell $(V_{SF})=0.5$ m/s, Velocity of fast femtocell $(V_{fF})=1$ m/s. Velocity of slow picocell $(V_{sP})=1$ m/s, Velocity of fast picocell $(V_{fP})=2$ m/s, Originating arrival rate of slow femtocell mobile subscribers are $\lambda_{sOF}=0.01$ calls/s. Originating arrival rate of fast femtocell mobile subscribers are $\lambda_{fOF}=0.1$ calls/s. Originating arrival rate of slow picocell mobile subscribers are $\lambda_{SOP}=0.1$ calls/s. Originating arrival rate of fast picocell mobile subscribers are $\lambda_{fOP}=1$ calls/s.

### *73.4.1 Blocking Probability of Picocell*

Figure 73.1 shows blocking probability of picocell with different arrival rate and service rate of slow and fast mobile subscribers. We observe that when numbers of channels of picocell $(C_P)$ are increased, blocking probability of picocell is decreased.

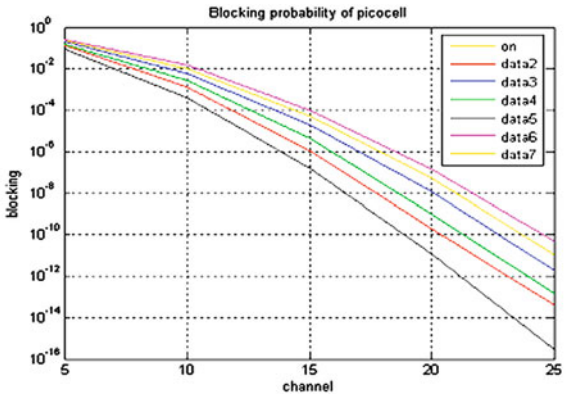


**Fig. 73.1** Blocking probability of picocell

### *73.4.2 Blocking Probability of Femtocells*

Figure 73.2 shows blocking probability of femtocell with different arrival rate and different service rate of slow and fast mobile subscribers. We conclude that when the number of channels of femtocell ($C_F$) are increased, the blocking probability of femtocell is decreased.

### *73.4.3 Force Termination of Blocking Probability*

Increasing number of femto Channels for constant number of pico Channels.

In Fig. 73.3, shows force termination probability of a picocell for slow and fast mobile subscribers and having five channels, which have blocking probability 0.0049. When we put number of femto channels, it is obtained that force termination probability is decreased.

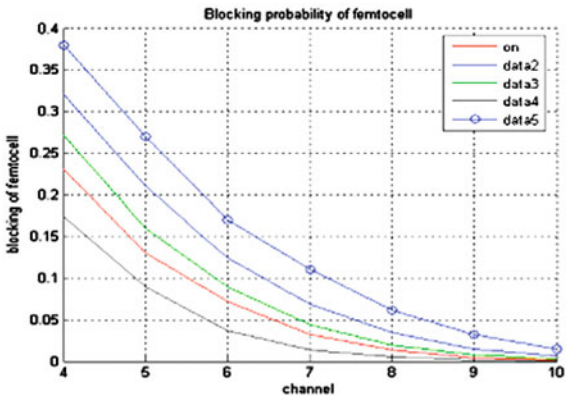


**Fig. 73.2** Blocking probability of femtocell

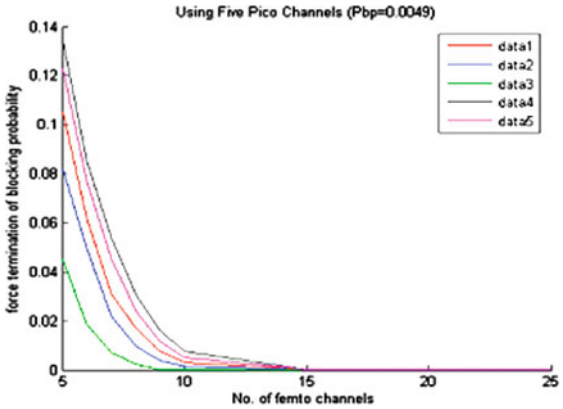


**Fig. 73.3** Using five pico channels

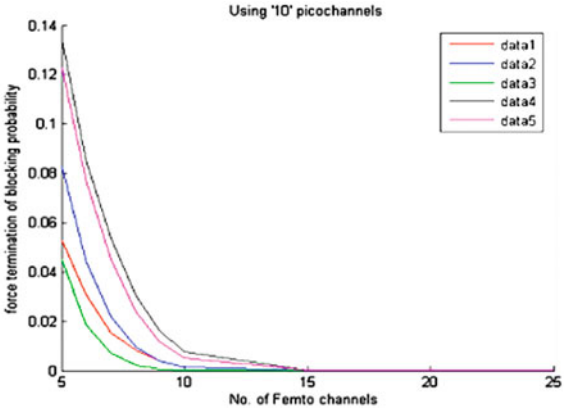


**Fig. 73.4** Using 10 pico channels

Figure 73.4 shows force termination probability of picocell with slow and fast mobile subscribers. On adding ten pico channels, blocking probability reduced to $2.37 \times 10^{-7}$. Further, as femto channels are increased, it is observed that force termination probability decreased.

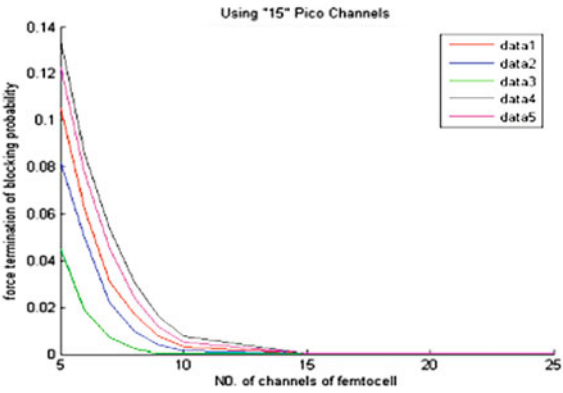


**Fig. 73.5** Using 15 pico channels

Figure 73.5, shows force termination probability at picocell for slow and fast mobile subscribers, when 15 pico channels are added to the system. Blocking probability due to these femto channels reduced to $1 \times 10^{-12.}$

## 73.5 Conclusion

In this paper, Mobile subscribers are divided into two classes: low and high mobility subscribers. Femtocells are used to address the originating and handoff calls both slow and fast mobile subscribers. Picocells are overlaid over the femtocells to handle overflow originating and handoff calls of both slow and fast mobile subscribers. An analytical model is developed. We considered HCN model consisting of femtocells and picocells and analytically evaluated the most important performance measures such as the blocking probability of originating calls and the forced termination probability of ongoing calls.

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# Chapter 74
# A Network Connectivity Preventing Disruption Algorithm Based on Agents

**Lin Yang**

**Abstract** In the present study, a network of mobile agents moved in response to external commands to perform a data-gathering task, and a group of controlled agents prevented disruption of the connectivity of the communication network. HOSM observers reconstructed the external commands to the mobile agents, from which positions of the agents were predicted and calculated within a given time window. Pairs of agents which were predicted to move beyond the maximum effective interaction range were then identified, and trajectories from the positions of the controlled agents to the midpoints of these pairs were generated.

**Keywords** Network connectivity · Preventing disruption · Agent · HOSM

## 74.1 Introduction

Systems of multiple agents that perform cooperative tasks have many military and civilian applications, including surveillance, reconnaissance, sensing, and gaming, and thus have been the subject of much recent research (for reviews, see [1, 2]). In typical scenarios, a group of agents investigates a phenomenon of interest, with individual agents performing a primary data-gathering task while also meeting other requirements for network coordination. In networks of mobile agents, coordination is often achieved by constraining the agents' movement: they may have to follow a leader (real or virtual; e.g., [3, 4]), maintain a specified group formation [5, 6], or maintain a certain distance from (or move at the same velocity as) other agents. In such networks, each agent gathers its data and ensures network coordination by adapting its movements to meet the system's goal.

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## 74.2 Preliminaries

The present communication network consists of $n$ uncontrolled agents (UAs) moving on a plane $\ominus^2$. The network configuration is described by an undirected graph $G_n : (V_n, \Omega_n)$ consisting of a set of vertices $V_n : \{1,,2,\ldots, n\}$ corresponding to $n$ agents and a set of edges $\Omega_n \subseteq \{(i,j) : i,j \subset V_n, i \neq j\}$, representing potential communication links between the agents, that is a subset of $V_n \times V_n$. (At most, the set of edges could coincide with the whole set $V_n \times V_n$.)

The measured position of each uncontrolled agent is denoted as $q_i \in \ominus^2$, and the $i$th agent's dynamics are described by

$$\begin{aligned} \dot{q}_i &= p_i \\ \dot{p}_i &= f_i(t) \end{aligned} \tag{74.1}$$

where $i \in V_n$, and $f_i(t) \in \ominus^2$ is a smooth and bounded unknown vector field.

*Remark 1* Equation (74.1) describes the motion of agents that perform a task (for instance, data gathering) without necessarily considering preservation of network connectivity.

*Remark 2* The functions $f_i(t)$ are generated in order to fulfill the data-gathering task and are assumed to be unknown by the controller that maintains the d-connectivity of the communication network.

The interaction range between agents $i$ and $j$ from the set $\Omega_n$ is defined as the distance

$$\left\|q_i - q_j\right\| = r_{ij} > 0, \quad r_{ij} = r_{ji} \tag{74.2}$$

**Definition 1** The undirected graph $G_n : (V_n, \Omega_n)$ is said to be d-connected if $r_{ij} \leq d, \forall i,j : (i,j) \in \Omega_n$, where $d > 0$ is a given constant that characterizes the maximum effective interaction range within which communication between agents can occur. If the graph $G_n$ is d-connected, the network is connected. If $r_{ij} > d$ for at least one edge $(i,j) \in \Omega_n$, the graph is said to be d-disconnected, and the network is disconnected.

A graph that is d-connected graph (and has no cycles) is a tree; further, it is a spanning tree, because it includes every vertex.

The UAs' motion in accordance with Eq. (74.1) could result in a violation of the constraint $r_{ij} \leq d$ for some $(i,j) \in \Omega_n$ at some time instant $t = t^*$. In this case, the edge $(i, j)$ $j$ is said to be cut and the graph $G_n : (V_n, \Omega_n)$ loses d-connectivity. The communication network becomes disconnected and therefore nonoperational.

## 74.3 Maintaining Network Connectivity

We assume that $q_i$ in Eq. (74.1) are known in current time. Using HOSM observers, the unknown vector fields $f_i(t)$ can be reconstructed and $p_i(t)$ can be exactly estimated, as described in Sect. 74.5. For any edge $(i,j) \in \Omega_n$, it is then possible to predict the positions of its vertices $q_i$ and $q_j$ and the distance $r_{ij} = \left\|q_i - q_j\right\|$ at any time instant on a given time interval $t \in [t_0, t_0 + T]$, where $T$ reflects the size of a prediction time window and $t_0$ denotes the current time instant. If the length $r_{kl}$ of some edge $(k, l)$ is predicted to exceed $d$ at time $\tau \in [t_0, t_0 + T]$, the edge is predicted to be cut on the given time interval, resulting in the disruption of the network. A controlled agent (CA) is dispatched to arrive at the midpoint of the predicted cut edge by time $\tau$ in order to prevent the network disruption.

### *74.3.1 Prediction of Loss of D-Connectivity*

The edges and time at which d-connectivity will be lost must be predicted in order to properly generate the commands for the CAs to follow.

The current time instant $t = t_0$ is fixed. Virtual time increases from 0 to $T$ by small simulation steps. $\Delta T \ll T$. The following algorithm steps are repeated in sequence on each $T/\triangle T$ simulation step. If the entire virtual time interval [0, $T$] is processed without prediction of loss of connectivity, we let the real time reach $t = t_0 + \Delta T$, and the algorithm is rerun. If a disruption is predicted within [0, $T$], a CA is introduced (as described in the following subsection), its trajectory is defined, the graph is updated, and the algorithm is reinitialized once the real time reaches $t = t_0 + \Delta T$ in both cases, $t_0$ is redefined as $t_0 + \Delta T$

The algorithm is accomplished in the following sequence of steps.

Step 1 A distance matrix $R = [r_{ij}]$ is calculated, with $r_{ij}$ as defined in (74.2).

Step 2 Entries of the distance matrix are compared with $d$ and an adjacency matrix $A = [a_{ij}]$ is calculated in turn, with

$$a_{ij} = \begin{cases} 0, \text{if } r_{ij} > d \text{ or } i = j \\ 1, \text{if } r_{ij} \leq d \end{cases} \tag{74.3}$$

Step 3 A degree matrix $\Delta$ is calculated as a diagonal matrix with the row sums of the adjacency matrix on the main diagonal.

Step 4 A Laplacian matrixes $L$ is constructed as $L = \Delta - A$ and its first cofactor are calculated. By Kirchhoff's matrix tree theorem, the value of any cofactor of the Laplacian matrix is equal to the number of spanning trees of the graph. Therefore, a zero cofactor indicates one or more cut edges and the loss of d-connectivity of the corresponding graph. Steps 5 and 6 below are to be executed only if loss of network connectivity is predicted in Step 4.

Steps 5 and 6 below are to be executed only if loss of network connectivity is predicted in Step 4.

Step 5 since d-connectivity of the graph is checked in Step 4 at each simulation step, the instant $t_l \in [0, T]$ of its loss can be identified. The adjacency matrix computed in Step 2 at time $t_1$ is subtracted from the adjacency matrix obtained at the previous simulation step. Nonzero entries in the resulting matrix reflect pair(s) of vertices $k$ and $l$ which have moved apart such that $r_{kl} > d$, resulting in a predicted cut edge. The zero cofactor indicates that these movements have d-disconnected the graph.

Step 6 Eq. (74.1) is solved using current (measured) position $q_i(t_0) = q_{io}$ and current (estimated) velocity $p_i(t_0) = p_{io}$ and acceleration $f_i(t_0) = f_{io}$ (assuming the acceleration will not change on the time interval $[t_0, t_0 + t_1]$ for all agents belonging to the predicted cut edge(s):

$$\begin{aligned} q_i(t_0) &= q_{io} + p_{io}t + \frac{f_{io}}{2}t^2 \\ p_i(t_0) &= p_{io} + f_{io}t \end{aligned} \tag{74.4}$$

Equation (74.4) is evaluated at $t = t_1$ to find the positions and velocities of the agents.

*Remark 3* It is assumed that if the disruption of the network is predicted on the time interval $[t_0, t_0 + T]$ then this event will definitely happen during this time interval.

### 74.3.2 Introduction of a Controlled Agent

As soon as $r_{kl} > d$ is predicted, we introduce a controlled agent (CA) moving on the same plane $\ominus^2$ which will be driven to the midpoint $z_{kl} = \frac{q_k + q_l}{2}$ of the predicted cut edge ($k$, $l$) by time $t = t_0 + t_1$ in order to maintain network connectivity. The position of the CA is denoted as $w_{n+1} \in \ominus^2$. The initial position of the first CA (and all others) is the geometric center of the graph (COG) $G_n : (V_n, \Omega_n)$, defined as:

$$\bar{q}(t) = \frac{1}{N}\sum_{I=1}^{N} q_i(t) \in \ominus^2 \tag{74.5}$$

where $N = n + m$ is the total number of vertices of the graph, with n the number of UAs and $m$ the number of introduced CAs? All nonintroduced CAs are assumed to exactly follow (by means of control) the COG (calculated in real time) as it changes due to the motion of the UAs.

The dynamics of the $(n + 1)th$ agent, the first CA with position $w$, are described by

$$\begin{aligned}\dot{w}_{n+1} &= g_{n+1} \\ \dot{g}_{n+1} &= u_{n+1} + \varphi_{n+1}(w_{n+1}, g_{n+1}, t)\end{aligned} \tag{74.6}$$

where $u_{n+1} \in \ominus^2$ is a vector control function and $\varphi_{n+1}(W_{n+1}, g_{n+1}, t) \in \ominus^2$ is an unknown vector disturbance with a known boundary, i.e., $\left\|\varphi_{n+1}(W_{n+1}, g_{n+1}, t)\right\| \leq C_{n+1} > 0$ The graph $G_n : (V_n, \Omega_n)$ becomes $G_{n+1} : (V_{n+1}, \Omega_{n+1})$, consisting of a new set of vertices $V_{n+1} : \{1, 2, \ldots\ldots, n, n+1\}$ that correspond to $n+1$ agents ($n$ existing UAs and one introduced CA), with the point $z_{kl}$ becoming the new vertex $n+1$. A new set of edges $\Omega_{n+1} \subseteq \{(i,j) : i,j \subset V_{n+1}, i \neq j\}$ is a subset of $V_{n+1} \times V_{n+1}$ (At most the set of edges could coincide with the whole set $V_{n+1} \times V_{n+1}$ the predicted or phantom graph (which does not yet exist in reality) $G_{n+1}$ is d-connected.

*Remark 4* It should be noted that two new edges $(k, n+1) \in \Omega_{n+1}$ and $(1, n+1) \in \Omega_{n+1}$ are introduced into the phantom graph $G_{n+1}$ in place of the predicted cut edge ($k$, $l$), which is eliminated from $\Omega_{n+1}$

### *74.3.3 Trajectory Generation for the CA*

A commanded trajectory $w_{(n+1)C}(t)$ that connects the initial position of the CA (coinciding with the COG) and the position $z_{kl}$, the destination point for the UA, to be reached by $t = t_0 + t_1$, is constructed by finding vector coefficients $a_0, a_1, a_2$, and $a_3$ of the cubic polynomial

$$w_{(n+1)C}(t) = a_0 + a_1 t + a_2 t^2 + a_3 t^3 \tag{74.7}$$

Such that

$$\begin{bmatrix} w_{(n+1)C}(t_0) \\ \dot{w}_{(n+1)C}(t_0) \\ w_{(n+1)C}(t_0 + t_1) \\ \dot{w}_{(n+1)C}(t_0 + t_1) \end{bmatrix} = \begin{bmatrix} \bar{q}(t_0) \\ \bar{p}(t_0) \\ \frac{q_k(t_0+t_1)+q_l(t_0+t_1)}{2} \\ \frac{p_k(t_0+t_1)+p_l(t_0+t_1)}{2} \end{bmatrix} \tag{74.8}$$

where $\bar{q}(t_0)$ and $\bar{p}(t_0)$ denote the position and velocity of the COG. Position is directly calculated using Eq. (74.5), while calculation of velocity requires using $p_i(t_0)$in place of $q_i(t_0)$ in Eq. (74.5).

## 74.4 Controllability of the Mobile Communication Network

The plant under consideration consists of a dynamic uncontrolled network of UAs and a dynamic network of CAs. The dynamics of the UAs in Eq. (74.1) and the unperturbed CAs in Eq. (74.6) can be generalized as follows:

$$\dot{x} = Ax + Df(t) \tag{74.9}$$

$$\dot{\zeta} = H\zeta + Bu \tag{74.10}$$

$$y = P(x, \zeta) \tag{74.11}$$

where $x \in \ominus^{4n}$ is the state vector of UAs, with $n$ the number of UAs, $\zeta \in \ominus^{4n}$ is the state vector of CAs, with $m$ the number of CAs, $f(t)$ is the bounded vector of command inputs, $u$ is a control function, and $y \in \ominus^{K}$ is the output vector that characterizes the interaction range between agents $i$ and $j$ from the set $\Omega_n$, as in Eq. (74.2). System (74.10) is assumed to be completely controllable. Apparently, system (74.9) is uncontrollable.

**Definition 2** Network Eqs. (74.9)–(74.11) is said to be completely controllable on a time interval $[t_0, t_0 + T]$ if for any two points $\zeta_1, \zeta_2 \in \ominus^{m}$ there exists a piecewise continuous control function $u$ such that the trajectories of system Eqs. (74.9)–(74.11) satisfy $\zeta(0) = \zeta_1$, $\zeta(\tau) = \zeta_2$ for the time instance $t = \tau$, where $\tau \leq t_0 + T$ is the predicted time of loss of connectivity.

*Remark 6* The value $\zeta_2$ is supposed to be located in the center of the edge whose length is predicted to be larger than $d$.

## 74.5 Control Strategy

The formulated problem of maintaining d-connectivity of the network using controlled agents is reduced to generating the paths Eqs. (74.7) and (74.8) for the CAs to follow. All CAs are to be located initially in the geometric center of the graph, defined by Eq. (74.5). By means of HOSM control, they are driven to follow the position of the COG as the UAs are moving, forced by partially known (or completely unknown) functions $f_i(t)$. The functions $f_i(t)$ are exactly reconstructed (assuming that the position $q_i \in \ominus^2$ of the $i$th UA is measured) using HOSM disturbance observers that are designed for (74.1) as follows:

$$\begin{aligned}
\dot{z}_{0ij} &= v_{0ij} \\
v_{0ij} &= -3\tilde{L}_{ij}^{1/3}\left|z_{0ij} - q_{ij}\right|^{2/3} sign(z_{0ij} - q_{ij}) + z_{1ij} \\
\dot{z}_{1ij} &= v_{1ij} \\
v_{1ij} &= -1.5\tilde{L}_{ij}^{1/2}\left|z_{1ij} - v_{0ij}\right|^{1/2} sign(z_{1ij} - v_{0ij}) + z_{2ij} \\
\dot{z}_{2ij} &= -1.1\tilde{L}_{ij}\, sign(z_{2ij} - v_{1ij})
\end{aligned} \tag{74.12}$$

where $z_{0ij} \to q_{ij}$, $z_{1ij} \to p_{ij}$, $z_{2ij} \to f_{ij}(t)$, $j = 1, 2$ in finite time and $\left|\dot{f}_{ij}(t)\right| \leq \tilde{L}_{ij}$

Instantaneous accelerations $f_i(t)$ are reconstructed at the current time instant $t_0$ and are used to evaluate the predicted positions of vertices corresponding to the predicted cut edge, as in Eq. (74.4).

At this same moment, the introduced CA starts moving from its initial location (the COG) to destination point along the path calculated in Eqs. (74.7) and (74.8). The control function $u_{n+1} \in \ominus^2$ that enforces this motion is designed in the format of quasi-continuous second order sliding mode control to provide finite time convergence in the presence of the unknown but bounded disturbance $\varphi_{n+1}(w_{n+1}, g_{n+1}, t)$. The sliding variables are introduced:

$$\sigma_{(n+1)j} = w_{(n+1)Cj} - w_{(n+1)j}, \quad j = 1, 2 \tag{74.13}$$

The sliding variable dynamics have vector-relative degree [2]:

$$\ddot{\sigma}_{(n+1)j} = \ddot{w}_{(n+1)Cj} - u_{(n+1)j} - \varphi_{(n+1)j}(w_{(n+1)}, g_{(n+1)}, t), \quad j = 1, 2 \tag{74.14}$$

The quasi-continuous second order sliding mode control functions are designed as follows:

$$u_{(n+1)j} = \alpha_{(n+1)j} \frac{\dot{\sigma}_{(n+1)j} + \beta_{(n+1)j} \left|\sigma_{(n+1)j}\right|^{1/2} sign(\sigma_{(n+1)j})}{\left|\dot{\sigma}_{(n+1)j}\right| + \beta_{(n+1)j} \left|\sigma_{(n+1)j}\right|^{1/2}}, \quad j = 1, 2 \tag{74.15}$$

where $\alpha_{(n+1)j}, \beta_{(n+1)j} \in \ominus^+$ and $\varepsilon_{(n+1)j}, \beta_{(n+1)j}$ are sufficiently large.

In order to implement the control law, the derivatives $\dot{\sigma}_{(n+1)j}$ of the sliding variables $\dot{\sigma}_{(n+1)j}$ are computed using HOSM sliding mode differentiators:

$$\begin{aligned} \dot{z}_{0(n+1)j} &= v_{0(n+1)j} \\ v_{0(n+1)j} &= -1.5\bar{L}_{(n+1)j}^{1/2} \left|z_{0(n+1)j} - \sigma_{(n+1)j}\right|^{1/2} \\ &\quad \times sign(z_{0(n+1)j} - \sigma_{(n+1)j}) + z_{1(n+1)j} \\ \dot{z}_{1(n+1)j} &= -1.1\bar{L}_{(n+1)j} \sin\, g(z_{1(n+1)j} - v_{0(n+1)j}) \end{aligned} \tag{74.16}$$

where $z_{1(n+1)j} \to \dot{\sigma}_{(n+1)j}$, $j = 1, 2$ in finite time and $\left|\dot{\sigma}_{(n+1)j}\right| \le \bar{L}_{(n+1)j}$

## 74.6 Conclusion

HOSM controllers drove the controlled agents along these trajectories in finite time, canceling out the effects of unknown bounded external disturbances. The movement of the controlled agents thus maintained an intact communication network.

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# Chapter 75
# Study of Proxy Re-cryptography in Group Key Management for Group Communications System

**Qichen Wang**

**Abstract** This paper presents a group key management mechanism PTGKM based on hierarchical and domain structure in Near-Space Network. The mechanism combines hierarchical and domain structure with the use of proxy re-cryptography algorithms. It has the following characteristics: (1) the core backbone network node cannot obtain the new group key. It only participates in the distribution of the new group key. So the mechanism solves the problem of a single point of failure of group key management based on hierarchical and domain structure; (2) The mechanism restricts the impact of group membership change in its domain, which improves the scalability of group key management scheme; (3) The inter-domain switching algorithm effectively reduces the rekeying overhead of the high mobile nodes' frequent switching between different domains; (4) The mechanism adapts to the characteristics of Near-Space Network and meets the forward security and backward security. The analysis results show that, PTGKM mechanism is applicable to near space environment and has good scalability and reliability.

**Keywords** Group key management · Proxy re cryptography · Security

## 75.1 Introduction

The Near-Space Network is a new space area which is about 20–100 km and between aviation and spaceflight. There are potential applications for Communication Guarantee, Information Collection, and Disaster Quickly Responses and it

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has be a hot research field [1–3]. The size of the Near-Space Network is very large, and resources are very limited. Group communication has been a very important application technology because of its ability to send data to a large number of users in the network in an efficient manner. However, because the Near-Space Network is in high degree of exposure, dynamic topology, heterogeneous networks, large scale and wide range, the network's security was seriously threatened [4]. The safety of the Near-Space Network is at an early stage of which the security mechanisms are not perfect. The existing group key management technologies of secure group communication system are mainly for wired networks, small wireless network, but not suitable for the characteristics of Near-Space Network. And therefore the study of group key management technology in Near-Space Network has great significance and is critical for deployment and application of security group communications system.

## 75.2 Description of Proxy Re-cryptography

The basic idea of proxy re-cryptography algorithm is that a proxy node with proxy key can convert a cipher text encrypted with a pair of keys to another cipher text encrypted with another pair of keys without the need to know the secret decryption key or the plaintext. This paper uses the unidirectional ElGamal proxy cryptography in [5], and its security is equivalent to the original ElGamal public key cryptography, which is based on the intractability of the discrete logarithm problem based on finite fields. It is described as follows:

**Definition 1** (Discrete logarithm problem based on finite fields, DL problem) given a prime number $p$ and a primitive element $g$ On $G_p$. Given $(g, g^x)$, for a certain $x \in Z^*_P$, to calculate $x$. There is an algorithm $A$ solving the discrete logarithm problem with the advantage of $\varepsilon$, if and only if

$$\Pr[A(g, g^x) = x] \geq \varepsilon \tag{75.1}$$

This probability depends on the random selection of $x$ and the output of $A$.

**Definition 2** (discrete logarithm assumption) Assume $\varepsilon$-DL is right, if and only if there is no probabilistic polynomial time for an attacker with the advantage of $\varepsilon$ to solve the DL problem.

## 75.3 Proxy-Function Tree Based Group Key Management for Near-Space Network

### *75.3.1 Group Key Management Framework*

PTGKM mechanism is a group key management mechanism based on the hierarchical and domain structure in the Near-Space Network. The ElGamal proxy re-cryptography algorithm is used in key distribution process to ensure that the rekeying message is transferred to the reliable group members when membership changes [6]. The main idea is that the next group session rekeying message is encrypted by proxy key and group key of group sessions *i*, which ensures that only the legitimate group members who own these two keys simultaneously can decrypt the rekeying message and get the updated group key. The group key management framework in PTGKM mechanism is designed as follows: Fig. 75.1.

The ground management and control center in the Near-Space network is as the group management center *S* in the whole communications system. All the DMCs at the core backbone network compose of a logical proxy-function tree, whose root is the DMC of domain that *S* is in and the middle proxy nodes are DMCs that participate in group key management. Group Management Center *S* is responsible for the group key's generation, distribution and updates. Child proxy nodes get the proxy key from its parent node in a safe way which h achieves hierarchical key distribution tree structure [7]. Group rekeying message is transferred along the path of proxy-function tree. The root proxy node use re-cryptography algorithm encrypts and sends rekeying message to its child proxy node, and then the child proxy node converts the cipher text from its parent node to another cipher text that can only be decrypted by members within its domain. In the whole update process, proxy re-cryptography algorithm is used to distribute update message to it child nodes until reaching the leaf proxy node. The sender uses the group key to encrypt communication data and sends encrypted data directly to all legitimate group

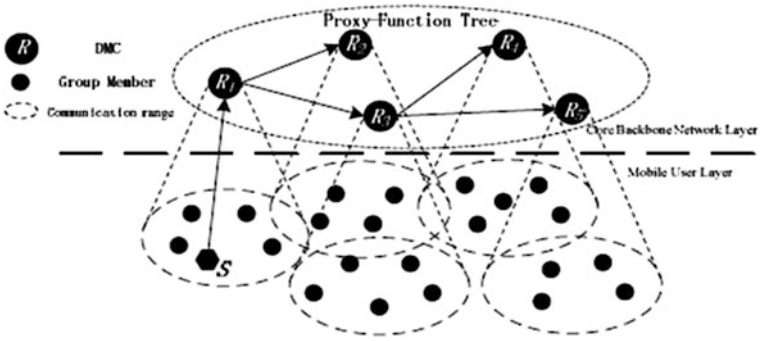


**Fig. 75.1** Framework of PTGKM

members. It should be noted that in PTGKM mechanism, the conversion process with proxy cryptographic algorithms is only used in updating the group key, while the security of communication data is guaranteed through encryption with group key.

## 75.4 Assumptions and Notations

In PTGKM mechanism, we first assume that when the core backbone network initializes, all DMC nodes are verifiable to be legitimate and the adjacent nodes have some basis of trust. Of group key distribution process, DMC nodes in the core backbone network layer is partial trusted, that is to say that the intermediate proxy nodes will use proxy cryptography in an intended way to convert the ciphertext received and forward in a right way. DMC does not participate in group communication. It only has the function of group key management and offers group key distribution services for user nodes in the mobile user layer. And we also assume that all the group rekeying messages can be authenticated. Notations are as follows:

$rk_j$: Proxy key of a proxy node $R_j$. It is shared by the proxy node $R_j$ members in its domain and its child proxy nodes. $rk_0$ Is shared by S and the root proxy node $R_0$. The use of proxy key can restrict the impact of group membership change in the domain.

$k_i$: Group key of session $i$. It is used to implement group communication among group members. $k_i$ Is shared among group members, and $y = g^{k_i} \pmod{p}$ is the public key. The middle proxy node is not a group member and cannot decrypt the cipher text.

$r_j$: Random number selected by proxy node $R_j$. It is a secret parameter selected from $Z_q$ in the process of encryption. $r_0$ is selected by S.

Give a way to use proxy re-cryptography algorithm. But the proxy node needs to know the original group key of session is in the conversion process. So it cannot maintain the independence with group session key in the distribution of the new group key, which makes it lost the original meaning to be a proxy. In this paper, PTGKM mechanism improves the use of re-cryptography algorithm. It is shown below: Fig. 75.2.

## 75.5 Group Rekeying Algorithm

When the membership of group communication system changes, group management center needs to trigger group rekeying action and form the new group session in order to meet backward security and forward security. Because of high mobility of group members in Near Space network, there are not only group members

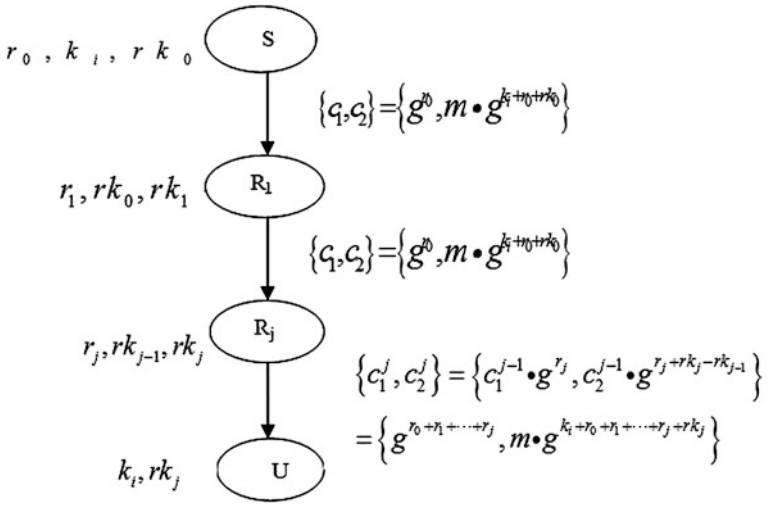


**Fig. 75.2** Employment of ElGamal proxy re-cryptograph

joining in and leaving the group communication, but also group members switch between different domains frequently and do not leave the group communication. This paper gives the rekeying algorithm for group members joining in, leaving the group, and stresses in the group rekeying process for members' switching between the domains.

Group member join: In the rekeying process for member joining, the member first sends a join request to DMC, and then DMC forward the request to the Group Management Center S. S Verifies the legitimacy of the members and changes group session and updates group key if it passes. Suppose that in the group session $i - 1$, when a member in the management domain of $R_j$ requests to join a group, after it is validated legitimately S implements the group rekeying algorithm as follows:

(a) S generates a new group key $k_i$ independent of $k_{i-1}$,
(b) S Uncases $k_i$ to the new member securely;
(c) $R_j$ Uncast $rk_i$ to the new member securely;
(d) S will use a proxy re-cryptography algorithm along the proxy-function tree to distribute $k_i$ to all the legitimate members of the group;

In the update algorithm for group member joining, the communication overhead of the update operation is two unicast messages and a broadcast message.

Group member leave: The events that group member take the initiative to leave or group management center cancels the member's qualification belongs to the leave event. The rekeying process includes proxy key update of DMC and group key update. When the event that member leaving occurs, the group session

changes and DMC $R_j$ performs the update operations. The proxy key update operation is limited to the domain that leaving member located in. Suppose that in the group session $i$, a group member in $R_j$ leaves group communication system, the implementation of group rekeying algorithm is as follows:

(a) $R_j$ First generate a new proxy key $rk'_j$ which is independent of the original proxy key $rk_j$,
(b) $R_j$ distributes securely $rk'_j$ to all group members in its domain and its child proxy node;

S generates a new group key $k_{i+1}$ independent of $k_i$, and use re-cryptography algorithm to distribute to all group members along proxy-function tree;

In the update algorithm for group member leaving, the communication overhead of the update operation is two broadcast messages.

Group member switch inter-domain: In order to reduce group rekeying overhead of group members frequently switch, this paper designs group key delayed update algorithm for member switching between domains. Only after certain conditions are met do we implement the relevant key update operation. Switch user can have multiple proxy keys of multidomains to ensure that it can reuse these keys when it returns after switch users leaved the original domain for some time.

Group Management Center S maintains a legitimate user list which contains information of all the legal group members in group communication system. Each DMC maintains a proxy key external owners list (EOL), which contains information of all the legitimate group members who have left this domain and still have the original proxy key. Suppose that in the group session $i + 1$, there is a member in $R_j$ switches to the adjacent $R_{j+1}$. Like the process of member join, after verifying the legitimacy of the switch users we implement the related operations, as follows:

(a) $R_{j+1}$ Generates a new proxy key $rk'_{j+1}$ independent of the original key $rk_{j+1}$ and distributes securely to all group members (including the switch user) and its child proxy node;
(b) $R_{j+1}$ Adds the information of switch user to EOL, rather than implements proxy key update action;

It does not need to update the current group session key in the whole process. Group communication system must regularly implement update of group key and proxy key, which prevents switch users from getting all proxy keys through interdomain switch. And when the records of EOL maintained by DMC are more than a certain amount, the DMC must implement its proxy key update operation.

Notation: If the members in this kind leave the group communication, not only we implement member leave rekeying algorithm, but also the DMCs affected implement proxy key updates action.

## 75.6 Security Analysis

The security of PTGKM mechanism is based on the discrete logarithm assumption and the security of symmetric cryptography. From the aspects of backward security, forward security, and framework security, the analysis is as follows:

(1) Backward Security: In the group rekeying algorithm for member join, $R_j$ securely unicasts its proxy key $rk_j$ to the new members joined. If group member wants to get $k_{i-1}$, although it owns $rk_j$, it do not know $k_{j-2}$, so it cannot decrypt cipher text $\{c_1, c_2\} = \left\{g^{r_0+r_1+\cdots+r_j}, k_{i-1}g^{k_{i-2}+r_0+r_1+\cdots+r_j+rk_j}\right\}$, because of the discrete logarithm assumption. So the new member cannot get $k_{i-1}$, even if it intercepted and stored the messages transmitted in the network before join. Therefore it can not decrypt the messages, which achieves the backward security of PTGKM.

(2) Forward Security: In the group rekeying algorithm for member leave, after the parent proxy node distributes $rk'_j$, only the legitimate group members in this domain and the children proxy nodes can update the proxy key from $rk_j$ to $rk'_j$. Group Management Center S transfers group rekeying message $\{c_1, c_2\} = \left\{g^{r_0}, k_{i+1}g^{k_i+r_0+rk_0}\right\}$ along the proxy-function tree. $R_j$, which is in the transmission path, uses $rk'_j$ to reencrypt the message $\{c_1, c_2\} = \left\{g^{r_0+r_1+\cdots+r_j}, k_{i+1}g^{k_i+r_0+r_1+\cdots+r_j+rk'_j}\right\}$, and transfers to group members in this domain and its child proxy nodes. The legal group members in $R_j$ receive the message and get the new group key $k_{i+1}$. Because the message is encrypted with $k_i$ and $rk'_j$, the user who has left group can not get $k_{i+1}$ without $rk'_j$. And this user cannot continue to participate in group communications too. So the forward security of PTGKM scheme is achieved.

(3) Framework Security: According to the basic idea of proxy re-cryptography algorithm, DMC nodes participating in group key distribution only has the message conversion function, and cannot get the new group key, which has fundamentally solved the problem of a single point of failure caused by attacking DMC.

## 75.7 Performance Analysis

The communication overhead and storage overhead of group rekeying process in PTGKM mechanism is shown in Table 75.1 $N$ denotes the total number of group members, $M$ denotes the average number of group members in each domain, and $C$ denotes the number of proxy child node of a proxy node in the proxy-function tree.

**Table 75.1** Results of performance analysis

| | | |
|---|---|---|
| Communication overhead | Member join | $2 + \log(M + C)$ |
| | Member leave | $2\log(M + C)$ |
| Storage overhead (not including the group key) | DMC | 2 |
| | Group member | $\log M + 1$ |

When $N \gg M \gg C$, $\log N \gg \log(M + C) = \log M$ comes into existence. So we can see from Table 75.1, PTGKM mechanism cannot only effectively alleviate the "1-affects-n" problem and improve the scalability of group key management mechanism, but also effectively reduce the network resources overhead of the group key management in Near-Space Network.

## 75.8 Conclusion

With the characteristics of near-space self-organizing network model, this paper improved the method in [5] and proposed a new group key management mechanism for the Near-Space Network. The paper takes full advantage of the local characteristics of intra-domain and inter-domain communication to solve the "1-affects-n" problem of group key management. And it also redesigned the proxy re-cryptography algorithm, so that the core backbone network nodes do not require and cannot access to the group session key which avoids the problem of a single point of failure fundamentally. And combining the characteristics of the Near-Space Network System, we focused on the group rekeying algorithm for members' inter-domain switching. Finally, the detailed security and performance analysis were given for PTGKM mechanism.

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# Chapter 76
# Incompatibility Between WCETT Route Metric and Flooding Control of AODV in Wireless Mesh Networks

**Bin Zhu, Junguo Liao, Yong He and Zhigang Li**

**Abstract** The Weighted Cumulative Expected Transmission Time (WCETT) metric can be incorporated into a routing protocol such as On-Demand Distance Vector Routing (AODV) in wireless mesh network. The new route is called Multi-Radio Link-Quality Source Routing, which is allowed to trade off channel diversity and path length by changing the value of the control parameter. But the incompatibility existed between WCETT and flooding technique in AODV. The original AODV cannot deal with the situation so that WCETT metric is not perfect to get the real link quality. We analyze the reason and the relevant solution is present. After experimental and theoretical analysis, the new route shows good performance than the old one.

**Keywords** WCETT · AODV · Incompatibility · Wireless mesh network

## 76.1 Introduction

In Wireless Mesh Networks (WMNs), mesh routers have minimal mobility or are always static and form the backbone of WMNs, which with mesh client provide network access for both mesh and conventional clients. The integration of WMNs with other networks such as the Internet, sensor networks, etc., can be accomplished through the mesh routers' functions of gateway and bridging [1, 2]. So the route protocol and respond route metric are important for WMNs. Different link-quality routing metrics have been proposed such as Expected Transmission Count (ETX)2,

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Expected Transmission Time (ETT)3, Weighted Cumulative ETT [3.5], and so on. Some new route protocol [3, 4] are designed and some classic route [5, 6] are modified to be compatible with above route metric for WMNs. On-Demand Distance Vector AODV routing protocol is present for ad hoc network and still suitable for WMNs as mature protocol. The route metric WCETT based on ETX is incompatible with flooding technique in AODV. In this paper, the reason is analyzed, and the relevant solution is present.

The remainder of this paper is organized as follows. Section 76.2 describes AODV and mainly implements routing metrics for WMNs. The incompatibility between WCETT and flood control is described in Sect. 76.3. Our experimental results are shown in Sect. 76.4. Section 76.5 presents our conclusions.

## 76.2 AODV Route and Route Metric

Ad Hoc On-Demand Distance Vector AODV [13] is a route protocol of routing message between mobile nodes or computers. The nodes can route the message through intermediate nodes to the destination which they cannot directly communicate. AODV discovers the routes along which messages can be passed which makes sure these routes do not contain loops and tries to find the shortest route possible. AODV can handle changes in routes and create new routes if there is an error. The process of AODV route can divide four parties as RREQ, RREP, RRER, and Local connectivity management.

Route Request (RREQ): When a node wants to send a packet to some destination, it first checks its route table to determine if it has a route to the destination. If having, it just forward the packet. If it has not any route, it initiates a route discovery process. This process begins with the creation of RREQ packet by some source nodes. The RREQ packet contains some information about the source, which propagates the whole network by broadcast via flooding. Once an intermediate node receives a RREQ packet, it sets up a reverse route entry for the source node in its route table. When the intermediate node has a more recent path than the one previously known to source, it sends a Route Reply (RREP) through the reverse route to the source. If not, it just forward the RREQ packet.

Route Reply (RREP): When RREQ packet reaches destination, the node responds to RREQ by sending a RREP back using unicasting and not flooding to the source using reverse path.

Route Error (RERR): A neighbor of a node is considered active for a routing table entry if the neighbor sent a packet within some interval and was forwarded using that entry. If the source moves, a new RREQ process is initiated. If intermediate nodes or the destination move, the next hop links break resulting in link failures for which routing tables are updated. Then RERR packet is initiated by the node upstream (closer to the source) of the break route and then propagated to all the affected destinations. When a node receives an RERR, it marks its route to the destination as invalid. A source node can reinitiate the route discovery when it receives an RRER.

Local connectivity management: Neighboring nodes periodically exchange hello message to determine whether the link between them is broken. Absence of hello message is used as an indication of link failure. Alternatively, failure to receive several MAC-level acknowledgments may be used as an indication of link failure. The main words in all headings (even run-in headings) begin with a capital letter. Articles, conjunctions, and prepositions are the only words which should begin with a lower case letter.

In wireless networks, hop count is the most used metric, which is convenient for wireless network because it indicate the character of wireless propagation that wireless signal is more easy to reach the nearest destination. On the other hand, as WMNs routers are usually stationary, routing metrics that reflect link-quality variations are feasible.

Weighted Cumulative ETT(WCETT) [7]: WCETT is a route metric based on Expected Transmission Time (ETT) [7] which is needed to calculate the Expected Transmission Count (ETX) [8]. In multi-radio multi-channel network, the sum of the ETTs of all hops on the path will ensure that the value is increased as more links is added to an existing path. The total sum of ETTs has a physical meaning which is an estimate of the end-to-end delay experienced by a packet traveling along that path. So for a path consisting of $n$paths, the computational formula is $\sum_{i=1}^{n} ETT_i$. However, if WCETT is considered the impact of channel diversity, simply adding up ETTs will not ensure the property. Another term $X_j$ is defined. Consider a $n$ hop path. Assume that the system has a total of $k$ channels, $X_j$ is calculated as $\sum_{Hop\ i\ on\ channel\ j} ETT_i$, which is the sum of transmission times of hops on channel. The channel with largest $X_j$ is the bottleneck channel, which dominates the total path throughput. The definition $\max_{1<j<k} X_j$ will favor paths that are more channel-diverse. If a node has multiple radios, they are tuned to different, noninterfering channels [9]. However, the value of this metric will not always increase as more hops are added to the path, because additional hops, that use nonbottleneck channels, do not affect the value of the metric. Taking weighted average of the two above metric, the final metric is defined as $\text{WCETT} = (1-\beta)\sum_{i=1}^{n} ETT_i + \beta^* \max_{1lt;jlt;k} X_j$, where $\beta$ is a tunable parameter subject to $0 \leq \beta \leq 1$.

## 76.3 The Incompatibility

WCETT route metric is not suitable for all route protocol of which it can be integrated. The incompatibility of WCETT and some flooding control technique are analyzed as follow.

When broadcasting, the source sends the control packet to all neighbor. Each neighbor who receives this control packet will forward the packet to its neighbors. To avoid flood storm, sequence numbers help to avoid the possibility of forwarding

the same packet more than once. When the control packet arrive the destination, the destination does not forward the packet. It means that there is a reachable path from the source to the destination.

From the flooding control technique in AODV, we can see that one broadcast packet only forward only once for each node due to avoid flood storm. So the key point is whether the selected path is the optimal path for AODV route with WCETT metric in wireless mesh networks.

As seen from Fig. 76.1, the source A wants to communicate with the destination D. The router A first runs RREQ process. The broadcast packets will flood to the destination D through router B and C. According the character of wireless communication, router C first receives the first route packet from router A, its neighbor. And then, it receives the packet with the same sequence numbers from router B. To avoid flooding storm, router C discards this packet (In Fig. 76.1a). But if WCETT is integrated into AODV, router C must accept the packet from router B. The WCETT value of path from A to C through B is 19.6 (20.35 from A to C directly). The selected path is A–B–C–D (A–B–D or A–C–D in normal AODV).

The basic flood control approach in AODV is conflicted with WCETT route metric. The intermediate node closes the "door" for another broadcast packet with the same sequence numbers after that it receives the first. The result is intermediate node cannot select the right path according the corresponding route metric.

The incompatibility between flooding control in AODV with WCETT metric make the protocol is in dilemma. If WCETT route metric is designed to integrate into AODV protocol, the "door" for every node must be open to receive more broadcast packets to select the optimal path. As a result, flood storm takes place. The key point of the solution is how to flood the broadcast limitedly. A part of the solution in this paper is that the number of the received broadcast with same sequence numbers is controlled by the number of link among one's neighbors. According the number of link among one's neighbor (supposed the number is), let it receive the flooding packet less than. Another rule is the forward policy. In normal AODV, a node forward the flood packet only the packet is with higher sequence numbers or more optimal than the previous one. In this solution, the intermediate node forward the flooding packets and the destination reply a route request only when the route table is change.

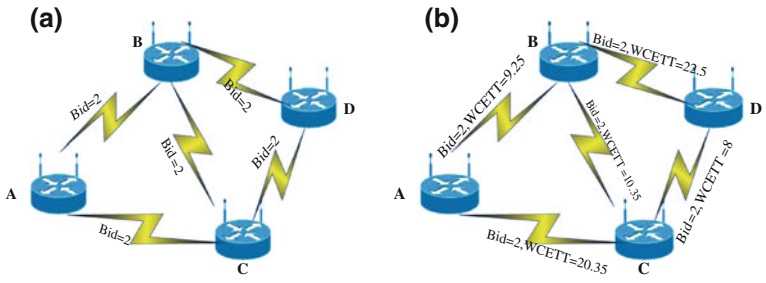


**Fig. 76.1** Path selection with different metric. **a** Normal AODV with hop count metric. **b** AODV with WCETT metric

## 76.4 Implement and Analyze

We implement AODV with WCETT under simulation platform ns2 [10] with multi-radio multi-channel extend [11, 12]. To simulate 802.11b orthogonal channel, the wireless physical layers are modified to with different frequency. The simulated network topology, as shown in Fig. 76.2, consists of 81 static Mesh Routers placed as a regular 9 × 9 grid in a 1800 × 1800 m area. Each Route equips two radios. Each radio randomly selects one of the three orthogonal 802.11b channels to stay on. The default simulation parameters used in all simulations are listed in Table 76.1.

Packet receive Ratio in the simulation, different traffic load are inject into the mesh router to measure the success packet receive Ratio. The number of flow is 10. Which randomly selects the source and the destination in each simulation. The rule to select the pair mesh route is that the hop between them must be more than four

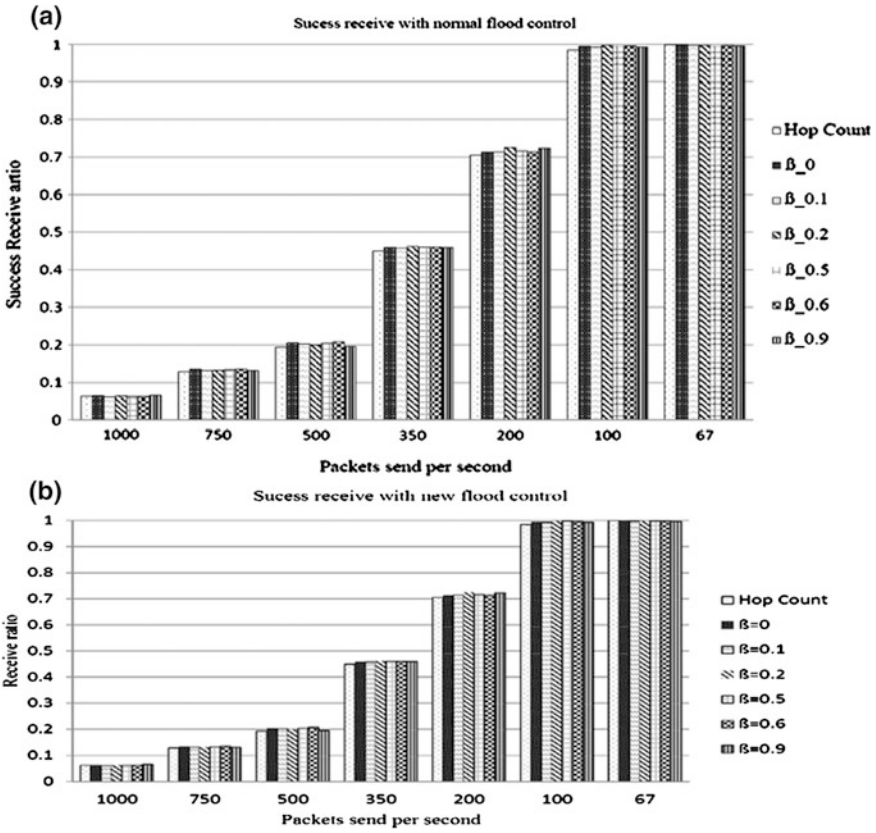


**Fig. 76.2** Success receive ratio with different flood control. **a** Success receive ratio with normal flood control.**b** Success receive ratio with new flood control

**Table 76.1** The experimental parameters

| Name | Value |
|---|---|
| Examined metric | Hop Count, WCETT (different $\beta$) |
| Simulation time | 500 |
| Simulation area | 1800 × 1800 |
| Propagation model | Two ground reflection |
| Traffic type | CBR (UDP) |
| Flow number | 10 |
| Flow rate (Packets/second) | 1000, 500, 200,1 00, 67 |
| Packet size | 1000 bytes |
| Transmission range | 250 m |

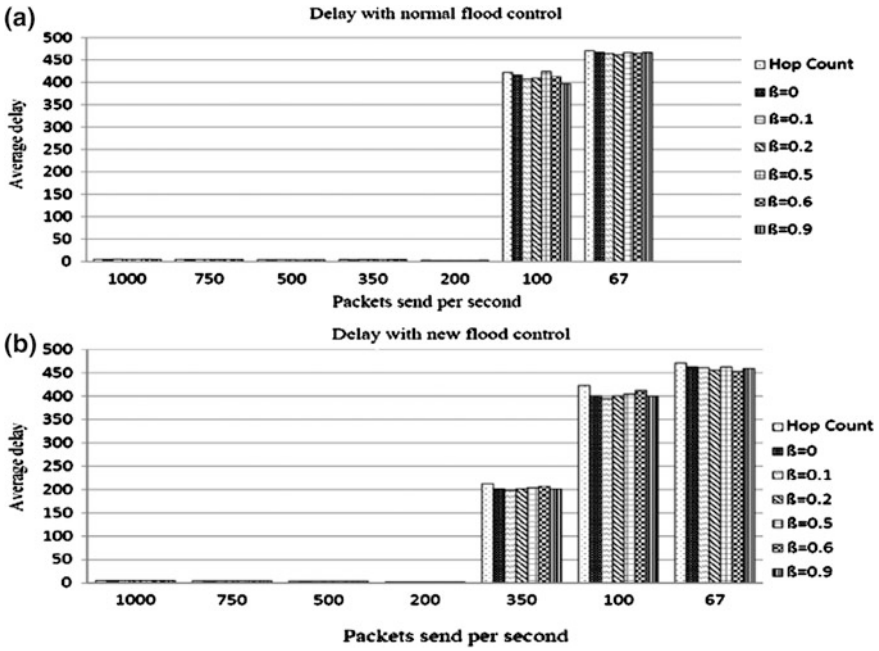


**Fig. 76.3** The average end-to-end delay. **a** Delay with normal flood control. **b** Delay with new flood control

hops. After adjusting the flood control and forward rule, the success receive ratio has been raised a little. Due to the use of multichannel, the interference between orthogonal channels does not exist. The performance is not so distinct. But the success ratio of WCETT with flood control on the whole is higher than the older version (In Fig. 76.2). The success ratio is 72.49 % with new flood control when $\beta$ 0.2 is and each source sends 200 packets per second (71.40 % with normal flood control, 70.56 % with hop count).

Delay WCETT trades off channel diversity and path length, by changing the value of the control parameter. The quality of the link is taken into account. Under different flow data, WCETT can select the higher quality link to transmit the

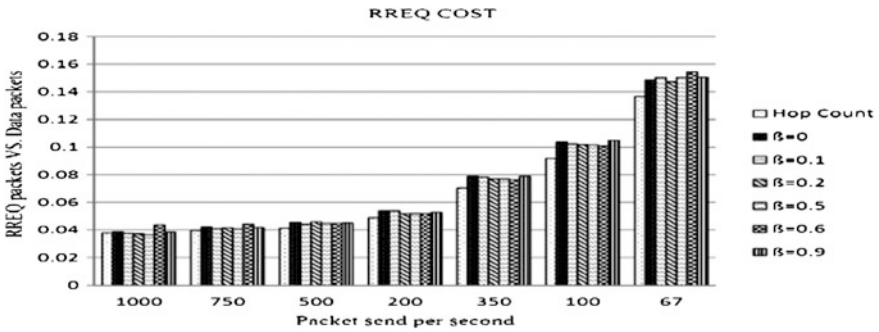


**Fig. 76.4** All received RREQ packets versus data packet sent

packet than Hop count. After adopting the new flood control, the strength is more obvious (in Fig. 76.3). The average delay is 2.43880 s with new flood control when $\beta$ 0.2 is and each source sends 200 packets per second (2.4615 s with normal flood control, 2.5234 with hop count).

Routing Packet Overhead The new flood control increases the route overhead obviously. The more route request packets come in, the higher quality link can be obtained. On the other hand, the new forward policy is adopted to limit the total number of route request packet in the network (in Fig. 76.4). The ratio of RREQ packets and all send data packet is 0.0516 s with new flood control when $\beta$ 0.2 is and each source sends 200 packets per second (0.04885 with hop count).

## 76.5 Conclusion

In this paper, the incompatibility between WCETT and flood control is described. And the corresponding solution is present. After modifying the flood control and forward policy, WCETT metric can compatible with AODV route. On the multi-channel multi-radio network, interfaces work on different channels generate multilink naturally. Existed work focus on how the find the optimal route metric. On the future, the nature multilink will be taken into account. And some schedule policy to maximize the capacity of wireless channel will be present.

**Acknowledgments** This material is based upon work supported by Project by Scientific Research Fund of Hunan Provincial Education Department (No: 10C0685, 10C0691, 11C0534), Hunan Provincial Natural Science Foundation of China (No: 10B034, No: 10JJ3067), and Hunan provincial innovation experiment program for university students (No: KDSC1005). We are grateful to the anonymous reviewers for their valuable comments on this work.

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# Chapter 77
# System Capacity of Unorganized Co-channel AP in High Density Area

**Jiansen Zhang and Sheng Zhang**

**Abstract** This paper is about the relationship between the network capacity in high-density environment and the number of unorganized AP. The experiment confirmed that increased co-channel AP hotspots could not improve the system capacity in the high-density environment. It provides the basis for the expansion of the hot spots, avoids random AP blind duplicate construction. And it proposes the method of increasing the Wi-Fi network capacity in high-density environment.

**Keywords** Network capacity · Network planning · CSMA/CA

## 77.1 Introduction

With Wi-Fi wireless communication technology widely used, more and more users use Wi-Fi to connect with the Internet. In some area with high-density wireless users (for example, in the airport, or in electronic market, etc.), people want high-speed wireless Internet service. But some of them cannot connect the network even their Wi-Fi terminal have scanned strong network signals. Therefore, to study the relationship between the No of AP hotspots and system capacity, to make sure that if we can increase the number of AP hotspots to improve the internet service bandwidth, those questions are concerned by more and more users now.

There are several ways to respond to the application of high-density Wi-Fi environment currently [1, 2]: the multicellular architecture constituted by thin AP + controller, the architecture of single-channel, Wi-Fi Array, the Wi-Fi

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standards which are used to support a higher speed. Solution of which the first three by the AP controller unified management, unified channel planning, and AP power control. Centralized management of these three methods facilitates network planning, network optimization, and fault management. But the flexibility is not very well and cannot respond the user's requirements immediately.

In practical applications, there are AP hot spots with multiple sources and the AP builds its own hot spots at the hot spots area. And more Wi-Fi operators are planning overlapping coverage. Those AP signals are overlapping covered and there is no uniform plan. Therefore, may cause serious interference between the signals and mutual influence. For this new scenario, this paper studied from both theoretical and experimental. Find out the relationship between the system capacities with the AP number of high-density Wi-Fi network using the same channel. The following results based on the experimental tests: In the AP cover area that can support the maximum transfer rate, to increase the number of AP hot sports in the same channel could not improve the network capacity, the network capacity may lead to decline instead.

## 77.2 802.11 DCF Principles and Network Capacity Analysis

The basic access method of the 802.11 MAC protocol is the Distributed Coordination Function (DCF) [3], also known as Carrier Sense Multiple Access with Collision Avoidance access (CSMA/CA). It is necessary that the DCF can be used at all sites for ad-hoc networks and infrastructure network.

The CSMA algorithm of DCF is based on the site sends the MAC service data unit (MSDU) when the site detected the media was free. However, if two sites detected the media for free at the same time, they will both send the MSDU and cause the collision. In order to avoid this collision, 802.11 introduced of the collision avoidance (CA) mechanism to reduce the probability of the collision. The core content of the CA mechanism is the site using a random back off procedure to resolve the collision of media competition. DCF in the specific timing shown in Fig. 77.1.

Short interface space (SIFS): the shortest frame interval for some frames to provide the highest medium priority access level.

PCF interface space (PIFS): works in the workstation under the centralized control media access to the time interval. Its priority is higher than the distributed

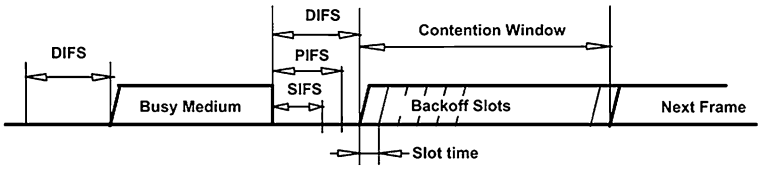


**Fig. 77.1** DCF timing and back off which

control. Once the monitoring of the medium is idle, it can be no competition in communications.

DCF interface space (DIFS): works in a distributed workstation control mode to use DIFS to send data frames and management frames

Where SIFS < PIFS < DIFS

The higher priority level of frame is, its frame interval is shorter. So the high priority frame has more opportunities to use the transmission medium. That is to say, when the workstation medium becomes free from busy, it cannot send data immediately. It will wait for a suitable frame interval time according to the frame of the priority level and during this time, the media remain free to transfer frame. In this way, the chance of same priority frame collision is still high. Therefore, after waiting for the same interval between frames, if this time the media is free, they will send frame in the same time which will cause the conflict situation. The way to solve this problem is that after waiting for the time interval between frames, the workstation will wait for a random length then sending frames. Since each workstation's random length may be different, the conflict of the frames will be reduced. This is the back off algorithm.

By throughput theory formula of the CSMA/CA [4], the throughput of the CSMA/CA (Carrier Sense Multiple Access multiplexing/Collision Avoidance) is associated with the following values:

$$Capacity = \frac{T(Data)}{T(Total)} = \frac{T(Data)}{T(Idle) + T(DIFS, SIFS, RTS, CTS, ACK, CW) + T(Data)}$$

Among them, the nondata transmission time includes:

Channel idle time; Transmission RTC/CTS/ACK time (fixed value); Nodes of DIFS, SIFS time (Fixed value); Node random contention window CW time.

Assuming that the sending node in the network sends out a data packet with the highest rate continuously, and all successfully sent data packets were received successfully. Then the more the nodes number, the greater the probability of competitive conflict and the channel utilization rate of decline. The longer the data packet, the more the amount of data transmitted by an access channel, and the relative drop in the proportion of the cost of the system, the channel utilization rate increases along with the data packet length increases, the channel utilization rate is saturated.

## 77.3 High-Density Wi-Fi Network Capacity Experiment

To simplify the experiment model, experimental unified using ISM band channel 1. AP and test PC supports the 802.11g standard, and not involved in triggering 802.11g protection mechanisms. The AP distance is less than 15 m in the experiment without shelter, and providing the highest rate of less than the AP support coverage.

Laboratory equipment: 1 Switch: Net gear GS608 Gigabit Switch 3 AP: Net gear N150 wireless router 4 PC: 3 laptop Wi-Fi chips used as a test terminal 1 Desktop compeer: support for 100 M Ethernet interface used as a file server Test Software: DU Meter Experimental network structure:

The network structure diagram of network capacity testing as shown in Figs. 77.2, 77.3, 77.4, and 77.5 is the experimental results (Table 77.1):

From the experimental results, the total throughput of the system changes as follows in a 15 m * 15 m test area:

When there is only one AP, along with its services terminal number increases, the total throughput will decrease (the blue line in the Fig. 77.5). The single AP environment optimal throughput was related to the following factors:

When AP and terminal distance are closer, the received signal strength is higher. But in more than AP receiver requires the highest rate corresponding to the minimum signal strength, the change of the distance between AP and terminal has little effect on the throughput of the system.

When one AP associated with the terminal number is more, AP total throughput will be reduced.

When two AP each connecting one test terminal, the total throughput is less than one AP connected to one test terminal's throughput.

When three AP each connecting one test terminal, the maximum throughput is less than two AP each connecting one test terminal.

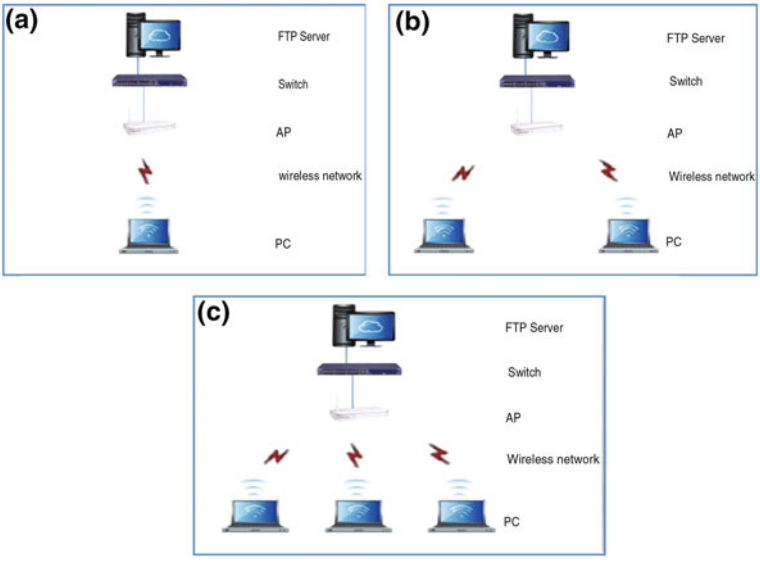


**Fig. 77.2** AP connected 1-3 PC. **a** 1 AP connected one PC. **b** 1 AP connected two PC. **c** 1 AP connected three PC

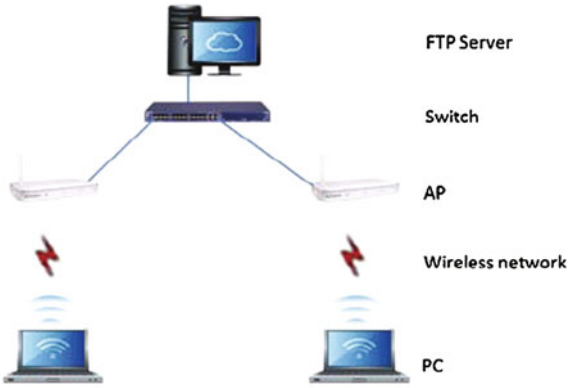


**Fig. 77.3** AP, each AP connected one PC

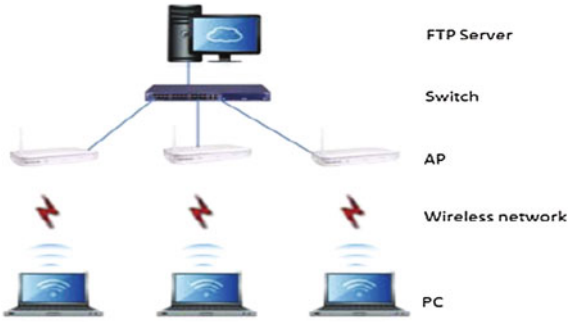


**Fig. 77.4** AP, each AP connected one PC

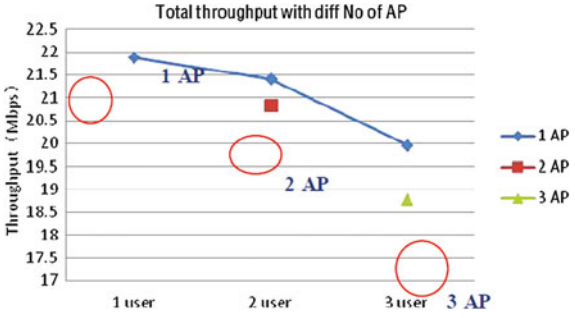


**Fig. 77.5** System total throughput comparison with 1-3 AP

**Table 77.1** System total throughput comparison with 1-3 AP

| Total Throughput(Mbps) | 1 user | 2 user | 3 user |
|---|---|---|---|
| 1 AP | 21.88 | 21.41 | 19.97 |
| 2 AP | | 20.84 | |
| 3 AP | | | 18.8 |

## 77.4 The Relationship Between System Capacity and the Number of Unorganized Co-channel AP in High-Density Environment

The test results can be seen, in all AP coverage area which can provide the highest service bandwidth, increase the number of co-channel AP will lead the total throughput down. The main reason is the bearing tasks related to AP. In addition to transmit data in Wi-Fi network, AP is responsible for the management associated with the user, sending network beacon and other works. Increasing the number of AP is in fact increasing the network overhead under the condition of not increase the capacity of wireless networks. Therefore, increasing the number of AP system service will decline the network bandwidth.

In the unorganized state, increasing the number of AP will lead to the probability of conflict increases and decline the network capacity. The main reason is because the performance of 802.11 DCF back off algorithm has its limitations [5, 6]. In some specially designed for high-density Wi-Fi network applications, the best way to reduce the probability of conflict is to unified network planning. Reasonable control of each AP coverage, minimizing the same frequency, and adjacent channel AP overlapping coverage area. But this method depends on the same supporting operator, cross operator, and the AP provider solutions have not yet been proposed.

The IEEE 802.11 standard [7] defined 13 channels in the ISM band, each channel interval is 5 MHz. Since the channel between each other is very close and adjacent channel overlap each other, there are only three channels that are not covered by each other in the 13 channels. Therefore, the same region consists of three channels separating AP, while providing service network capacity maximum in the 2.4G frequency band.

## 77.5 Conclusion

When more than one 802.11g AP are working at the same frequency and the signal strength is strong (more than the maximum transmission rate required for minimum reception level intensity), the total throughput of the system is not improved due to the increase of AP nodes. It will decline by the increase of AP nodes instead. Therefore, it cannot improve the capacity of the network by increasing the Co-channel AP blindly in the hot spot region. In order to improve the network capacity in high-density commercial areas, the best solution is to carry out network planning by the same unit (for example, to create a Wi-Fi user organization with a information database), which can optimize each AP coverage, reduce the AP overlapping between the co-channel and the adjacent channel, centralize management and maintain the network, and avoid the channel interference which is caused by unorganized construction.

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# Chapter 78
# Study of TD-SCDMA Employing Virtual MU-MIMO

**Yang Zhang, Jian Bo Hu and Li Yan**

**Abstract** This paper is to study the system level performance of TD-SCDMA employing power control and virtual MIMO, and presents some evaluation methodologies. Open loop power control and determinant pairing scheduling (DPS) are evaluated in Virtual MU-MIMO systems based on TD-SCDMA. Simulation results show that with power control and DPS, the TD-SCDMA system throughput could be improved, and the fairness criterion among users could be satisfied.

**Keywords** TD-SCDMA · Power control · VMIMO · DPS

## 78.1 Introduction

The TD-CDMA wireless communication system has been widely discussed all over the world. TD-SCDMA makes its effort on higher user data rates, greater spectrum efficiency, and improved system capacity and coverage. Multi-Input Multi-Output (MIMO) increases system capacity in the way of spatial diversity and multiplexing. To protect the already existing network equipments, yet still reach the long term evolution (LTE) performance, MIMO has been introduced into TD-SCDMA system with some enhanced technologies.

One of the key techniques in TD-SCDMA is joint detection (JD). It reduces multiuser address interference (MAI) and improves user load. To combine MIMO

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with JD, Ref. [1] has introduced a simple and efficient methodology. But in this paper, JD was achieved with zero forcing-block linear equalization (ZF-BLE), which is less efficient than minimum mean square error-block linear equalization (MMSE-BLE). In this paper, MMSE-BLE is used in MIMO-JD instead of ZF-BLE.

In reality, mobile terminals are equipped with only one transmit antenna. In order to make full use of MIMO spatial multiplexing, Virtual MIMO has been adopted for uplink data transmission. In a Virtual MIMO system, different users sharing the same time-frequency resource constitute a user group. The user group and BS can make up of a MIMO system on condition that the number of users in one group is not larger than that of the receive antenna equipped in BS. Ref. [2] has proved that Virtual MIMO can dramatically increase the overall performance in terms of cell throughput and cell edge user throughput.

Power control mitigates the near-far effect deriving from the presence of intracell interference. In our system, the intercell interference is from other cells due to the simultaneous use of the same subcarrier by different users in adjacent cells. The intercell interference will cause severe degradation of system performance, especially for the situation where the user is located at the cell edge. Therefore, the role of power control is to adapt power to path loss and shadow fading fluctuations and reduce the other-cell interference [3].

This paper is to study the system level performance of TD-SCDMA uplink with MIMO-JD and Virtual MU-MIMO, and presents some evaluation methodologies. Joint orthogonal user grouping, proportional fairness (PF) scheduling, and open loop power control are evaluated in Virtual MU-MIMO system through the system level simulation.

The rest of this paper is organized as follows. Virtual MIMO system models are shown in Sect. 78.2. In Sect. 78.3, the proposed scheduling algorithm and power control for the uplink is given in detail. In Sect. 78.3.4, the performance of this scheme is presented via system level simulation. Finally, we give conclusions in Sect. 78.4.

## 78.2 System Model in Uplink of TD-SCDMA

In this paper, we consider the uplink of TD-SCDMA cellular system with $M$ subcarriers. Assume each user has one transmit antenna, and each BS is equipped with $N_R$ receive antennas. In a Virtual MIMO system, $N$ users sharing the same time-frequency resources are settled in a group, denoted as group $A$. Users in group $A$ and their serving BS can make up of a $N_R \times N$ MIMO when $N_R^3 N$. A $N_R \times N$ Virtual MIMO model is illustrated in Fig. 78.1.

In Fig. 78.1, Users 1, 2…$N$ are in the same cell and compose of user group $A$. Each user has one transmit antenna, and the BS is equipped with $N_R$ receive antennas. In a multicell Virtual MIMO system, each user suffers from both

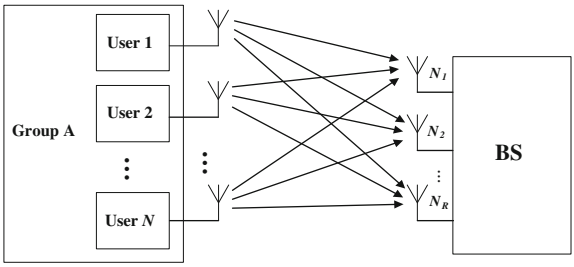


**Fig. 78.1** Structure of virtual MIMO

intracell interference and intercell interference due to the usage of the same subcarrier simultaneously. In such a case, MMSE equalizer is used to distinguish the useful signal of each user at BS. Denote $m$, $n$, and $q$ as the subcarrier index, user index, and interfering cell index, respectively. $A_q$ is defined as the user group in interfering cell $q$. $X_m = (x_m^1, x_m^2, \ldots, x_m^N)^T$ represents the transmit signal vector of users in group an on subcarrier m and is a $N \times 1$ vector. The received signal vector at their serving BS on subcarrier $m$ can be expressed as:

$$y_m = H_m P_m X_m + \sum_{q=1}^{b} H_{m,q} P_{m,q} X_{m,q} + n_m = (y_m^1, y_m^2, \ldots, y_m^{N_R})^T \quad (78.1)$$

$P_m = \text{diag}(\sqrt{P_m^1}, \sqrt{P_m^2}, \ldots, \sqrt{P_m^N})$ is a $N \times N$ diagonal matrix and $P_m^n$ is the transmission power of user $n$ on subcarrier $m$. $H_m = \left(h_m^1, h_m^2, \ldots, h_m^N\right)$ is an $N_R \times N$ complex matrix, where $h_m^n = (h_m^{1,n}, h_m^{2,n} \ldots, h_m^{N_R,n})^T$ is an $N_R \times N$ vector representing the channel fading coefficient on subcarrier $m$ from user $n$ to each receive antenna of BS. $H_{m,q} = \left(h_{m,q}^1, h_{m,q}^2, \ldots, h_{m,q}^N\right)$ is a $N_R \times N$ complex matrix, in which $h_{m,q}^n = (h_{m,q}^{1,n}, h_{m,q}^{2,n}, \ldots, h_{m,q}^{N_R,n})^T$ is an $N_R \times 1$ vector representing the channel gain on subcarrier $m$ from user $n$ of user group $A_q$ in interfering cell $q$ to each receive antenna of BS. $P_{m,q} = \text{diag}(\sqrt{P_{m,q}^1}, \sqrt{P_{m,q}^2}, \ldots, \sqrt{P_{m,q}^N})$ is the transmit power matrix and $P_{m,q}^n$ is the transmission power of user $n$ in interfering cell $q$ on subcarrier $m$. $X_{m,q} = (x_{m,q}^1, x_{m,q}^2, \ldots, x_{m,q}^N)^T$ is transmit signal vector of user group $A_q$ in interfering cell $q$, and $b$ is the number of interfering cells. $n_m$ Is a $N_R \times 1$ complex Gaussian random variable with zero mean and covariance matrix $\sigma_m^2 I$ [4].

Express $G_m = \left(H_m^H H_m + \sigma^2 I_N\right)^{-1} H_m^H$ as the $N \times N_R$ MMSE equalizer matrix and use $g_m^1, g_m^2, \ldots, g_m^N$ to represent row vectors of $G_m$ [5].

The transmit vector $X_m$ of user group and on subcarrier m after detection at BS can be given as follows:

$$\begin{aligned}\widehat{X}_m &= G_m y_m = G_m H_m P_m X_m + \sum_{q=1}^{b} G_m H_{m,q} P_{m,q} X_{m,q} + G_m n_m \\ &= \begin{pmatrix} g_m^1 \\ g_m^2 \\ \vdots \\ g_m^N \end{pmatrix} \left\{ \left(h_m^1\, h_m^2 \ldots h_m^N\right) \begin{pmatrix} \sqrt{P_m^1}\, x_m^1 \\ \sqrt{P_m^2}\, x_m^2 \\ \vdots \\ \sqrt{P_m^N}\, x_m^N \end{pmatrix} + \left(h_{m,q}^1\, h_{m,q}^2 \ldots h_{m,q}^N\right) \begin{pmatrix} \sqrt{P_{m,q}^1}\, x_{m,q}^1 \\ \sqrt{P_{m,q}^2}\, x_{m,q}^2 \\ \vdots \\ \sqrt{P_{m,q}^N}\, x_{m,q}^N \end{pmatrix} \right\} \\ &\quad + G_m n_m \end{aligned} \tag{78.2}$$

The total interference of user $n$ on subcarrier $m$ includes the intracell interference coming from other users in user group A and intercell cochannel interference from group $A_q$ in adjacent interfering cells, due to the usage of the same subcarrier simultaneously.

Accordingly, the received signal to interference and noise ratio (SINR) of user $n$ at BS on subcarrier $m$ can be presented by:

$$\mathrm{SINR}_m^n = \frac{p_m^n \left| g_m^n h_m^n x_m^n \right|^2}{\sigma^2 \left\| g_m^n \right\|^2 + \sum\limits_{\substack{n'=1 \\ n' \neq n}}^{N} p_m^{n'} \left| g_m^n h_m^{n'} x_m^{n'} \right|^2 + \sum\limits_{q=1}^{b} \sum\limits_{n''=1}^{N} p_{m,q}^{n''} \left| g_m^n h_{m,q}^{n''} x_{m,q}^{n''} \right|^2} \tag{78.3}$$

After getting the received SINR, the achievable instantaneous transmission rate of user $n$ can be obtained by looking up the modulation and coding scheme table. Denote this rate as $r_n$, which will be used in next section.

## 78.3 User Grouping Scheduling in Virtual MIMO

Virtual MIMO has been adopted for the uplink. In case of $N_R \times N$ Virtual MIMO, $N$ users composing of a user group can share the same time-frequency resource. In Virtual MIMO implementation, the user grouping scheduling has played an important role in improving system performance. The purpose of Virtual MIMO scheduling is to select right users among all of the users. Orthogonal user pairing scheduling can mitigate the intracell interference from other users in the same group [2].

### 78.3.1 Orthogonal User Pairing Scheduling

Assume $H_m$ is the complex spatial multiplexing channel for subcarrier $m$. Further define the channel matrix of $N_R \times N$ MIMO configuration as:

$$F_m = H_m^H H_m = \begin{bmatrix} f_{11} & f_{12} \\ f_{21} & f_{22} \end{bmatrix} \tag{78.4}$$

where $A^H$ denotes the Hermitical of matrix $A$. Choose the determinant formula for $N_R \times N$ MIMO configuration represented as below:

$$D_m = \frac{\det(F_m)}{\mathrm{tr}(F_m)} \tag{78.5}$$

where det($Fm$) and tr($Fm$) are the determinant and trace of matrix $Fm$. $\overline{D}$ is the average $D_m$ of two users chosen in group A (user 1, 2… $N$) Over $M$ subcarriers and can be simply calculated as

$$\overline{D} = \frac{1}{M} \sum_{m=1}^{M} D_m \tag{78.6}$$

The orthogonal user scheduling may select $N$ users to compose a user group, relying on the PF scheduling algorithm.

### 78.3.2 Proportional Fairness Scheduling

Proportional fairness based orthogonal user grouping is adopted in this paper to calculate the priority value of each user group and allocate the system resource to the group with the highest priority.

Section 78.3.2 has given $r_n(t)$ as the achievable instantaneous data rate for user $n$ in the $t$th scheduling period. Define $T_n(t)$ as the average data rate of user $n$ in the $t$th scheduling period, respectively. Updating the average rate of user $n$ at the end of each scheduling period gives:

$$T_n(t+1) = (1 - \frac{1}{T_c}) T_n(t) + \frac{1}{T_c} r_n(t) \tag{78.7}$$

in formula (78.7), $T_c$ is related to the maximum time to be starved. If user $n$ has not been served in the $t$th slot, $r_n(t)$ is equal to zero. Users have no data to send still get their average rate updated, too. The update of the average rate specified here is done by using a low pass filter with a time constant $T_c$. In our simulation, we assume $T_c = 1,000\, T_s$ , where $T_s$ is the duration of a scheduling period [6].

In case of $N_R \times N$ Virtual MIMO, the orthogonal user grouping and PF scheduling can be divided into two steps: the first step is to find the most

orthogonal user groups. This operation guarantees the orthogonality for each grouped users. The second step is to assign subcarrier clusters to user groups provided by the first step for Virtual MIMO transmission [7].

Assume there are $U$ users in each cell and can be divided into $F = U/N$ groups, which are expressed as A1, A2… AF.

Step 1: Calculate $\overline{D}$ for any $N$ users among all the users and find the most orthogonal user group to make up of group A1. Then find the most orthogonal user group to make up of group A2 from the remaining $U$–$N$ users, until there is no remaining user. Totally, $F$ groups from A1 to AF are settled.

Step 2: According to PF algorithm, calculate the priority value of each group on each subcarrier and assign active user pair to the group with highest priority value till there is no user left.

The PF scheduling algorithm is given by

$$\rho_A(t) = \sum_{n=1}^{N} \frac{r_n(t)}{T_n(t)} \tag{78.8}$$

In formula (78.8), $\rho_A(t)$ is the priority value of group an on subcarrier $m$ in the $t$th scheduling period. $T_n(t)$ and $r_n(t)$ are the average rate and achievable instantaneous rate for user $n$ on subcarrier $m$ in the $t$th scheduling period, respectively.

### 78.3.3 Open Loop Power Control

In uplink of TD-SCDMA adopting Virtual MIMO, users suffer from both the intracell interference and intercell interference, which will cause severe degradation of system performance, especially for the cell edge users. In our simulation, uplink power control is used to compensate the path loss and shadow fading fluctuations in open loop mode, which can effectively reduce the other cell interference with lower complexity [8].

Open loop power control scheme is proposed: the target SINR should be set as a function of the path loss difference between the serving cell and the strongest neighboring cell:

$$\begin{aligned} \mathrm{SINR}_{\mathrm{target}} &= \Gamma + (1 - \alpha) \cdot \Delta\,\mathrm{Pathloss} \\ &= \Gamma + (1 - \alpha) \cdot (\mathrm{Pathloss\_}q - \mathrm{Pathloss\_}s) \end{aligned} \tag{78.9}$$

where Pathloss_$q$ and Pathloss_$s$ are the path loss (including shadowing) of the user to its strongest neighbor cell and to its current serving cell, respectively. $\alpha$ is the compensating factor to compensate the path loss difference? $\Gamma$ is a parameter to adjust the target SINR value?

Therefore, the user transmit power spectrum density (PSD) is calculated.

$$\begin{aligned} \text{TxPSD} &= \text{SINR}_{\text{target}} + \text{Pathloss\_}s \\ &= \Gamma + (1 - \alpha)\,\text{Pathloss\_}q + \alpha\,\text{Pathloss\_}s \end{aligned} \tag{78.10}$$

.

### *78.3.4 System Level Simulation Results*

In order to simulate and evaluate the performance of the proposed scheduling and power control scheme in the uplink of virtual MU-MIMO cellular system, a TD-SCDMA system level simulation platform is established. We consider a scenario where each user undergoes fast fading and large-scale fading. The fast fading of users can be generated via the SCME Model [9]. The propagation model can be given by $PL = 128.1 + 37.6\text{l g}(R)$, where $R$ in kilometer, is the distance between the BS and the user. The shadowing fading is lognormal distribution with mean 0 and standard derivative 8 dB, and the correlation distance is 50 m.

The snapshot and time-driven methods are adopted in this simulation. During one "drop", the channel undergoes fast fading according to the motion of the users, and the cell layout and locations of the BS are fixed, but the locations of the users are randomly varied at the beginning of each drop. Channel state information is fed back from the users to the BS, and the BS allocates the system resource to users according to the scheduling algorithm. We only consider full queue (FQ) traffic in the simulation. FQ traffic means that in the buffer of each user, the data queue is always full so that we can just focus on the concerned system performance. Our TD-SCDMA simulation platform is developed by C++ language, compile and run successfully in the development environment. The main system simulation parameters and MCS table applied in this simulation are listed in Tables 78.1 and 78.2, respectively.

In this simulation, in order to evaluate the system performance gain, we simulate the average sector throughput with and without open loop power control (OLPC) in uplink.

In multiuser systems, the fairness among users is an important criterion to evaluate the system performance. The fairness is evaluated by determining cumulative distribution function (CDF) of the normalized user throughput with respect to the average user throughput for all users. The fairness curve should lie to the right of the fairness criterion predetermined by the three points in Table 78.3. Otherwise, it is treated as violation of fairness criterion.

Figure 78.2 shows the fairness curves of no PC scheme and OLPC scheme. It could be noticed that OLPC can satisfy the fairness criterion, while no PC scheme violates it. Therefore, OLPC has better fairness among users.

**Table 78.1** Main system simulation parameters

| Parameters | Values |
|---|---|
| System bandwidth | 1.6 MHz |
| Number of cells | 19 |
| Number of sectors per cell | 3 |
| Neighboring subcarrier spacing | 15 kHz |
| Scheduling period | 5 ms |
| Inter-site distance | 500 m |
| Propagation model | $PL = 128.1 + 37.6\text{l g}(R)$, $R$ in Km |
| User maximal Tx power | 21 dBm |
| Traffic type | Full queue |
| MIMO antenna configuration | 2 × 2, Virtual MIMO |
| MIMO channel model | SCME |
| MU-MIMO receiver type | MMSE-BLE |
| User speed | 3 km/h |
| Outer loop power control | 1 for increase; 0.01 for decrease |
| Power control rate | 200 |
| $\Gamma$ | −36 |
| $\alpha$ | 0.5 |

**Table 78.2** MCS table in simulation (Turbo Coding)

| NO | Modulation | Coding rate |
|---|---|---|
| 1 | QPSK | 1/3 |
| 2 | QPSK | 1/2 |
| 3 | QPSK | 2/3 |
| 4 | QPSK | 3/4 |
| 5 | QPSK | 4/5 |
| 6 | 16 QAM | 1/2 |
| 7 | 16 QAM | 2/3 |
| 8 | 16 QAM | 3/4 |
| 9 | 16 QAM | 4/5 |

**Table 78.3** Criterions CDF

| Normalized user throughput with respect to average user throughput | CDF |
|---|---|
| 0.1 | 0.1 |
| 0.2 | 0.2 |
| 0.5 | 0.5 |

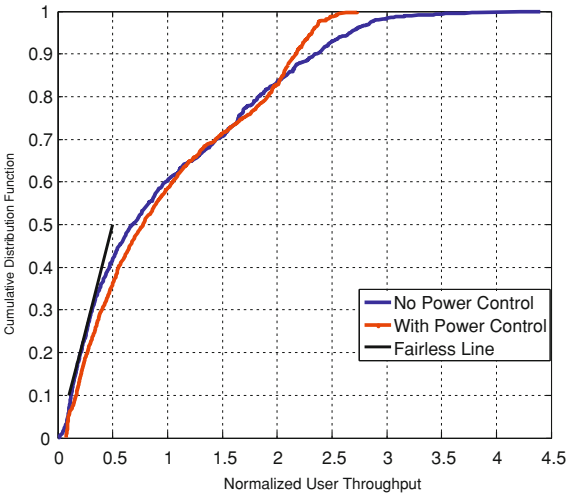


**Fig. 78.2** Fairness curves with/out PC

## 78.4 Conclusion

This paper is to study the system level performance of TD-SCDMA uplink employing open loop power control and virtual MU-MIMO. Also we presented some evaluation methodologies. Joint orthogonal user grouping, PF scheduling, and open loop power control are evaluated in Virtual MU-MIMO systems. Simulation results show that open loop power control can improve the system throughput, lower system interference condition, and satisfy the fairness criterion among users.

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# Part IX
# Mathematical Computation

# Chapter 79
# Reliability and Validity Evaluation Based on Monte Carlo Simulations in Two-Stage Cluster Sampling on Sensitive Question Survey

**Zongda Jin, Hongru Zhu, Qiaoqiao Du, Xiangyu Chen and Ge Gao**

**Abstract** In this paper, additive randomized response technique (RRT) model was presented in application to asking questions on sensitive topic in a survey of men who have sex with men (MSM) in Beijing, China. And MSM were selected by two-stage cluster sampling design. Monte Carlo simulation was successfully applied in the assessment of reliability and validity in additive RRT model for sensitive question investigation in two-stage cluster sampling.

**Keywords** Monte Carlo simulation · Sensitive question · Randomized response technique · Additive model · Two-stage cluster sampling

## 79.1 Introduction

Sampling survey is one of the most common methods of scientific research in numerous fields, including psychology, demography, sociology, medicine, and health [1]. Sampling investigation related to sensitive information is inevitably encountered. Sensitive issues mean that the content of questions themselves can be considered as intrusive and the answers to questions are socially undesirable or unacceptable and the meanings of questions have threat of disclosure. Such as evading income tax, prostitution, HIV-positive, homosexuality, and usage of illegal drugs, that it is difficult to achieve valid information in the area of sensitive topics. If a direct survey research is employed to assess the characteristics of

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sensitive topic, respondents often decline to take part or reply untruthfully and are willing to give socially desirable responses rather than accurate ones because of privacy concerns. Potential threat to accuracy is both nonresponsive and reporting error [2]. A proposed solution is the RRT designed for the purpose of circumventing social desirability bias (SDB), guaranteeing confidentiality, improving respondent cooperation, and procuring reliable estimates [3].

Sensitive issues can be broadly categorized according to character as either quantitative sensitive questions or qualitative sensitive questions (dichotomy and multichotomy) [4]. The RRT was originally introduced by Warner in 1965 [5]. In Warner method, the respondents are given two logically opposite questions, which are sensitive one and nonsensitive one. A first alternative to Warner's design is known as Simmons' model or unrelated question model. In Simmons' model, the respondents are provided with the opportunity of replying to one of two questions by replacing nonsensitive characteristic with innocuous and unrelated one. Further modifications and extensions of the RRT include polychotomous measures and quantitative measures, such as RRT tree model, additive model, and multiplicative model, which was expected to reduce response bias and increase the precision and efficiency of the sensitive estimate.

Our major project funded by the National Natural Science Foundation of China was fully devoted to a detailed application of complex statistical methods that is meaningful and essential for practical investigation of sensitive question, which had not been given before. In this paper, we not only focus on statistical method of additive RRT model of two-stage cluster sampling on quantitative sensitive question survey, but also employ Monte Carlo simulations to examine the reliability and validity of that statistical method.

## 79.2 Two-Stage Cluster Sampling and Additive RRT Model

### *79.2.1 The Concept of Two-Stage Cluster Sampling*

Population composition. Suppose the population is composed of $N_1$ primary units, and the $i$th primary unit contains $N_{i2}$ secondary units ($i = 1, 2, 3, \ldots, N_1$). On average, each primary unit contains $\overline{N}_2$ secondary units. The $j$th secondary unit of the $i$th primary unit contains $N_{ij3}$ tertiary units ($i = 1, 2, 3, \ldots, N_1$, $j = 1, 2, 3, \ldots, N_{i2}$). On average, each secondary unit contains $\overline{N}_3$ tertiary units. The population totally includes $N$ tertiary units.

Sampling process. At the first stage, $n_1$ primary units were drawn from the population. At the second stage, $n_{i2}$ secondary units were chosen from the $i$th chosen primary unit ($i = 1, 2, 3, \ldots, n_1$). On average, $\bar{n}_2$ secondary units are drawn from per chosen primary unit. The total tertiary units were investigated from the chosen secondary unit.

### 79.2.2 Additive RRT Model for Quantitative Sensitive Question

The additive RRT model for quantitative sensitive questions was designed to create uncertainty about the validity of the respondent's answer and, thereby, provide the respondent with some degree of confidentiality in answering sensitive questions that require a numerical response. Respondents would be asked to scramble their responses utilizing a presetting randomization device which contains a pack of 10 cards identical in all respects. Each of the cards in the deck would have a number listed on it, labeled by the integers from 0 to 9.

Each sampled respondent (all the tertiary units from the chosen secondary unit) is instructed to pick up one random card out of the deck without telling the interviewer what the card said. This process is known as simple random sampling with replacement. And then the respondent reported a value (Z) which is obtained by adding a value of chosen card (random variable Y) to the true value of the response to the sensitive question.

### 79.2.3 The Statistic of Two-Stage Cluster Sampling

The calculation of $\mu_{ij}$. Let $\mu_{ij}$ represent the mean of the sensitive study variable obtained for the $j$th secondary unit drawn from the $i$th primary unit; let $\mu_{ijZ}$ stand for the mean of the reported response obtained for the total $j$th secondary unit drawn from the $i$th primary unit. And let $\mu_Y$ denote the mean of random variable generated by the given randomization device. We get the unbiased estimator for $\mu_{ij}$, given by

$$\mu_{ij} = \mu_{ijZ} - \mu_Y (i = 1, 2, \ldots, ; j = 1, 2, \ldots,) \tag{79.1}$$

The estimator and variance of the population mean. Let $y_{ijk}$ represent the values obtained for the $k$th tertiary unit in the $j$th secondary unit drawn from the $i$th primary unit; let $\hat{\mu}_i$ be the estimator of the mean of the $i$th primary unit. And let $\hat{\mu}, V(\hat{\mu})$, respectively, stand for the estimators of the population mean $\mu$ and the variance of $\hat{\mu}$. According to Cochran and Wang [1, 6], we can approximately get the estimator of the population mean $\mu$ and the estimator of the mean of the $i$th primary unit.

## 79.3 Monte Carlo Simulation

### 79.3.1 Create a Simulated Population

Field survey. Two-stage cluster sampling was employed to investigate behavioral features of MSM in Beijing, capital city of China, in August 2010. Define districts/countries as the primary units, gay-identified venues (e.g. nightclubs, parks, bars,

and bathhouses/saunas) as the secondary units, and the MSM as tertiary units. Beijing Municipality comprises 16 administrative county-level subdivisions, of which 14 are districts and two are counties ($\bar{n}_2 = 16$). At the first stage, six administrative county-level subdivisions were drawn ($\bar{n}_2 = 6$). At the second stage, five gay-identified venues were, on average, selected from each chosen administrative county-level subdivision ($\bar{n}_2 = 5$). A total of 1,523 MSM were investigated from all the chosen gay-identified venues. Additive RRT model for sensitive quantitative characteristics is presented for application to ask MSM about the average age of them who had their first male sexual partner. From formulae [6], we could get answer to this question. The average age of MSM who reported first sex with a male partner is 20.24 years ($\hat{\mu} = 20.24$), and the estimator for $V(\hat{\mu})$ which denotes the variance of $\hat{\mu}$ is 0.31 ($v(\hat{\mu}) = 0.31$).

Construct a simulated population. We define a simulated population that is a finite population comprising the 1,523 MSM who enrolled in the field survey in Beijing. The simulated population consists in six primary units ($N_1 = 6$), each averagely with five secondary units ($\overline{N}_2 = 5$), each of which averagely has 51 tertiary units ($\overline{N}_3 = 51$). Primary units contain 7, 5, 4, 5, 6, and 3 secondary units, respectively. The simulated population totally contains 1,523 tertiary units ($N = 1{,}523$). Therefore, the simulated population mean is 20.24 ($\mu = 20.24$).

### 79.3.2 Sample Size Determination Under Simulated Sampling

To have both acceptable reliability and viability in our parameter estimates, we could get sample size of simulated sampling from Wang [6]. At the first stage, 4 primary units ($n_1 = 4$) were randomly drawn from the simulated population. At the second stage, 85 % of secondary units were randomly drawn from the chosen primary unit. The total simulated respondents, which account for approximately 70 % of the entire tertiary units, were investigated from the chosen secondary unit.

### 79.3.3 Monte Carlo Experimental Results

Additive RRT model pertaining to two-stage cluster sampling was employed to investigate respondents in the simulated population who were instructed to answer sensitive question. And then we can get the estimators of the simulated population mean and the simulated population variance of that sensitive question according to formulae [6], i.e. $\mu_0$ and $\mu_0$, respectively. This process is equivalent to playing simulation sampling out one time on a computer, and Monte Carlo simulation sampling was repeated 30 times. All the results of simulated investigation were given in Table 79.1.

**Table 79.1** Monte Carlo simulation results

| Simulation times | $\mu_0$ | $\mu_0$ |
|---|---|---|
| 1 | 18.16 | 1.74 |
| 2 | 22.25 | 2.29 |
| 3 | 22.01 | 2.69 |
| 4 | 19.66 | 1.59 |
| 5 | 20.5 | 1.61 |
| 6 | 18.63 | 2.71 |
| 7 | 21.57 | 2.23 |
| 8 | 17.92 | 2.17 |
| 9 | 22.01 | 2.65 |
| 10 | 21.11 | 2.43 |
| 11 | 17.93 | 1.57 |
| 12 | 21.91 | 2.50 |
| 13 | 21.83 | 1.55 |
| 14 | 22.67 | 1.79 |
| 15 | 17.92 | 2.82 |
| 16 | 18.22 | 2.03 |
| 17 | 21.63 | 1.83 |
| 18 | 17.65 | 2.61 |
| 19 | 21.57 | 2.08 |
| 20 | 19.31 | 1.86 |
| 21 | 17.53 | 2.60 |
| 22 | 18.48 | 2.69 |
| 23 | 18.76 | 2.26 |
| 24 | 18.26 | 1.99 |
| 25 | 18.85 | 2.05 |
| 26 | 22.01 | 1.80 |
| 27 | 18.39 | 1.94 |
| 28 | 19.21 | 1.93 |
| 29 | 17.36 | 2.45 |
| 30 | 22.62 | 2.60 |

### *79.3.4 Evaluation Reliability and Validity in Sensitive Question*

The principles of reliability and validity are fundamental cornerstones of the scientific method. Reliability is defined as the extent to which a measurement is repeated under identical conditions [7]. Validity refers to the degree to which a test measures what it purports to measure [8]. Establishing good quality studies need both high reliability and validity.

Assessment of reliability, The one-sample Z-test is used to test whether the mean of every simulation-based investigation into the sensitive question which can be considered as the simulated sample mean $\hat{\mu}$ is significantly different from the simulated population mean ($\mu_0 = 20.24$). Table 79.2 gives a summary of

**Table 79.2** Assessment of reliability and validity of sensitive question

| Simulation times | $S_{\hat{\mu}}$ | $S_{\hat{\mu}}$ | $Z = \frac{\hat{\mu}-\mu_0}{S_{\hat{\mu}}}$ | $p$ value |
|---|---|---|---|---|
| 1 | 18.16 | 1.32 | −1.58 | 0.11 |
| 2 | 22.25 | 1.51 | 1.33 | 0.18 |
| 3 | 22.01 | 1.64 | 1.08 | 0.28 |
| 4 | 19.66 | 1.26 | −0.46 | 0.65 |
| 5 | 20.5 | 1.27 | 0.20 | 0.84 |
| 6 | 18.63 | 1.65 | −0.98 | 0.33 |
| 7 | 21.57 | 1.49 | 0.89 | 0.37 |
| 8 | 17.92 | 1.47 | −1.57 | 0.12 |
| 9 | 22.01 | 1.63 | 1.09 | 0.28 |
| 10 | 21.11 | 1.56 | 0.56 | 0.58 |
| 11 | 17.93 | 1.25 | −1.84 | 0.07 |
| 12 | 21.91 | 1.58 | 1.06 | 0.29 |
| 13 | 21.83 | 1.24 | 1.28 | 0.20 |
| 14 | 22.67 | 1.34 | 1.82 | 0.07 |
| 15 | 17.92 | 1.68 | −1.38 | 0.17 |
| 16 | 18.22 | 1.42 | −1.42 | 0.16 |
| 17 | 21.63 | 1.35 | 1.03 | 0.30 |
| 18 | 17.65 | 1.62 | −1.60 | 0.11 |
| 19 | 21.57 | 1.44 | 0.92 | 0.36 |
| 20 | 19.31 | 1.36 | −0.68 | 0.50 |
| 21 | 17.53 | 1.61 | −1.68 | 0.09 |
| 22 | 18.48 | 1.64 | −1.07 | 0.28 |
| 23 | 18.76 | 1.50 | −0.98 | 0.33 |
| 24 | 18.26 | 1.41 | −1.40 | 0.16 |
| 25 | 18.85 | 1.43 | −0.97 | 0.33 |
| 26 | 22.01 | 1.34 | 1.32 | 0.19 |
| 27 | 18.39 | 1.39 | −1.33 | 0.18 |
| 28 | 19.21 | 1.39 | −0.74 | 0.46 |
| 29 | 17.36 | 1.57 | −1.84 | 0.07 |
| 30 | 22.62 | 1.61 | 1.48 | 0.14 |

statistical analyses on data from simulation survey. The $p$ value statistic for a two-tailed test ranges from 0.07 to 0.84. It is clear that there are no statistically significant differences between each simulated sample that have a $p$ value more than 0.05 and the simulated population. Thus all the results of simulated investigation are very close to the simulated population mean $\mu_0$, showing that the method and formulae for additive RRT model for application to quantitative sensitive question under two-stage cluster sampling appear highly reliable.

Assessment of validity. The total results of simulated investigation are very close to the simulated population mean $\mu_0$. In addition, the simulated populations mean was acquired by researchers when conducting real investigation, showing that the method and formulae presented in this study is accurate and valid.

## 79.4 Discussion

Monte Carlo methods are stochastic techniques based on the theory of probability and mathematical statistics [8]. This class of computational algorithms relying on random sampling provides a viable alternative to generation of multiple trials to determine the expected value of a random variable, and its structure is simple and easy to program and debug. In many of the useful applications, the mathematical problem itself arises in a problem of probability in physics, biology, pharmacy, operational research, general statistics, economics, or econometrics.

Monte Carlo methods can be divided into three categories: the sampling methods, the optimization methods, the integration methods. In the current research, a Monte Carlo sampling simulation was produced to imitate situations that present the process of practical investigation. The simulation procedure involved the construction of a stochastic model of the sampling process by using a series of random sequence and the performance of sampling experiments upon it and the calculation of simulated survey parameters. This Monte Carlo scheme, employed under two-staged complex survey designs for sensitive question, had certain innovation and high-applied value.

During the past decades, RRT had been successfully applied to the study of various kinds of sensitive topics and had acquired good effect of application. Compared with the conventional data collection methods of face-to-face interviewing, telephone interview, computer-assisted interviews, and self-administered questionnaires (SAQ), RRT produce significantly more valid and reliable estimates of embarrassing questions.

However, most of the literatures on theory of RRT are restricted to simple random sampling, especially for the research on sensitive questions. Moreover, objects of investigation into sensitive topics, initially confined to a small range, are selected by a simple random design. Furthermore, the analysis of complex sample survey data might be performed with formulae which only take characteristics of the sample design into account. In addition, evaluations of reliability and validity on sensitive questions in survey research using the RRT have been seldom reported. In our present study, these weaknesses have been successfully overcome.

The method and formulae for additive RRT model relating to two-stage cluster sampling on sensitive question survey show strong reliability and validity. Thus, two-stage cluster sampling presented in this paper is recognized as an effective method for obtaining more accurate estimates of sensitive quantitative characteristics in the context of survey sampling. This would be expected to not only allow local policy makers to better formulate public health policy, but also provide the scientific basis for effective prevention and control of HIV/AIDS among high risk group.

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# Chapter 80
# Study on Suitable Exception of National Anti-Monopoly Law Based on Economics Curves

**Xia Yue**

**Abstract** Based on the literature of the national anti-monopoly, this paper analyzed the relevant law of the applicable exception mechanism and the anti-monopoly law. It came to the conclusion on premise principles, means, and modes of the applicable exception mechanism in Chinese anti-monopoly law. Meanwhile, it analyzed from the angle of economics and under the anti-monopoly applicable exception mechanism that how the monopoly manufacturers realized the effective competition in the condition of the economies of scale and competition efficiency. And it pointed out the analysis which was about the necessity and importance of the applicable exception mechanism on the national anti-monopoly law not only helped to safeguard the social interest and promoted the progress of technology and innovation but also helped to improve the comprehensive national strength and promoted and perfected the national anti-monopoly law.

**Keywords** Anti-monopoly law · Applicable exception mechanism · Economics · Competition · Curve equation

## 80.1 Introduction

In China, the anti-monopoly applicable exception mechanism or the legal monopoly or applicable exemption meant the anti-monopoly law and other related laws or regulations might touch to the anti-monopoly law and violate its relevant rule and mechanism of some special industry, industry or a special way of the

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enterprise, but the laws and regulations would not investigate their responsibilities. And the main body of the mechanism was the specific industries and some enterprises which were important for the country's economic benefits and social benefits but relatively did not cause huge interference and influence to the market competition [1, 2]. It was mainly to restrain the overall social benefit and interests in a certain competition pattern [3]. This paper was based on some relevant rules of the national anti-monopoly law to study and discussed the applicable exception mechanism which was aimed to guide the specific industry and enterprise to carry on the reasonable and effective approach to achieve a better economic and social benefit, thus creating more benefits and value for the society and our nation.

## 80.2 The Legislation Premising Principles, Means and Modes of the Anti-Monopoly Applicable Exception Mechanism

### *80.2.1 The Legislation Premise Principles of the Anti-Monopoly Applicable Exception Mechanism*

The legislation premise principles of our anti-monopoly applicable exception mechanism formulated that the mechanism could not damage the country's economic and social benefits, and maintained the benefit as the prerequisite. The legislation premise principles of the anti-monopoly suitable exception mechanism and the anti-monopoly law were unified, or they were the corresponding echo to each other. The effective competition in the market was only as the surface rule of the anti-monopoly law, and it was a effective way to realize the interest balance of our society and the market, to maintain the relative stability of the market and the social value [4].

### *80.2.2 The Legislation Means of the Anti-Monopoly Applicable Exception Mechanism*

The legislation means of the anti-monopoly applicable exception mechanism was divided into the behavior exemption and department exemption. The former one was to remove some patterns possessing banned competition with a specific reason in the anti-monopoly laws and regulations and it was direct at the specific patterns of behavior [5]. While the latter was mainly for specific industries and department it would be excluded from the anti-monopoly law. But along with the development of the society and the times, all countries thought that all the industries and the department should not belong to the limit category of the anti-monopoly law. Exemption means was better, but it has strict standard and other premises.

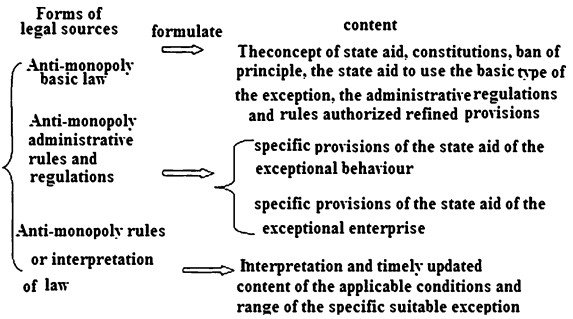


**Fig. 80.1** The entity framework figure of the national anti-monopoly applicable exception mechanism

### *80.2.3 The Legislation Modes of the Anti-Monopoly Applicable Exception Mechanism*

The legislation mode of the anti-monopoly applicable exception mechanism was combined with specific political economy, law, and the current situation of each country. It would correspondingly be affected by the impact of these factors. The United States anti-monopoly suitable exception mechanism was spreader in some provisions. And German formed a perfect system. The anti-monopoly law of China was more perfect and systematic, and formed a legal system [6, 7].

From Fig. 80.1, we could know that the entity framework figure of the national anti-monopoly applicable exception mechanism was mainly divided into three parts which were the basic law, administrative regulations, and rules or legal interpretation. The basic law mainly formulated the concept, elements and types, and authorization; the administrative rules and regulations were to formulate specific provision; rules or legal interpretation were mainly to do the corresponding notes, or updating.

## 80.3 Research on the Realization of the Effective Competition in the Anti-Monopoly Applicable Exception Mechanism from the Angle of Economics

### *80.3.1 The Enterprise Scale Economy of the Anti-Monopoly Applicable Exception Mechanism*

When enterprise was in the growth stage, it constantly expanded production capacity. Because the expansion of the scale, the economic benefit of enterprise increased, and the enterprise made more profit. That was the enterprise scale economy; but when the enterprise expanded to a certain scale, further increases production would lead to lower efficiency, and then the size of the economic phenomenon appeared. The most fundamental reason of these two phenomenons was the impact of the enterprise expansion.

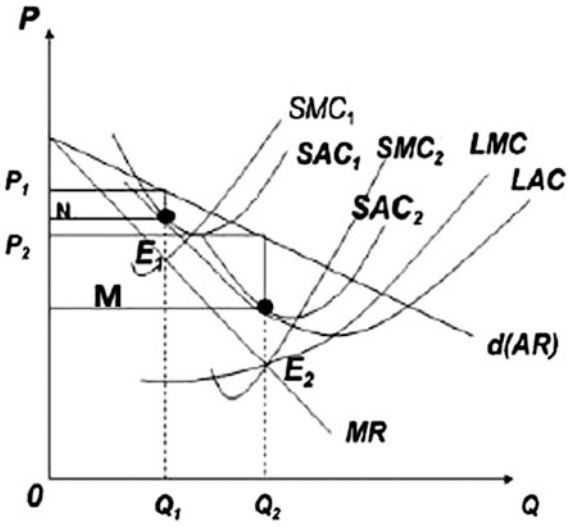


**Fig. 80.2** The scale curve of monopoly enterprise economics

We would analyze the natural monopoly of the anti-monopoly exception mechanism [8]. As shown in Fig. 80.2, *d* stand for demand, so the corresponding curve was the demand curve. Curve *MR* was the marginal benefit curve. *LAC*: long-term average cost curve; *LMC*: long-term marginal cost curve. If the initial enterprise product in $SAC_1$ and $SMC_1$ category, in this stage, when the monopoly plants used $MR = SMC$ as the standard condition, it should be made changes to realize the 25 to (equilibrium output) and $P_1$ (equilibrium price) accordingly. When implemented $E_1$ balance, the monopoly profits could be shown by *N*. When in the long-term production process, in order to achieve maximum benefit, enterprises needed to expand production with $MR = LMC$ as the standard. To realize the balance of $E_2$, $Q_2$ (equilibrium output), and $P_2$ (equilibrium price), manufacturers would make the optimal production scale adjustment, shown as $SAC_2$ curve and $SMC_2$. And in this stage, monopoly enterprises also made the most profit and we could use *M*. The realization of the benefits was based on the monopoly of the market, and the manufacturers should properly adjust their capacity expansion.

### *80.3.2 Anti-Monopoly Suitable Exception Competition Efficiency*

When faced with the imperfect competition and monopolistic competition market, the production capacity of the enterprise was less than ideal production. This was also like many small enterprises product homogeneous commodities which caused the crowded and the excessive competition situation.

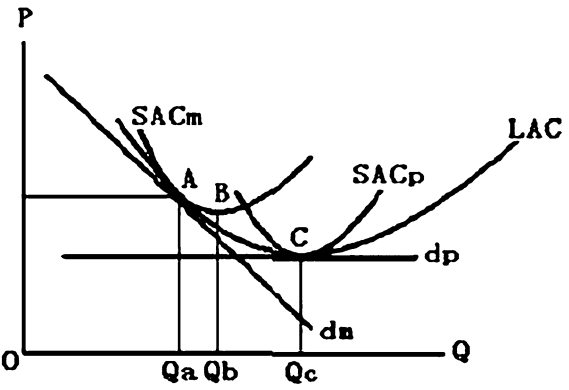


**Fig. 80.3** Monopoly enterprise competition efficiency curve

In Fig. 80.3, the *dm* and *dp* stand for the demand curve, but the former was monopolistic competition of the demand curve while the latter was for perfect competition of the demand curve. Along the tilt of the lower *dm*, when in the realization of the long-term equilibrium condition, *LAC* (long-term marginal cost curve) can only reached a point on the left of the area, but if the manufacturer was completely in competitive state, and achieve long-term equilibrium, *dp* would reach the lowest point *C* tangent. When compared the two points of corresponding production, $Qa < Qc$ the actual minus ideal production was namely for remaining capacity $(QaQC)$. *QaQb* Stand for other not fully and effectively use the equipment configuration. *QbQc* Said enterprise fails to capacity increases production conditions. Anti-monopoly suitable exception mechanism was to effectively control excessive competition in the market and made the social resources be fully use and play thus realizing the scale economy, at the same time, competed reasonably and effectively [9, 10] (Fig. 80.4).

As shown in Table 80.1, from the long-term marginal cost curve of *QaQb* and *QbQc* factors, *dm* accounted for 0.54 of the demand curve data under the monopolistic competition while under perfect competition the ratio was 0.17. As to *dp*, the ratios were 0.24 and 0.44. As the result shown that *Qab* accounted for more under monopolistic competition than perfect competition that was to say the country's anti-monopoly law adapted to the development of Chinese market demand under the perfect competition.

## 80.4 Analysis on the Necessity and Importance of the Anti-Monopoly Exception Mechanism

Anti-monopoly law was to promote harmony and fair competition. Appropriate monopoly could not only realize effective stimulation of the competition, but also improve the production efficiency and achieve scale effect and economic, and meet demand while giving consumers more interests.

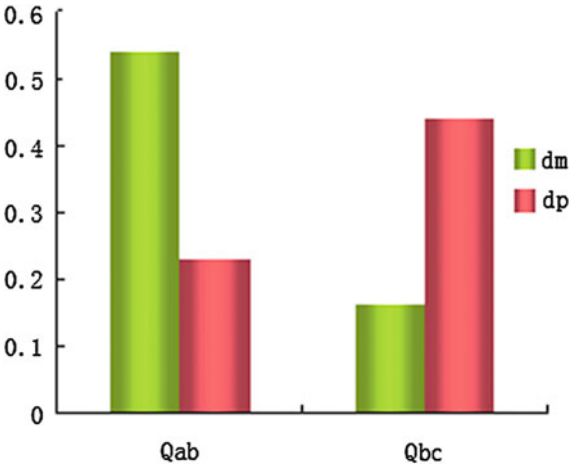


**Fig. 80.4** The contrast diagram of EBQ VE TLCQ factors

**Table 80.1** The long-term marginal cost curve data table of *QaQb* and *QbQc* factors

| | *Qab* | *Qbc* |
|---|---|---|
| *dm* | 0.54 | 0.17 |
| *dp* | 0.24 | 0.44 |

(1) Help to safeguard the social interests

In the pursuit of scale production, we should take certain means to control the society to develop peacefully and coordinately, thus realizing efficient distribution of resources and the most economic interests. At the same time, also met the needs of the various social groups not only should reflect a fair basis conditions, but also to realize economic and the most social benefit to safeguard social interests. Anti-monopoly law exception mechanism was combined with the economic and social status and the coordinated development of the phase. Only realized the effective coordination, could market compete orderly, and create a orderly market, a stable society. And people's life could be ensured and the society could be more harmonious and fair.

(2) Help technology progress and innovate

Modern social competition reflected the technological competition, and technology could not only bring the rapid social development, but also realize higher benefit and the lasting core competitiveness. If an enterprise had no core technology and could not realize the technology progress and innovation, the enterprise could not exist for long and could not realize the sustainable development. Finally, it would be eliminated by society. At the same time, under the trend of modern economic globalization and information globalization, the enterprise should constantly develop technology to let itself invincible and constantly change its process; technology and so on, thus making itself could not be imitated by

others and beyond [11]. So the enterprise could walk in the leading edge of the times and industry, and finally went out of the country to realize the national market competition and get more benefit and value. Only realized the technology progress and innovation could the enterprise compete and cooperate internationally. And only in this way could they realize the powerful combination and the sustainable development.

(3) Help to improve the overall national strength

If countries wanted to go out of the country and realize international competition and stand firmly, they must participate in international competition. In international stringent standards, only to face the competition of the international market could they stand on the international market to participate in the international market competition, achieve higher profits and manifest the comprehensive strength of the country. In developed countries, some had used the anti-monopoly exception mechanism to realize the technology innovation and reform as well as the economy industry structure adjustment [12]. This could not only help to reach the company's rapid development by the power of the state but also captures the international market field by the policy of the country, thus improving the overall national strength of a country.

(4) Help to fix and improve the anti-monopoly law

And the existences of things were complementary relationship. The constant improvement of the exception applicable mechanism correspondingly helped the correction and improvement of the anti-monopoly law. Because every single country in the world held a vague position for monopoly, there were a variety of practices and did not have a uniform standard. Only after effective discussion and analysis of regulations and through the development of the law could they function effectively [13]. And exception mechanism also could cause the anti-monopoly law easy to be operated flexible and changed the mechanical processing mode. In the market competition, unified regulations were helpful for the market to be stable. Effective reasonably suitable perfect and improvement of the mechanism could help the anti-monopoly laws to be more flexible and open and would make the social more harmonious, and do good to the sustainable development of society.

## 80.5 Conclusion

China should legislate with knowledge, economic globalization. In the economic globalization background, the world formed a new era which made knowledge, information as the core. National anti-monopoly legislation used the globalization of economy as the backing and globalization angle to position them.

Used the combination of the listing and summarization to plan for the relevant system range of the anti-monopoly exception applicable law. Due to the various

causes and purposes between different countries, to promote domestic out was the core purpose of the market competition. In increasingly combination of the domestic and international market, the relevant departments should abide the international obligations and pay attention to the national markets as well as the coordination of conflict for anti-monopoly policy. Meanwhile, pursued national strategic interests and reasonable allocation of resources in the global range to promote the benign competition and maintain the competition order of the international market, and made it operate healthily and stably.

Combined with the national conditions, we should prevent blind competition comparisons. As a socialist country developing rapidly, we still regarded the industrial economy as the leadership thus restraining the laws could not advance superstructure, otherwise would lead an illegal norms effect and could not promote the economic development of the whole state. We should learn from the legislative system and advanced experience of the developed countries, and based on the national situation to strictly prohibit the abuse of intellectual property rights and natural monopoly, and to protect the country's industrial development and economic security.

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# Chapter 81
# Identifying Method of University Poor Students Based on Ethics and Score Statistics of Index Weight

**Linlin Li and Dongchao Jia**

**Abstract** The modern society pays more and more attention to poor students; universities also have many appropriate subsidies and preferential policies for poor students and provide a lot of work-study opportunities. However, at the same time, we must consider the psychological feature of poor students and use various methods to identify poor students. So how to carry out the identification of poor college students is our thinking focus. This article constructs poor student's index system from the ethics of qualitative point, mainly including its own, family, school and society four levels of indexes determination, combined with analytic hierarchy process for the poor students' identification methods for quantitative analysis. This paper attempts to transform qualitative problem into quantitative problem, finally constructing poor student's identity identification system based on the view of ethics, identifying poor students in universities more effectively, so that universities can be much fairer and more justice when they carry out corresponding activities and work.

**Keywords** Ethics · Evaluation method · Analytic hierarchy process · Index weight · Score statistics

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## 81.1 Introduction

At present, the poor students, as a special group, their living and learning are greatly concerned by community, school, and even country. China gives them care and help by taking various financial aid measures, strengthening and improving universities' funding system, and measures and policies. Each university has a basic identification pattern to identify poor students [1]. There also exists problems including social, school, and individual factors in the working process of identifying poor students. For more humane, scientific, fair, accurate for the poor students identity identification, rational use of social funding resources, ensuring college poor students each internal funding system, policy and measure to implement the real impoverished students, we carry on the discussion of poor students identity identification system from the perspective of ethics, showing humanistic care for poor students [2].

## 81.2 Analysis on Identifying Method of College Poor Student

### *81.2.1 The Index System of Poor Students*

At present, the influencing factors of identifying poor students in colleges and universities mainly include four aspects; namely, the students' own factors, family factors, school factors, and national social situation factors. In order to easily measure on index, criterion level corresponding to index hierarchy index factor selection needs to select clearer and measurable indicators factors identified as factors. As shown in Table 81.1.

Table 81.1 shows the selected index identified factors from students personal factors of the standard level mainly include average monthly standard cost of living, buying expensive items, drinking, smoking habits and go out to work or work-study, and so on. [3]. Valuables are defined according to current social and economic situation as well as the students' professional and personal work, not regarding expensive computer, mobile phone, and other electronic products as a veto premise; students' family factor is one of the most important influencing factors of the criterion level, so in the index hierarchy "the per capita monthly household income" of family factors is the most difficult to value and execute; therefore, we resort to deceit declaration student punishment based on the principle of good faith, in a fair, objective, and impartial identification of poor students; students' school factor adds school grants and scholarships for the school, in order to achieve the purpose of helping poor students comprehensively [4]. Regarding helping each other as a principle in the subsequent application, students who have won scholarships or grants should give priority to those who have not. And students' learning performance ranking is to encourage the

**Table 81.1** Index system table on identifying college poor students

| Target level X | Standard level Y | Index level Z |
|---|---|---|
| Impoverished cognizance level factors of identifying college poor students | Students' own factors | The average monthly standard cost of living |
| | | Situation of buying expensive things |
| | | Drinking, smoking habits |
| | | Go out to work or work-study etc. |
| | Family factors | The per capita income |
| | | Family member |
| | | Family minimum condition |
| | | Number of family labor |
| | | Household situation |
| | School factors | Scholarship |
| | | School grants |
| | | Disposal situation |
| | National social situation factors | Living condition of permanent address areas |
| | | Whether being the students in the disaster area |

majority of students to regard learning as their major task, study hard, finish school, and repay the society; in the national social situation factor, we follow the principle of people oriented, to students of impoverished area and the disaster area, such as landslides, earthquakes, floods, and other disasters factors leading to poor students, we should give humanistic care.

### *81.2.2 Determining the Index Weight of Impoverished Students*

Identify the importance between index factors through the way of experts scoring on each index factor, each index weight fraction are got by soliciting of expert opinion, as shown in Table 81.2.

Table 81.2 shows in index hierarchy, we can know after experts scored, the contrast of various factors' importance at the object level is shown in Fig. 81.1, while the contrast of each factor's importance in the standard level is shown in Fig. 81.2.

According to Table 81.1 the index system of factors was graded, and according to Table 81.2, experts assessed each index weight scoring table, the judgment matrix of five relevant poor students is constructed [5, 6].

**Table 81.2** Experts on the evaluation of each index weight scoring table

| Y | Z |
|---|---|
| 0.47 | 0.44 |
| | 0.23 |
| | 0.23 |
| | 0.1 |
| 0.31 | 0.36 |
| | 0.2 |
| | 0.21 |
| | 0.12 |
| | 0.11 |
| 0.12 | 0.54 |
| | 0.23 |
| | 0.14 |
| 0.1 | 0.66 |
| | 0.34 |

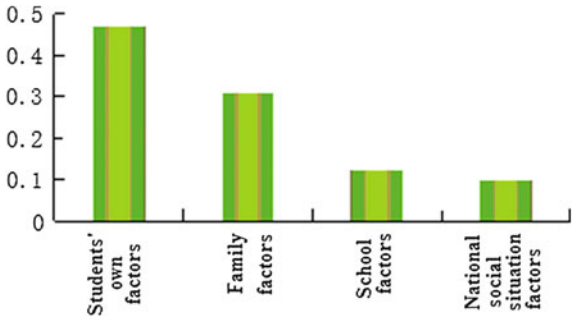


**Fig. 81.1** Contrast of standard level factor's importance in index level

$$X = \{0.47, 0.31, 0.12, 0.1\}$$
$$Y1 = \{0.44, 0.23, 0.23, 0.1\}$$
$$Y2 = \{0.36, 0.2, 0.21, 0.12, 0.11\}$$
$$Y3 = \{0.54, 0.23, 0.14\}$$
$$Y4 = \{0.66, 0.34\}$$

Therefore, the index judging matrix table of poor students is not $Y4 = \{0.66, 0.34\}$ as Table 81.3 shown

### *81.2.3 Doing Index Data Matrix Consistency Test*

From Table 81.4, we can draw a conclusion: the consistency test result of the index judging matrix of poor students is satisfied [7]. Therefore, we can make clear the index weight system of poor students, namely system weight is the important

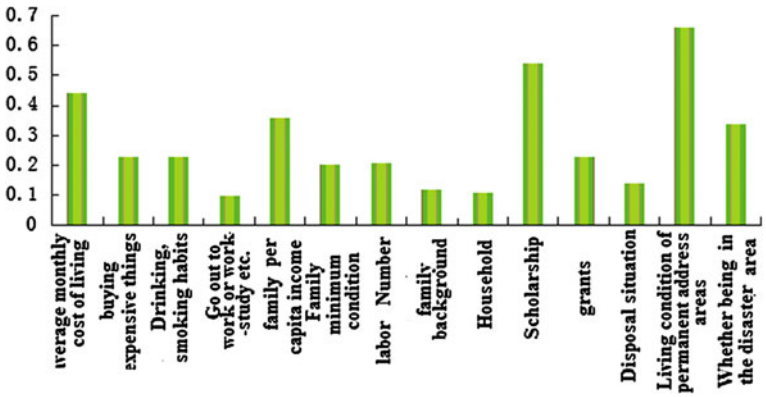


**Fig. 81.2** The contrast of index level factors' importance in standard level

**Table 81.3** The index judging matrix table of poor students

| X | Y1 | Y2 | Y3 | Y4 | | Y1 | Z1 | Z2 | Z3 | Z4 |
|---|---|---|---|---|---|---|---|---|---|---|
| Y1 | 1 | 3 | 4 | 5 | | Z1 | 1 | 2 | 3 | 4 |
| Y2 | 1/3 | 1 | 3 | 4 | | Z2 | 1/2 | 1 | 2 | 3 |
| Y3 | 1/4 | 1/3 | 1 | 2 | | Z3 | 1/3 | 1/2 | 1 | 2 |
| Y4 | 1/5 | 1/4 | 1/2 | 1 | | Z4 | 1/4 | 1/3 | 1/2 | 1 |
| Y2 | Z5 | Z6 | Z7 | Z8 | Z9 | Y3 | Z10 | Z11 | Z12 | Y4 |
| Z5 | 1 | 2 | 3 | 3 | 6 | Z10 | 1 | 3 | 5 | Z13 |
| Z6 | 1/2 | 1 | 2 | 4 | 5 | Z11 | 1/3 | 1 | 2 | Z14 |
| Z7 | 1/3 | 1/2 | 1 | 2 | 4 | Z12 | 1/5 | 1/2 | 1 | |
| Z8 | 1/3 | 1/4 | 1/2 | 1 | 4 | | | | | |
| Z9 | 1/3 | 1/5 | 1/4 | 1/4 | 1 | | | | | |

degree quantitative ratio of all index factors of different aspects, and it can be used as a poor student evaluation factor, an important basis to treat poor students differently.

## 81.3 Constructing Poor Students Identification System from the Perspective of Ethics

### *81.3.1 Establish Determination Index System of Ethics Humanistic Poverty*

Poverty index determination system and ethics seem not related, but both reflect the education authority and the humanistic care of education for students. Their combination can better solve the allocation of funds shortage caused by lack

**Table 81.4** Index consistency test results

| The index hierarchy factors | N | CI | CR | Consistency test results |
|---|---|---|---|---|
| Y4 | 3 | 0.05 | 0.043 | CR < 0.2 |
| Y3 | 5 | 0.007 | 0.006 | CR < 0.2 |
| Y2 | 7 | 0.006 | 0.003 | CR < 0.2 |
| Y1 | 5 | 0.017 | 0.017 | CR < 0.2 |
| X | 5 | 0 | 0 | CR < 0.2 |

of education resources. Ethics view of poverty index determination system is showing human nature and ethics function of the perspective of ethics at the time of embodiment of the mandatory implementation of the guidelines. At the same time, follow the principle of fair and justice at the time of arrangement and supply of poverty index determination system [8]. Determination and funding process of poor students in colleges and universities, almost all universities sponsor students by loaning, helping, awarding, and so on. This is very important for poor students' founding work of universities and relatively backward economic development areas. Therefore, poor students identification system should be based on ethics idea, cannot take some rigid index, and we should use humane index measures to guarantee humanistic care and operable of poor students identification system.

### *81.3.2 Showing the Right Equivalence Principle of Equity and Justice of Ethics Determining*

Right equivalence is the core idea and the principle of fairness, that must be followed in the process of poor student's identification, is guarantee of fair, justice, and equality of the perspective of ethics for the identification of poor students and funding work, and it reflects the ethical justice. And making and carrying out poor student's identification system need to follow students' rights and debt obligations of the principle of fairness. Because of the large number of impoverished students, we must establish and conform to rights and obligations correctly, and do justice ethics.

### *81.3.3 Showing the Ethic Responsibility, Doing the Publicity and Verification Work of the Results of System of Poor Students*

Responsibility of ethics thinks that there require a process at the time of the behavior person to the responsibility of behavior, in order to request the behavior person overcome negative influence, it requests to foresee the outcome before [9].

And the goal of ethics requires that the society gives justice. The aim of publicity and verification work of the results of system of poor students is to meet the needs of modern society and the public's right to know, and effective means to ensure poor college students the process of determining the three principles. There must be three public notices in the procedure of identifying poor students followed by the ethics and human evaluation [10]. This will not only ensure the poor students obtain social aid opportunity, but also maintain their self-esteem. At the same time, the mode of supervision can regulate the behavior and words of poor students, affect the college morality, and also regulate and guide the social ethics morals.

## 81.4 Conclusion

With the social economic development and the increase in number of funding for poor students, identifying university students in poverty to develop and work is facing enormous changes and challenges. Therefore, index identification work for poor students in colleges and universities is a very formidable job. This task requires not only responsibility of college education staff, but also joint attention of the state, society, and researchers. Using scientific method and view of ethics to solve the problem of identifying Chinese impoverished college students is conducive to the correct development of educating poor students in the theoretical funding system and the orderly and smooth development of practice work. They all have important social and economic significance.

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# Chapter 82
# Research on Relationship Between Prefabricated Chunks and Expression Quality Based on Mathematical and Physical Statistics

**Chunyan Luo**

**Abstract** In modern society, college students should not only have high level of knowledge, but also need to have strong interpersonal skills, so the language expression of college students is given high attention. However, college students' language expression is little studied, many researches are only based on language written test. Under prefabricated chunks of the literature data, aiming at the quality of students language expression, to build the index factors and contrast test, to carry out empirical analysis, and then more targeted and data to study it, it is helpful to guide college students to strengthen language skills.

**Keywords** Prefabricated chunks · Written test · Empirical · Index factor · Mathematical and physical statistics

## 82.1 Introduction

In modern society, college students are not only concerned about the professional knowledge and skills, but also pay more attention to communicate with people of college students in the language expression. A person language expression not only reflects a person knowledge level, but also can better reflect ability level. Hence, the students' language quality research is a focus on the topic [1]. Speech output is reflected not only in written expression, also reflected in the oral communication. At the same time, the language quality is determined by a lot of factors; therefore, the academic circles also strengthen the language expression analysis. Based on the premise of prefabricated chunks, to carry out empirical

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analysis for college students' language quality, which not only embodies the analysis of qualitative and quantitative, the data are more convincing, but also has some guidance and practical significance for the university students' language teaching [2, 3].

## 82.2 Prefabricated Chunks Related Modules

Prefabricated chunks are a kind of grammatical structure and vocabulary that are combined to form, it normally contains many words, but also relatively single words can reflect more information, but also have the certain language skills. However, these prefabricated chunks will be stored in the human brain, it will be more familiar and skilled due to the extent of use. It is relatively stable, having a fixed collocation, but also has some changes. At the same time, prefabricated chunks bind to realistic scenarios, and also will reflect the different meaning [4].

Prefabricated chunks can not only provide knowledge search function for the people's exchanges to access information, but also can carry out the information integration that saves the language's acquisition time, making the people to enhance language expression ability, it will be smoother and more fluent, and also more firm for the prefabricated chunks storage, correspondingly also enhance the human communication ability and self-confidence. Written expression not only shows the people regarding the language organizational capacity, more reflected people's comprehensive level, logic thinking for the article writing. Written expression related to the end of the beginning of the article, topic changes, and prefigures transition areas, etc. Those frame are required to have the classic prefabricated chunks, so as to written expression is more logical, the connection is more smooth, structure is clear, to expressed the thinking is a clear overview [5].

The classic prefabricated chunks are stored and used, they can faster organization, improving efficiency and quality, written expression is also more abundant. At the same time, they can also make people learn more native cultural knowledge, making it more appropriate.

From the Fig. 82.1, the generation process of prefabricated chunks rule can be shown that prefabricated chunks are composed of words and a pragmatic component, vocabulary is not analyzed block, the syntax is combined to get the

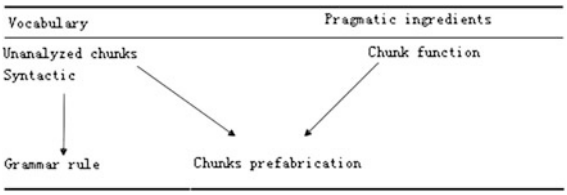


**Fig. 82.1** Prefabricated chunks rule generation process diagram

grammar rules, it will use with language function to get chunks prefabricated chunks, then combined to the grammar rules, it can realize the rule generation process of prefabricated chunks.

## 82.3 Design Research and Method

Aiming at freshmen and junior students of a college English major to conduct a survey, and choosing two classes' students forming of two groups to analyze and to carry out the oral tests, it is mainly through the semi structure interview to research. Interview time is defined as 5 min, content is the combination of students' learning process and experience to question, such as "when did you begin learning English?", "favorite degree of the English language, improving the mode and method of language learning", and so on. Using the recording test for students test, through the data processing and statistics analysis, that is the recording through sound processing software to convert, and to save it as text, and then to carry out the data processing and analysis [6].

## 82.4 Results and Analysis

The premise of the research is that the surveyed students are basically the same level in the intelligence and English language learning. For the survey of the freshmen and junior college students, the involved main elements that are the type of prefabricated chunks, quantity and the use of frequency, to discuss the relationship between their respective and oral fluency, to study entering the university as junior students by the lifting and variation characteristics of the use of prefabricated chunks [7].

### *82.4.1 Prefabricated Chunks Based on the Number of Change Characteristics*

In the number of changes, it mainly reflects that the testing students are obtained from the use of words prefabricated chunks and the proportion of sample quantity. The experimental data obtained that the prefabricated chunks of junior students are significantly greater than the freshmen in the number of words, the former accounted for the mean is 16.55 %, the latter accounted for average is 10.21 %, which also reflects the change characteristics of word using quantitative of students in each period of study for prefabricated chunks.

### 82.4.2 Prefabricated Chunks Based on the Type of Change Characteristics

Prefabricated chunks changes are that language sample prefabricated chunks changes in abundance, and they reflect the overall sample books that are compared to those actual number of entries, and this ratio and 1 were compared with 1 more close to that said the use of prefabricated chunks is very diverse. In the test, the mean value of junior TTR is 0.61 and freshmen is 0.42, which reflect that junior students are more diverse than freshmen for using of the prefabricated chunks.

### 82.4.3 Prefabricated Chunks Characteristics Based on the Using of Frequency

Prefabricated chunks characteristics based on the use of frequency are respondents to the particular prefabricated chunks to show and to use number of times, survey data are shown in Table 82.1.

In Table 82.1, it can be shown that the relationship between the prefabricated chunks and the quality of college students' language expression, smoothing curve as shown in Fig. 82.1, and the curve formula as

$$y = -0.1049Ln(x) + 0.4853 \tag{82.1}$$

From Table 82.1 and Fig. 82.2, it can be shown that the total of the freshmen prefabricated chunks is 200 for using frequency analysis of students' language expressions prefabricated chunks in two groups of experiments, and the junior is 240. However, the freshmen are more than five times the largest number of prefabricated chunks that are 125, at the same time ratio is 62.5 %; the second is the 1 prefabricated chunks number is 38, the proportion has reached 18.7 %, and 14 types; the last is 2–4 times prefabricated chunks number is 37 and accounted for 18.6 %, having six types; the type of 1 prefabricated chunks number is greatest. For the junior, the number of more than five times prefabricated chunks is largest

**Table 82.1** Using frequency of students' language expressions prefabricated chunks in two groups of experiments

| | Total number of prefabricated chunks | | Number of 1 prefabricated chunks | | Number of 2–4prefabricated chunks | | Number of more than 5 prefabricated chunks | |
|---|---|---|---|---|---|---|---|---|
| | Case | Type | Case | Type | Case | Type | Case | Type |
| Freshmen | 200 | 38 | 38 | 14 | 37 | 6 | 125 | 5 |
| Junior | 240 | 99 | 98 | 35 | 84 | 8 | 159 | 9 |

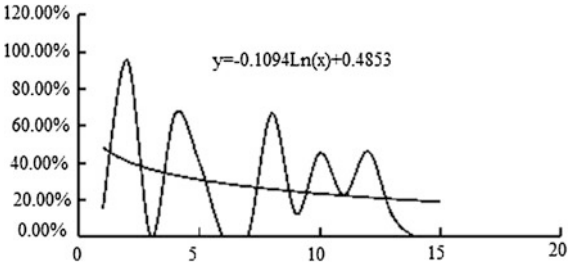


**Fig. 82.2** Relationship between the prefabricated chunks and the language expression quality of college students

that is 159 and accounted for 48.4 %, having nine types; then the number of 1 prefabricated chunks is 98 and accounted for 24.3 %, having 35 types.

In Fig. 82.3, it can be shown that the total number of freshmen is less than junior, whether it is 1 prefabricated chunks or 2–4 times prefabricated chunks, the freshman's data proportion and types are less than junior. The total number of freshmen is less than junior in the more than five prefabricated blocks; however, the proportion is larger than the proportion of junior, and type is the opposite.

### *82.4.4 To Enhance the Role of Oral Fluency in Prefabricated Chunks*

Oral fluency not only reflects that the average value of length of the language fluency is increased, but also correspondingly reduces the hesitation pause; it also reflects a student has improved his/her ability in prefabricated chunks. Mainly to discuss and analyze the four related indicators of language fluency that are respectively MLR (average language fluency length), ALP (average hesitation pause length), SR (language speech rate), and NHP (pauses number). The analysis result is shown in Table 82.2.

Dates of the average value of four oral fluency indicators quality in the two groups of students can be shown in Fig. 82.4. In SR and MLP factors, freshman mean value is greater than junior, however in ALP factors, freshman is 0.93 s that is less than 1.04 s of junior; in NHP factors, freshman is 74.1 that is also less than junior, which is 112.8; the index data of freshman and junior have significant

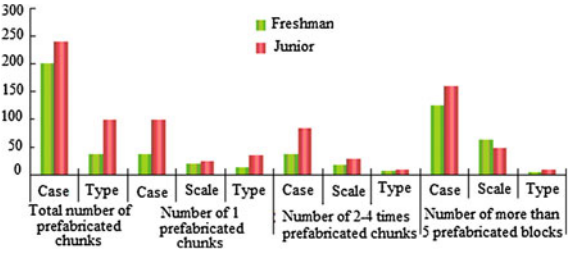


**Fig. 82.3** Frequency comparison chart of language expression prefabricated chunks in two groups of experiment students

**Table 82.2** Data table of the average value of four oral fluency indicators quality in the two groups of students

| | SR (Syllable)/Piece | MLP (Syllable)/Piece | ALP (Second) | NHP (Piece) |
|---|---|---|---|---|
| Freshmen | 161.2 | 8.6 | 0.93 | 74.1 |
| Junior | 134.1 | 5.3 | 1.04 | 112.8 |

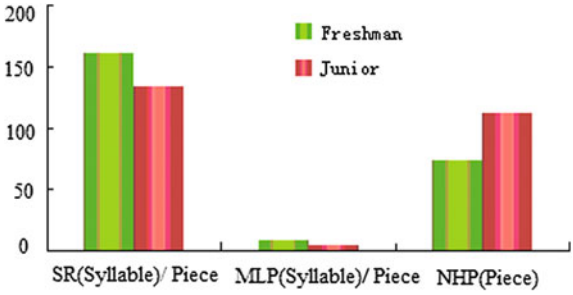


**Fig. 82.4** Comparison chart of the average value of four oral fluency indicators quality in the two groups of students

difference at the 0.05 level, it shows that junior is improved in prefabricated language chunks' skills, and also need to strengthen further guiding and learning.

## 82.5 Conclusion

After the analysis of prefabricated chunks for the freshman and junior, survey shows that students are greatly improved in language expression ability after the students were trained in related knowledge , it is not only reflected in the language coherent, language expression is fluent and smooth, but also improved the use of language. It is embodied in the following aspects.

(1) Language phrase structure is not only significantly lengthened, polymerization of the words and chunks of the sentences is also exhibited different growth. However, some students have the flexibility to be used based on the structure of phrases and sentences to construct chunks, these skills are significantly improved. After lexical aspects of learning, language chunk in the custom has not changed much. This is fully drawn, after learning, custom language chunk use spoken is relatively small in teaching materials, so students are not enough understanding for learning colloquial chunks, it should strengthen college students on the importance, simultaneously must strengthen the study, and continuously strengthen the custom language chunk using;
(2) Students in the chunk type are also dramatically increased, based on phrase structure, chunks are more frequently used in the aspect of a verb and a preposition. At the same time, to build sentence discourse and transform use forms of the existing language, in order to carry out chunk adaptation as form subject dominated, syntactic blocks are also correspondingly increases. And in

the types of sentences, it also shows diversity, reflecting the students' thinking from a single change to the overall concept, based on sentence structure and text construction and the combination of logical relation to carry out expression of chunk opinion, so students linguistic coherence is significantly improved;

(3) College students also begin to pay close attention to chunks operation mode and custom language, they gradually reduce to use for person and modal verbs, mainly using the comment form to be discussed and that can improve their language fluency.

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# Chapter 83
# Study on New Teaching Pattern of College Music Art Major Based on Equations of Mathematical Physics and Statistical Regularity

**Yiwen Zhu**

**Abstract** The current music education and teaching was developing more and more quickly. Various colleges and universities were all exploring new teaching pattern of music art major. It investigated the new teaching reform of music art in schools, economy, and other parts of different areas. And it analyzed the results of new teaching pattern of college music art from the understanding and identity of different teaching content in music teaching field thus getting the teachers and students' favorites as well as the most important and the easiest course content of the new music teaching model. This would provide some basis of the reform for the new music art teaching course.

**Keywords** A new teaching mode · Research and investigation · Statistical regularity · Equations of mathematical physics

## 83.1 Introduction

Nowadays, along with the reform tide of the music art education all over the world, Chinese music art discipline was also constantly doing the internal revision adjustment, especially the research and reform on education mode and teaching system, including the rediscovery on humanistic value and position of music art professional course as well as the development of new teaching model system and teaching methods [1]. In the background of Chinese college students' quality education, the new model of music art professional education obtained a rapid development which had got some achievements and present a good education developing situation [2].

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Lecture Notes in Electrical Engineering 225, DOI: 10.1007/978-3-642-35470-0_83,

## 83.2 Analysis on New Teaching Pattern of College Music Art Major

Music art major was a comprehensive area of art subject which had a unique teaching function [3]. It especially paid attention to the management and maintenance in the student class of music art [4, 5]. It also concentrated on the flexible thinking and rich knowledge as well as the education method and teaching ability of college music art teachers who should be live learning and drove students' thinking to make them both learn music art professional knowledge be edified by esthetic education of music art. The new teaching mode should be equipped with following points [6–8]:

(1) The university teachers of music art major should have very rich knowledge skills and open minds.
(2) As new teaching mode of college music art, it needed special teaching resources and conditions.
(3) As music art, it should strengthen its unique showing forms.

## 83.3 The Research Process of the New Teaching Pattern in College Music Art Major

This paper studied the reform of the new teaching mode of college music art in different school and economy condition of different areas through a long time of questionnaire survey. The investigation data were shown in Table 83.1

This survey had total 279 questionnaires of students including 275 valid questionnaires whose effective recovery rate was 97 %. And the total university teachers' questionnaires were 71 with 65 valid questionnaires and the effective recovery rate was 91 %.

The basic information of new teaching situation survey on college music art major was in the following [9].

The questionnaire survey of university teachers investigated 65 college music art teachers from nine provinces and cities of the first level; College student's survey investigated 275 college students from seven provinces. As shown in Table 83.2, Figs. 83.1 and 83.2.

**Table 83.1** Data statistics of new teaching situation survey on college music art major

| | Questionnaire survey | Students interviews | Discussion | Classroom observation |
|---|---|---|---|---|
| College teachers | 65 | 33 | 2 times | 20 |
| College students | 275 | 21 | | 21 |

**Table 83.2** Data statistics of university teachers and students sample distribution

| | | Provinces | Ares | Counties | Developed areas | Mid-developed areas | Underdeveloped areas | Experimental schools | Schools not in experimental |
|---|---|---|---|---|---|---|---|---|---|
| College teachers | Teachers population | 16 | 18 | 31 | 12 | 5 | 45 | 46 | 16 |
| | Ratio | 24.1 | 29.3 | 45.5 | 17.3 | 9.3 | 73.2 | 70.2 | 29.3 |
| College students | Students population | 106 | 117 | 54 | 67 | 38 | 172 | 162 | 114 |
| | Ratio | 38.2 | 42.6 | 18.9 | 24.1 | 14.1 | 62.5 | 58.3 | 42.9 |

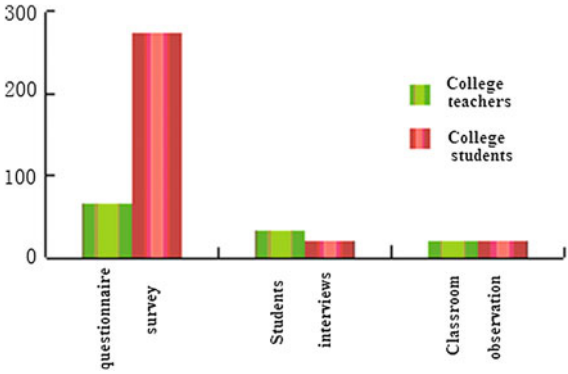


**Fig. 83.1** Contrast figure of new teaching situation survey on college music art major

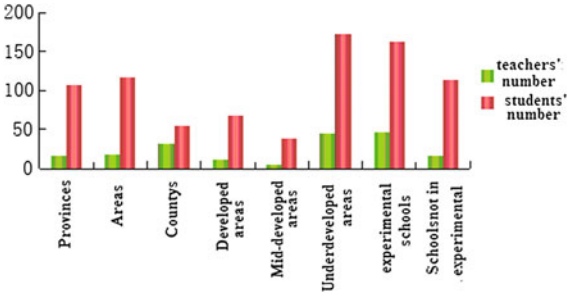


**Fig. 83.2** Contrast figure of university teachers and students samples distribution

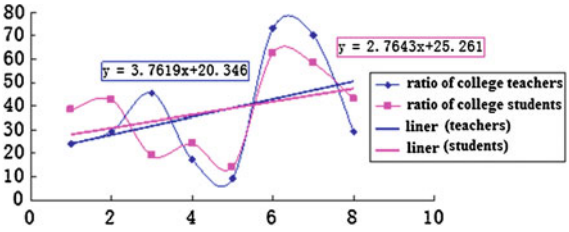


**Fig. 83.3** The regional trend chart of the understanding and recognition of university teachers and students to the new teaching pattern

From the Table 83.2, it was known that the investigated music teachers of provincial level accounted for 23.5 %; 29.8 % of the city level; 46.8 % of the county level. The investigated college students of provincial school were total 102 people, accounted for 38.4 %; 42.3 % of cities; 19.5 % of the county level. That was to say the university students' understanding were different according to the regional difference. And the trend could be shown with the equations [10]:

$$y = 2.7643x + 25.261$$

In which the $x$ stand for the number of the regional investigated students.

And the trend of college teachers could also be shown as the following equation [11]:

**Table 83.3** The questionnaire of the understanding and recognition on university teachers' new teaching pattern

| | The new course adaption | | The new course content | | The education concept of new course | | New curriculum music | |
|---|---|---|---|---|---|---|---|---|
| | Sum | Rate | Sum | Rate | Sum | Rate | Sum | Rate |
| Clear | 21 | 32.1 | 24 | 35.2 | 8 | 28.6 | 26 | 37.8 |
| Not very clear | 43 | 64.2 | 32 | 51.4 | 8 | 56.3 | 37 | 54.1 |
| Unclear | 3 | 3.2 | 7 | 12.4 | 7 | 12.4 | 5 | 9.5 |

$$y = 3.7619x + 20.346$$

In which the $x$ stand for the number of the regional investigated teachers (Fig. 83.3).

## 83.4 The Research Results and Analyses on New Teaching Model of College Music Art

### *83.4.1 The Questionnaire of the Understanding and Identity on University Teachers' New Teaching Pattern*

The teachers' understanding on the new teaching content, the new curriculum as well as concepts and other indicators of music art as shown in statistical Table 83.3

It was known from the above form that most of the university music teachers were in the basic understanding state of the new teaching content, the new curriculum as well as concept and other indicators. Only few college teachers of music art did not understand them. College music teachers should understand new teaching mode and related contents profoundly and keep the identity concept to truly make the new teaching pattern and related contents applied into the teaching process (Fig. 83.4).

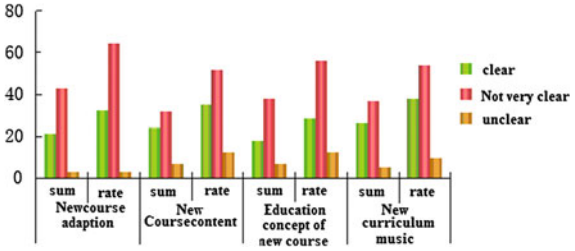


**Fig. 83.4** Contrast figure of the understanding and recognition on university teachers' new teaching pattern

**Table 83.4** The new teaching content table of college music teachers' recognition

| | Reading music | Singing | Appreciation | Self creation | Instrument knowledge | Musical common sense |
|---|---|---|---|---|---|---|
| Very agree | 15 | 29 | 23 | 3 | 5 | 3 |
| Disagree | 11 | 6 | 4 | 26 | 14 | 5 |
| Agree with the teaching content | 4 | 12 | 25 | 4 | 5 | 16 |
| Disagree with the teaching content | 12 | 15 | 3 | 14 | 17 | 6 |
| The most important content | 13 | 24 | 18 | 4 | 6 | 12 |
| The most unimportant | 6 | 3 | 6 | 24 | 21 | 6 |
| The easiest content | 1 | 42 | 6 | 1 | 3 | 11 |
| The hardest content | 14 | 3 | 9 | 28 | 15 | 8 |

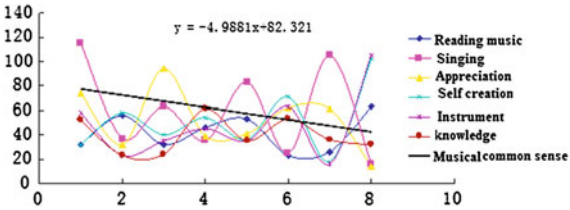


**Fig. 83.5** Contrast figure of college music teachers' recognition of the new teaching content

### *83.4.2 Survey on Teachers' Recognition Degree of the New Teaching Content in the Field of Music Art*

From the Table 83.4, the university music art teachers' likability to the teaching content could be shown as the equation [12]:

$$y = -4.9881x + 82.321$$

So, teacher's favorite was singing, and they did not like creation. University teachers did not believe that the best way to develop teaching materials were to enjoy. And college students also liked singing most and regarded creation as the most difficult one (Fig. 83.5).

### *83.4.3 Survey on Students' Recognition Degree of the New Teaching Content in the Field of Music Art*

From the Fig. 83.6, it was known that students' favorites and the most important as well as the most easiest course content of the new teaching mode was singing and the result was the same with college teachers (Table 83.5).

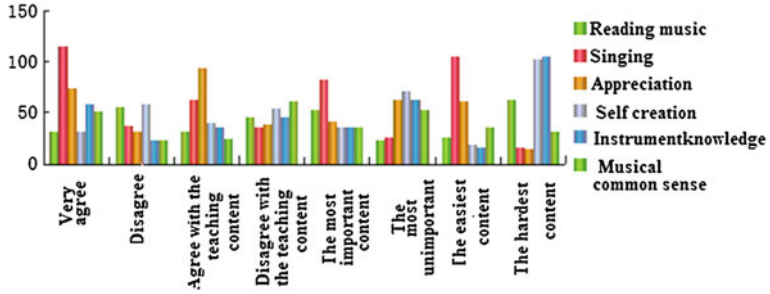


**Fig. 83.6** Contrast figure of college music students' recognition of the new teaching content

**Table 83.5** College music students' recognition of the new teaching content table

| | Reading music | Singing | Appreciation | Self creation | Instrument knowledge | Musical common sense |
|---|---|---|---|---|---|---|
| Very agree | 32 | 115 | 74 | 32 | 58 | 52 |
| Disagree | 56 | 37 | 32 | 58 | 23 | 23 |
| Agree with the teaching content | 32 | 63 | 94 | 40 | 35 | 24 |
| Disagree with the teaching content | 46 | 35 | 39 | 54 | 45 | 61 |
| The most important content | 53 | 83 | 41 | 36 | 35 | 35 |
| The most unimportant | 23 | 25 | 62 | 71 | 63 | 53 |
| The easiest content | 26 | 105 | 61 | 18 | 16 | 36 |
| The hardest content | 63 | 16 | 14 | 102 | 105 | 32 |

## 83.5 Conclusion

The current music education and teaching developed more and more quickly. College music teachers should preach knowledge to students, help students to learn to study, and answer student doubts. In order to be better adapted to the receiving degree of music knowledge in the new era, teachers and students should improve their learning ability level to achieve the need of the society's development. New teaching model of music art should be established for college students to explore and research independently and seek knowledge actively. Therefore, colleges and universities were required to improve the professional teaching effect, carry on the institutions with a clear goal, establish a harmonious relationship between teachers and students as well as the campus, and build a good class atmosphere to constantly develop music field.

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# Chapter 84
# Distributed Computing Method Based on Mathematical Morphology

**Yanbo Wang**

**Abstract** The mathematical basis of mathematical morphology is set theory, which is widely used in the field of image processing, and distributed computing methods will require significant computing resources case that is broken down into small pieces, it has a plurality of computer parallel collaborative, and finally gives the results. Based on the heterogeneous network workstation as research platform, the mapping hyperspectral image processing technology is studied as a case that discusses the mathematical morphology and distributed computing method in the platform applications surveying and mapping hyperspectral image processing heterogeneous. Hyperspectral imaging is a new remote sensing technology. Its effective response time is the key of space earth science and planetary exploration. In response to this problem, the distributed calculation method is realized based on mathematical morphology to establish performance evaluation indicators. Through comparative analysis, the method is verified that using the morphological algorithm of distributed algorithm has a time advantage, which will contribute to the high spectrum image to select the appropriate distributed computing technology and to adopt a particular application strategy.

**Keywords** Mathematical morphology · Distributed computing · High-spectral imaging · Heterogeneous network · Group performance

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## 84.1 Introduction

Mathematical morphology was born in 1964, it is a strict mathematical theory discipline, its basic ideas and methods have had a significant impact for modern mathematical and engineering techniques, the techniques and applications of relevant mathematical morphology are constantly researched and developed. However, the current distributed computing resources are tens of thousands of volunteers to provide, these computational resources via the Internet to transmit data and command control [1]. The mathematical morphology is introduced into the distributed computing, making heterogeneous network more stable performance more powerful, it is an important problem of current faced.

Heterogeneous network is a very promising distributed resources parallel architecture; it is different from the traditional parallel platform, which runs on the heterogeneous cluster of different processors. Traditional parallel algorithm calculates uniform distribution on different processors cannot balance load. In synchronization point, after the faster processor executes the calculation part, it will have to wait for the slower processor. In the heterogeneous computing, it is usually assumed that the processor is not biodegradable, namely a variety of algorithm cannot in the same processor execute. Based on that assumption, it should allocate different work for processor, try to balance the resources allocation, and maximize efficiency [2, 3].

In recent years, the heterogeneous computing has begun in the application of remote sensing image processing to play an important role. This type of acquisition to high-dimensional and large-volume image data set requests processing platform must be highly extensible. In actual use, it is also efficient fast algorithm to give the results of the analysis. For example, satellite images and aerial reconnaissance image field have data size continue to expand, the spatial resolution to deepen, the number of spectral channels to increase, with the passage of time collected sequence images increasing. Based on this, the overall performance of ready-made heterogeneous cluster also needs to improve [4].

## 84.2 Research Purposes

Aiming at the parallel efficiency problem of isomeric system running high spectrum image processing applications, to research on combining mathematical morphology and distributed computing is more efficient use of heterogeneous cyber source [5].

In this study, the platform is a fully heterogeneous cluster, by varying the speed of the processor through the Internet. The computing platform may use graph $G = (P, E)$ as a complete modeling. In the graph model, each node represents a computing resource Pi's weight; weight is associated with cycles $W_i$ Each edge of graph model represents a communication link weights, weight is associated with

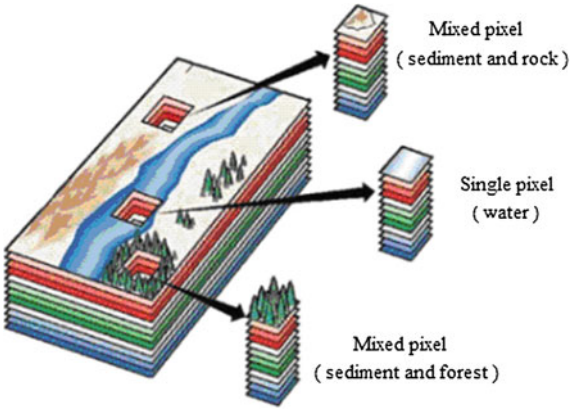


**Fig. 84.1** High-dimensional remote sensing image morphological processing schematic diagram

capacity $C_{i,j}$ $C_{i,j}$ is said from the physical communication node Pi to the slowest link maximum capacity of $P_j$. And the system has a symmetry that is $C_{i,j} = C_{j,i}$. In view of the above hypothesis, to design the hyperspectral image distributed processing scheme. In Fig. 84.1, it is the scheme that briefly sketch has three needs to be considered: the first needs a continuous algorithm to process the large data sets, each pixel in hyperspectral image is represented as a $N$ dimensional vector, setting $W$ is each step of algorithm to implement work's total amount; second, the workload is divided into pieces, so that the parallel execution time is shortest, it needs the load balance work to involve in the resources allocation; the other is an important problem that is resource selection priority, as far as possible to do the best configuration [6, 7].

## 84.3 Application of Morphological Theory in the Distributed Computing Model

To introduce the heterogeneous parallel processing framework of hyperspectral multidimensional image processing application, according to the data information in the node processing speed, its framework has the advantages that are automatically assigned to each processor load. First, to briefly describe the morphological processing algorithm, it will serve as the research base of our entire thesis work. Then, to specially develop two distributed computing method for heterogeneous platform. In the important issues of algorithm design, such as workload partitioning and task scheduling will focus on [8].

### 84.3.1 Mathematical Morphology Theory and Algorithm Design

Mathematical morphology has been widely applied in image processing, based on the morphology spatial and spectral information integration mode, hyper-spectral imaging applications is a very good processing framework. To consider a defined in the *N-D* space image, *N* is a component or band. In order to define morphological operations of a multidimensional space, it need to be inside a search window to set pixel point vector based on spectral bands to be sorted and to definite a *B* neighborhood, in order to define a correlation distance, $f(x,y)$ is expressed the *N-D* vector space of discrete point$(x,y) \in Z^2$, *B* neighborhood distance of all pixels' vector in space can be expressed as:

$$D_B[f(x,y)] = \sum_s \sum_t dist[f(x,y),\ (x+s, y+t)],\ \forall (s,t) \in Z^2(B) \tag{84.1}$$

In the formula, dist is the two *N-D* vector space distance, $D_B[f(x,y)]$ is distance sum of $f(x,y)$ and all other pixel vector. Erosion operation objects have the minimum distance $D_B$'s pixel vector of *B* neighborhood.

$$\begin{aligned}(f\Theta B)(x,y) &= \{f(x+s', y+t'), (s',t')\} \\ &= \arg\max_{(s,t)\in Z^2(B)} \{D_B[f(x+s, y+t)]\}, \quad (x,y) \in Z^2\end{aligned} \tag{84.2}$$

On the other hand, dilation operation object is pixel vector of the *B* neighborhood's maximum distance *DB*.

$$\begin{aligned}(f \oplus B)(x,y) &= \{f(x-s', y-t'), (s',t')\} \\ &= \arg\max_{(s,t)\in Z^2(B)} \{D_B[f(x-s, y-t)]\}, \quad (x,y) \in Z^2\end{aligned} \tag{84.3}$$

In order to distinguish distance with formula 84.2, spectral angle distance (SAD) is a kind of spectral data analysis that is widely used by measure distance, it can be defined as the two *N-D* pixel that are $f(X', Y')$ land $f(x'', y'')$.

$$\text{SAD}\,[f(x',y'), f(x'',y'')] = \cos^{-1}\left(\frac{f(x',y')\cdot f(x'',y'')}{\|f(x',y')\| \quad \|f(x'',y'')\|}\right) \tag{84.4}$$

In many applications, computing cost is very high; however, a suitable parallel strategy and scheduling mechanism can greatly improve the algorithm performance.

### 84.3.2 Distributed Computing Scheduling Mechanism

In order to the image processing applications based on neighborhood, the convolution or mathematical morphology is computed as a structural element, some in

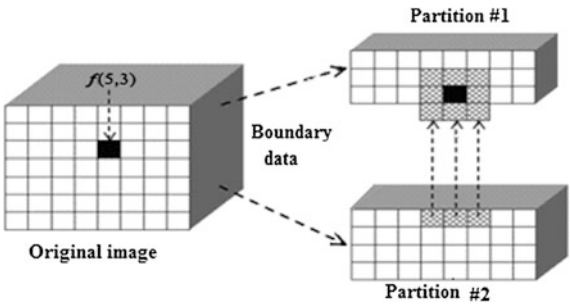


**Fig. 84.2** Data partitioning and task allocation diagram

the boundary nodes may be assigned to more than one processor. In Fig. 84.2, it is a 3 * 3 pixels' structure element. In this example, every pixel needs two heterogeneous processor computation and communication overhead, involving 3 high-dimensional pixel vectors.

Therefore, according to the contextual information to be optimized, each processor Pi need to send some size of $S$ boundary data to the neighborhood of Pored ($i$) and Psucc($i$). In a heterogeneous environment, obviously $S$ does not represent a fixed amount of traffic, the size of area depends on each processor cycle time $W_i$.

The above solution, meeting with great structure element may be possible failure. For a given platform, it can set the threshold as the application threshold to determine the redundant information or data exchange strategy. In the consideration of application specific, $P$ processor cycle time scheduling optimization problem as follows : to given the processor cycle time of $P$, communication link of $P(P-1)$, and the capacity of $C_{i,j}$; to given total workload $W$ and the communication overhead $S$ of each step, the goal is time pin minimization:

$$T_{\text{STEP}} = \min\left\{\max_{1\le i\le p}\left[\alpha_i\cdot(W+S)\cdot w_i\right], \max_{1\le i\le p}\left[\alpha_i\cdot W\cdot w_i + S\cdot\left(C_{\text{pred}(i),i} + C_{i,\text{succ}(i)}\right)\right]\right\} \tag{84.5}$$

The first is a single-step algorithm additional boundary data that is replicated overhead; the second refers to the exchange boundary data's overhead between continuous processor. The formula (84.5) is expressed as optimization problem that is easy, when all communication is equal, the target platform is composed of uniform communication each processor in the same speed.

### *84.3.3 Algorithm Design and Implementation*

In order to solve the polynomial time optimization problem, a heuristic greedy algorithm is adopted to determine the best scheduling strategy, and provides experimental verification its practice, the experiment is introduced into two

different heterogeneous algorithms based on MPI library. The first algorithm is referred to base on the redundant computing heterogeneous algorithm (RCHA), and the second is known as data exchange heterogeneous algorithm (DEHA). The two algorithms in programming both use MPICH technology to realize the communication between processors. Using the server client architecture, server node is responsible for the workload distribution, and the client node carries on morphology operations, and their value is returned to the server. The distributed algorithm can be divided into two parts, one is the client's morphological processing; another is on the basis of the server load distribution mechanism. Table 84.1 is the server implementation of RCHA algorithm, DEHA algorithm can be found in the related literature.

DEHA algorithm network mainly adopts the greedy algorithm instead of the 2–7 step of Table 84.1, it will process as a virtual ring structure. And the heterogeneous technology in Table 84.1 can be dynamically adjusted at runtime, that is to say, to select the exchange scheduling strategy based on redundant computing, it can be more effective use of heterogeneous network resources.

## 84.4 The Algorithm Performance Estimation

In this section, using a very high spectral resolution and high spatial resolution images, it represents a very challenging classification problem as shown in Fig. 84.3, which calls an AVIRIS image.

In the comparison of heterogeneous algorithms performance, to previously proposed two kinds of heterogeneous algorithms are RCHA and DEHA to carry on experiment analysis. Using structural elements size is B3 × 3, B5 × 5, B7 × 7,

**Table 84.1** The server side implementation of RCHA algorithm

| | |
|---|---|
| Input | *N-D* image f, Structure element *B* |
| Output | Contains the morphology image 2D |
| Start | |
| 1 | Configuration system information, including the number of processor *P*, the label Pi, processor time period $W_i$, i.e. |
| 2 | The use of *B* neighborhood, to identify the original data need to disk partitions |
| 3 | Setting $a_i = \left\lvert \frac{(p/w_i)}{\sum_{i=1}^{p}(1/w_i)} \right\rvert, i \in \{1.\ldots.p\}$ |
| 4 | Starting cycle from $m = \sum_{i=1}^{p} a_i$ to $(V + R)$ |
| 5 | To find satisfaction $w_k \cdot (a_k + 1) = \min\{w_i \cdot (a_i + 1)\}_{i=1}^{p}$ 的 $k$, $k \in \{1..p\}$ |
| 6 | $a_k = a_k + 1$ |
| 7 | The $\{a_i\}_{i=1}^{p}$ can get the heterogeneous spatial partition set $(V + R)$, partition results are sent to the corresponding processor |
| 8 | To collect the processing results $\{MPS_i\}_{i=1}^{p}$ of each processor Pi, and the final result $MPS = \cup_{i=1}^{p}\{MPS_i\}_{i=1}^{p}$ of the synthesis |
| End | |

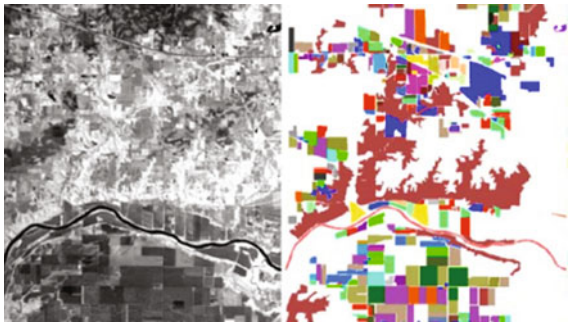

**Fig. 84.3** High-dimensional remote sensing image

**Table 84.2** The classification accuracy rate of two-heterogeneous algorithms RCHA and DEHA

| | B3 × 3 | B5 × 5 | B7 × 7 | B9 × 9 | B11 × 11 | B15 × 15 |
|---|---|---|---|---|---|---|
| Classification accuracy | 65.24 | 76.33 | 80.21 | 84.56 | 91.23 | 92.10 |
| RCHA | 200 | 328 | 286 | 326 | 369 | 524 |
| DEHA | 234 | 275 | 328 | 372 | 432 | 645 |

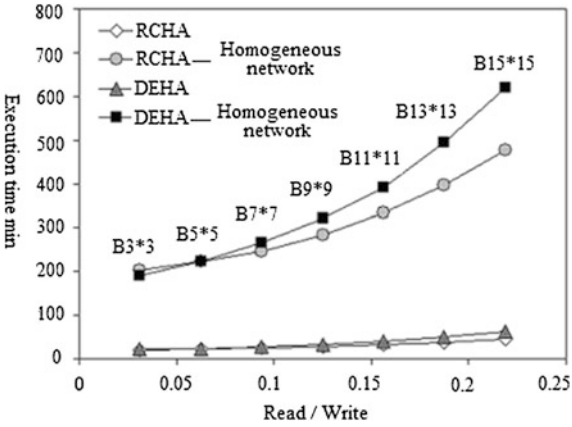


**Fig. 84.4** Execution time comparison of two algorithms in the platform

B9 × 9, B11 × 11, and B15 × 15. In Table 84.2, it can be shown that the two algorithms classify correct rate of single processor processing.

In Fig. 84.4, RCHA and DEHA respectively show the execution time in the two networks of same structure and heterogeneity. From the graph, it can be seen that the heterogeneous' RCHA has the most short execution time, and the time consumption of isomorphism's DEHA is biggest.

## 84.5 Conclusion

The high-dimensional image data are discussed in the parallel performance of heterogeneous platform, which combine with the theory knowledge of morphological aspects, at the same time it will require mapping hyperspectral image of large computational resources that is decomposed into small pieces, and they comprises plurality of computer parallel collaborative, finally to give the results. In the heterogeneous network workstation as research platform, the two kinds of distributed computing method of RCHA and DEHA are designed, and establish the performance evaluation index. For comparison purposes, the high-dimensional image is introduced as the experimental object, through comparative analysis, the method is proposed that the distributed algorithm of morphological algorithm has a time advantage, which will contribute to the high spectrum image to select suitable distributed computing technology and to take the particular application strategy.

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# Chapter 85
# Study on Rural Residents Income Growth Based on Quasi-Stepwise Regression Model

**Lingbo Cong and Jihua Cai**

**Abstract** To analyze rural residents' income growth in Heilongjiang province, the "quasi-stepwise regression" variable selection method is proposed. This method is based on the regression estimate of minimum sum of absolute errors. In its application to rural resident revenue forecast, household business revenue model and wage revenue model are established. The total relative error of the fitted model is about 8 %. According to these models, factors affecting rural resident revenue are analyzed, and some proposals are given for the increase of rural resident revenue.

**Keywords** Absolute error · Quasi-stepwise regression · Variable selection · Rural resident revenue

## 85.1 Introduction

In Heilongjiang province, the vast majority of people are farmers, so the income level of farmer directly relates to the province's economic lifeline. Low level and growth of peasant income are the major problems which directly relate to rural economic development and social stability in rural areas. There is no more time to delay for raising farmer's income. For these reasons, long-term trend of pure rural residents' income in Heilongjiang needs to be reasonably forecasted according to

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whole development of the national economy, the changes of agricultural industry policy in Heilongjiang, and other factors as rural residents' accumulation of human capital.

## 85.2 Quasi-Stepwise Regression Variable Selection Method

The following are specific processes of variable selection [1]:

Step 1. Get availability index $T^*$ of the model with all of $m$ variables.

Step 2. Add the variables that have been deleted to the model, in turn, and get effectiveness index $T_j$ of this model,

$$T^1 = \min\{T_J | j \in \text{Variables having been delete}\}.$$

Step 3. Delete variable of the model, in turn, write validity index of the model with the $i$th deleted variable as $T_i$, let $T^2 = \min\{T_1, T_2, \cdots, T_m\}$.

Step 4. Let $\tilde{T} = \min\{T^1, T^2\}$, if $\tilde{T} \leq T^*$, let $T^* = \tilde{T}$; if not, stop choosing.

Step 5. If $\tilde{T} = T_1$, let $m = m + 1$, add the corresponding variable into the model, if not, let $m = m - 1$, delete the corresponding variable, turn to Step 2.

This method is similar to stepwise regression as we all know, so it is called as quasi-stepwise regression, which can be realized with programming of MATLAB.

## 85.3 Prediction Model and Analysis of Rural Residents' Income in Heilongjiang Province

### *85.3.1 The Preliminary Classification of Model*

In the article, "income" means "per capita income", its formula is:

Pure income = gross income − household expenses − tax expenses − depreciation of production fixed assets − investigation subsidy-external family expenses.

Income of farmer is made up of family income (income of the first industry and nonfirst industry), wages income, property income, and transfer income [2]. The factors effected various income are different. Considering sample data and complexity influencing factors, two kinds of model are built to ensure freedom degree of the model. Family income and transfer income are one united model named family manages income model; salary income and property income merge the wage income model. Taking into account integrity of the data of affecting factors,

**Table 85.1** Variable sorts and adjustment of price index

| Variable | | Adjustment method |
|---|---|---|
| Net income from family business | Per capita income of the first industry | Convert into agricultural products price index |
| | Per capita income of nonfirst industry | Convert into index of commodity retail price |
| Per capita divert income | | Convert into consumer price index of household |
| Per capita wage income | | Convert into consumer price index of household |
| Per capita income from property | | Convert into consumer price index of household |
| Per household expenses,per household expenses of the first industry | | Convert into consumer price index of capital goods |

Price index adopts basic contrast form, such as price index in 1999 was 100

one model is built with the 10 samples from 2000 to 2009, in which variables related price factors were comparable to adjust. These are shown in Table 85.1.

## *85.3.2 Household Operating Income Model*

### 85.3.2.1 Data Statement of the Model

Household operating income is made up of the first industry income and the nonfirst industry income. The former is principal part (occupy 70–80 %). Initial variables are selected in accordance with influencing factor such as: effective irrigation ratio (effective irrigation area and cultivated land area ratio), usage amount of fertilizers on one mu of cultivated land (kg/mu), per capita number of large anima, per capita agricultural machinery power (kW/person), agriculture product price index, capital goods price index, per capita household management charge, junior high schools and higher education ratio, and the first industrial personnel ratio and time (Table 85.2).

### 85.3.2.2 Sifting from Model Variable

Sift from variables in the above by quasi-stepwise regression variable selecting method.

**Table 85.2** Data of variable in household operating income model (2000–2009)

| Variable | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Net Income from family business | 1,697.7 | 1,878.5 | 1,943.7 | 2,098 | 2,278.8 | 2,363.9 | 2,521.5 | 2,848.9 | 3,163.7 | 3,326.7 |
| Per capita income of the first industry | 1,614.5 | 1,803.4 | 1,846.5 | 1,976.8 | 2,160.3 | 2,248.1 | 2,412.7 | 2,736.8 | 3,018.9 | 3,168 |
| Effective irrigation ratio | 2.113 | 2.197 | 2.297 | 2.18 | 2.304 | 2.368 | 2.419 | 2.243 | 2.235 | 2.191 |
| Usage amount of fertilizers on one mu of cultivated land | 8.43 | 8.964 | 9.09 | 8.64 | 9.679 | 9.952 | 9.309 | 8.719 | 8.62 | 8.528 |
| Per capita agricultural machinery power | 0.882 | 0.908 | 0.963 | 0.99 | 1.083 | 1.247 | 1.446 | 1.58 | 1.769 | 1.998 |
| Junior high schools and higher education ratio | 30.76 | 37.56 | 39.72 | 40.8 | 44.85 | 50.56 | 59.51 | 65.42 | 77.54 | 80.81 |
| Agriculture product price index | −3.2 | −0.4 | −1.5 | 3.6 | 1.5 | 0.7 | 5.9 | 19.9 | 17 | −1.9 |
| Per capita household management charge | 758.8 | 884.8 | 890.2 | 921 | 1,093.8 | 1,111.3 | 1,184.1 | 1,461.5 | 1,750.8 | 1,687.2 |
| The first industrial personnel ratio | 51.1 | 50.2 | 50.4 | 51.3 | 48.3 | 46 | 45.3 | 44.7 | 43.4 | 43.2 |

Data from: Statistical yearbook of Heilongjiang province

## 85.4 Get Effective Index of the Model Containing All Eight Variables

Step 1. The sample was divided into four groups, and three groups were selected to fit the given model, forecast result $t = \frac{1}{10}\sum_{i=1}^{10}\frac{|Y_i - \hat{Y}_i|}{Y_i}$, alternate four times.

$$t_1 = 0.0029365, t_2 = 0.0028487, t_3 = 0.0029716, t_4 = 0.0029749,$$

$$T^* = \frac{1}{4}\sum_{i=1}^{4} t_i = 0.0029329.$$

Step 2. Use successively deleted variables in the model to get the effective index of this model $T_j$, let $T^1 = \min\{T_j | j \in \text{deleted variables}\}$.

Step 3. Delete variable of the model, in turn, write validity index of the model with the *i*th deleted variable as $T_i$, let

$$\begin{aligned} T^2 &= \min\{T_1, T_2, \cdots, T_8\} \\ &= \{0.0026082, 0.0029505, 0.0029723, 0.0029931, 0.005212, 0.0029163, 0.002456, 0.0028403\} \\ &= 0.0024561. \end{aligned}$$

Step 4. Let $\tilde{T} = \min\{T^1, T^2\}$, if $\tilde{T} \le T^*$, let $T^* = \bar{T}$; if not, stop choosing.

Step 5. If $\tilde{T} = T_1$, let $m = m + 1$, add the corresponding variable into the model, if not, let $m = m-1$, delete the corresponding variable, turn to Step 2. Result is shown in Table 85.3.

**Table 85.3** Variable selecting of household operating income model and estimate of coefficient [3]

| | |
|---|---|
| Surplus variable and estimated value of coefficient | Per capita income of the first industry (1.093809) |
| | Agriculture product price index (−0.756433) |
| | Per capita household management charge (−0.016470) |
| | The first industrial personnel ratio (6.201399) |
| Deleted variable | Effective irrigation ratio |
| | Usage amount of fertilizers on one mu of cultivated land |
| | Per capita agricultural machinery power |
| | Junior high schools and higher education ratio |
| Effectiveness of model | 0.21 % |
| Relative error of model | 6.97 % |

**Table 85.4** Variables data of wages income model

| years | Per capita wages income | Per capita wages income at last year | Junior high schools and higher education ratio | Labor of builder trade ratio | Labor of homemaking service ratio |
|---|---|---|---|---|---|
| 2000 | 338 | 319.7 | 30.76 | 3.035 | 7.010 |
| 2001 | 351.5 | 338 | 37.56 | 3.548 | 6.112 |
| 2002 | 376.6 | 351.5 | 39.72 | 3.677 | 8.848 |
| 2003 | 394.2 | 376.6 | 40.83 | 3.943 | 8.971 |
| 2004 | 413.1 | 394.2 | 44.85 | 4.665 | 9.186 |
| 2005 | 464.3 | 413.1 | 50.56 | 6.685 | 8.625 |
| 2006 | 654.6 | 464.3 | 59.51 | 7.464 | 8.727 |
| 2007 | 773.9 | 654.6 | 65.42 | 7.825 | 8.762 |
| 2008 | 911.4 | 773.9 | 77.54 | 8.561 | 9.589 |
| 2009 | 1,012.7 | 911.4 | 80.81 | 9.173 | 9.953 |

## 85.5 Model of Rewards for Labor

### *85.5.1 Data Statement of Model*

Wages income means the revenue that rural household members received by selling their labor employed by units or individuals. Changes of wage income mainly come from the following reasons: (1) changes of the wages of previous year's workers, (2) changes of workers' education level, (3) changes of the workers' number, and (4) changes of workers' obtain employment structure. According to these factors, import such initial variables as per capita wages income at last year, junior high schools and higher education ratio, labor of industry ratio, labor of builder trade ratio, proportion of the rural labor employed in transport service, proportion of the rural labor employed in catering services, proportion of the rural labor employed in retail business, and proportion of the rural labor employed in household service and proportion of the rural labor employed in other services [4]. Data statement is shown in Table 85.4.

### *85.5.2 Selection of Model Variable*

See Table 85.5

**Table 85.5** Variable selecting of wages income model and estimate of coefficient

| | |
|---|---|
| Surplus variable and estimated value of coefficient | Per capita wages income at last year (0.414309) |
| | Junior high schools and higher education ratio (6.679466) |
| | Labor of builder trade ratio (103.1638) |
| | Proportion of the rural labor employed in household service and other services (−77.09627) |
| Deleted variable | Labor of industry ratio |
| | Proportion of the rural labor employed in transport service |
| | Proportion of the rural labor employed in catering services |
| | Proportion of the rural labor employed in retail business |
| Effectiveness of model | 3.34 % |
| Relative error of model | 5.69 % |

**Table 85.6** General fitting of per capita income of rural residents' model

| Years | Original value of income from family business | Fitting value of income from family business | Original value of wages income | Fitting value of wages income | General income | Fitting value of general income | Average relative error of general income |
|---|---|---|---|---|---|---|---|
| 2000 | 1,697.7 | 1,698.0 | 338.0 | 335.2 | 2148 | 2,033.2 | 8.98 % |
| 2001 | 1,878.5 | 1,896.1 | 351.5 | 346.4 | 2,280 | 2,242.6 | |
| 2002 | 1,943.7 | 1,945.2 | 376.6 | 397.8 | 2,405 | 2,343.0 | |
| 2003 | 2,098.5 | 2,088.9 | 394.2 | 367.0 | 2,509 | 2,456.0 | |
| 2004 | 2,278.8 | 2,269.8 | 413.1 | 419.1 | 3,005 | 2,689.0 | |
| 2005 | 2,363.9 | 2,351.9 | 464.3 | 503.7 | 3,221 | 2,855.6 | |
| 2006 | 2,521.5 | 2,523.7 | 654.6 | 613.5 | 3,552 | 3,137.2 | |
| 2007 | 2,848.9 | 2,858.7 | 773.9 | 787.9 | 4,132 | 3,646.7 | |
| 2008 | 3,163.7 | 3,156.1 | 911.4 | 906.2 | 4,856 | 4,062.2 | |
| 2009 | 3,326.7 | 3,333.2 | 1,012.7 | 1,013.4 | 5,207 | 4,346.7 | |

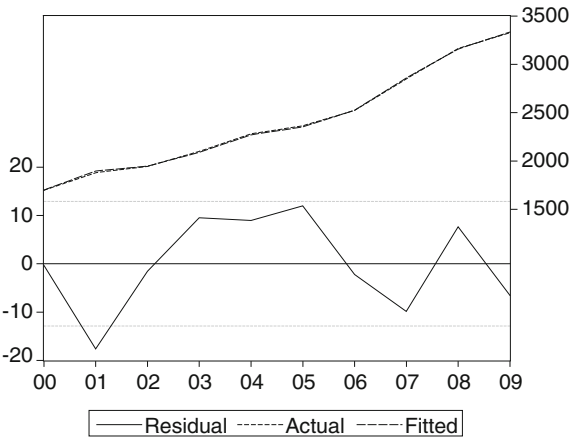


**Fig. 85.1** Family manages income fitting chart

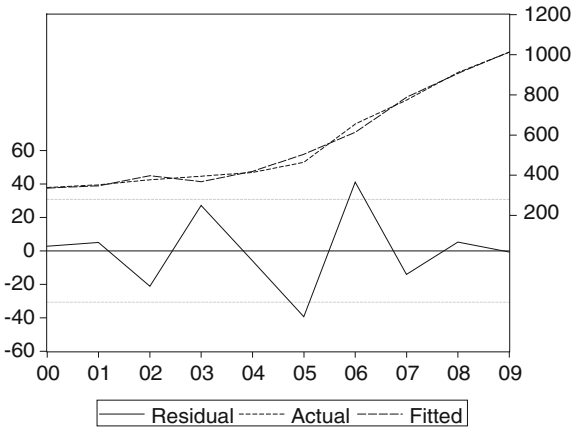


**Fig. 85.2** Salary income model fitting chart

### *85.5.3 Totality Fitting of the Model*

General fitting of per capita income is shown in Table 85.6. Family manages income fitting chart is shown in Fig 85.1 and salary income model fitting chart is shown in Fig 85.2.

## 85.6 Suggestion for Promoting Sustained Growth of Farmers' Income

Relative continue to increase policy support for agriculture and increase the adjustment of agricultural structure. Continue to increase and implement the plan of direct subsidies to grain farmers, farm machinery purchase subsidies, and general subsidies for agricultural production and other subsidies [5].

Continue to enlarge the adjustment of agricultural structure. Vigorously develop the high quality, distinctive features, and high value-added agricultural products.

Accelerate industrialization of agriculture. The key is to cultivate some farmers leading enterprises that have the ability of developing market and deep processing of agricultural products. These enterprises may provide services to farmers and stimulate the promotion of farmers' production.

Establish a sound social security system in rural areas. Pay adequate attention to farmer vocational training and vocational counsel for peasant.

## 85.7 Conclusions

It is important for country and individual to research rural resident income. In this paper, the model got with the "quasi-stepwise regression" variable selection method through the vast square and minimum standards have very low error and good validity, the method can also be applied to other prediction problems. In order to build a big agricultural province which have good economy and quick development, the grain market should be opened and use market mechanisms to stable price. While actively help farmers to adjust industrial structure, use comparative advantages to increase economic efficiency and prevent imports in the short term to avoid serious impact on farmers' income. From the obtained models, it may be discovered that the education level of the labor in the countryside, biochemical technology represented by usage amount of fertilizers on one mu of cultivated land, and agricultural mechanization level represented by per capita total power of agricultural machinery play a very important role to increase the income of rural residents. In the course of future development, stick to development-oriented poverty reduction, establishing financial steady growth of poverty alleviation fund mechanisms; speed up the development of characteristic agricultural products such as fruits and vegetables, flowers, nursery stock, traditional Chinese medicine, and forming a number of characteristic agricultural production and processing base.

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# Chapter 86
# Encryption Based on Encoding Partial Algorithm

**Lei Liang and Maoyan Fang**

**Abstract** This paper presents encoding partial encryption algorithm (EPEA), according to the fact of classical encryption algorithm. For this algorithm, the file would be encrypted to be divided into several partitions-son files by the rule firstly, and then one son file is saved evidently and other son files are saved as hidden, and these son files are saved in different hard disk positions. When we need the whole file, first pick these son files up from different disk partitions and recover them by the rule. This paper presents the file partition and recover algorithm, and the rule of the son files saved. If you want this file, you should get all son files, and know the order, so this algorithm can reduce the probability of secrets lost.

**Keywords** Encoding partial · Encryption · Partition · Recover

## 86.1 Introduction

The technology of computer and database develops very quickly, and database is the core of computer information system. Because of saving lots of sensitive data shared by some users, the security of database is very important. If the database of finance, government or other important organization be visited without permit, the important data would be lost easily, and the loss of national finance is huge [1].

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Symmetrical encryption and unsymmetrical encryption are classical encryption system. For symmetrical encryption, encryption and decryption use the same key—session key (SK). The symmetrical encryption technology be used in lots of field, because it is easy to come true on CPU, and speed of calculate is fast, but both sides confirm SK secretly, each side cannot open the key, so security management is hard. Unsymmetrical encryption has two different keys: public keys for encryption, and secret keys for decryption. The public key can be transferred or opened between both sides, but secret key is secret, and the cipher text encrypted by public key only be decrypted by secret key. Unsymmetrical encryption's security is high, but the speed of calculate is slow. Classical encryption system's reliability is dependent on the session key and the algorithm intension, and classical encryption system mainly uses symmetrical encryption to protect data, and it is impossible to lose the key or violence decryption [2].

Encoding partial algorithm, this paper not only guarantees the file's security in time, but also improves the convenience, by file's partition and recover and setting update manage machine algorithm database in time with session key. It is easy to come true, and it also explores a new way to realize classical encryption system. So it is a new research direction.

## 86.2 Encoding Partial Algorithm (EPA)

Encoding partial algorithm is an encryption algorithm which partitions file and save the son files in different area. The key technologies include file partition, son files save, son files reading, and original file recover.

### *86.2.1 Original File Partition*

File partition is that the original file be divided into several partitions. It is an encryption process [3–5]. First, the original file is transferred into 0–1 model data, and then, the data be divided into $m$ partitions according to the file partition algorithm, and these partitions are named son files or encoding partials, they are saved in different hard disk positions. There are lots of partition algorithms; we employ the same D-value array partition algorithm.

$$l = \mathrm{mod}(n, m) \tag{86.1}$$

$$t = \mathrm{floor}\left(\frac{n}{m}\right) \tag{86.2}$$

where $n$ and $m$ all are integers, and $n$ is the length of the file, $m$ is the number of the son files. $\mathrm{mod}(n, m)$ Is the modulus after division? $\mathrm{floor}(x)$ Rounds the elements of $x$ to the nearest integers less than or equal to $x$.

Obviously: $l \leq m$.

The value in position $k$ of the $i$ son file is:

$$n_{ik} = f(mk + i), \quad i = 1, 2, \ldots, m; \; k = 0, 1, 2, \ldots, t. \tag{86.3}$$

Here, $n_{ik}$ is the value in the position $k$ of the $i$ son file, and *f(i)* is the value in position $i$ of the original file which data are 0–1 model.

From Eq. (86.1), we can conclude that the length of the son files from one to $l$ is $t + 1$, and the length of the rest $m - l$ son files is $t$.

According to this method, the original file is divided into $m$ son files.

### 86.2.2 Recover Original File

Recover original file is that all son files combine to form original file, it is a decryption process [6]. First, all son files are picked up for different hard disk positions, and then put these encoding partials into one file according to the recover algorithm, and the file's data are 0–1 model, and transfer the file into the original file by software finally.

The following is recovering algorithm. When $\mathrm{mod}(n, m) \neq 0$, $j = \mathrm{mod}(n, m)$. When $\mathrm{mod}(n, m) = 0$, $j = m$.

The value in position $n$ of original file which data are 0–1 model is:

$$N = f_j\left(\mathrm{floor}\left(\frac{n}{m}\right) + 1\right). \tag{86.4}$$

Here, $N$ is the value in position $n$ of original file which data are 0–1 model, and $f_j(k)$ is the value in position $k$ of the $j$ son file.

### 86.2.3 Encoding Partials Saving

Encoding partials saving is one important partition in encoding partial encryption algorithm [7, 8]. The problem that how we can prevent all son files be stolen and we can read the file easily, we chief considering in encoding partials saving.

Here, we present the rules of son files saving.

First, we select one from $m$ son files random to save as normal, and its name and characters are same as the original file, and the saving road is the same as the user setting of the original file. This saving model is named evidently saving. And in this son file, prepare some area for saving other son files information.

Second, select areas for other son files. In order to prevent all son files be stolen together, these son files cannot be saved together, so we confirm the saving areas random, and produce these son files name random, and these son files saving character is hidden, and this saving model is named hidden saving.

### 86.2.4 Original File Reading

Because the evidently saving son file is normal, and this son file saves other son files' saving information, so first read the evidently saving son file, and then read other son files according to the information saved in the evidently saving son file, and all son files combine to form original file according to recover algorithm finally.

## 86.3 The Advantage of Encoding Partial Algorithm

Compared with classical encryption algorithm, EPA has advantages such as:

This encryption algorithm is more secure, we encrypt one file as a whole by classical encryption algorithm. Once the session key lost, it easy to lost the secret. Even the session key does not lost, if the ciphertext be stolen, the ciphertext also be decrypted by violence decryption with the computer improve. For EPA, the original file is divided into several son files, and only one saved by evidently saving, the others saved by hidden saving, so it is difficult to steal all son files, and even steal all son files, only knowing the right order can recover original file. So EPA reduces the probability of secrets lost.

The algorithm is easy. EPA mainly involves original file partition algorithm and recover algorithm. From the text present algorithms, we can find that all algorithms are simple, and it is easy to come true.

From algorithms, we can conclude that the quantity calculation of EPA depends on the length of the file. And most secret files are text files, and the length of these files is not too long, so the quantity calculation of EPA is not huge.

## 86.4 Simulations

Suppose there is a file, it is 0-1 data model is:

$$A = [11011001110110100111]. \tag{86.5}$$

The length of the file is 20. Now we divide the file into three partitions according to the same D-value array partition algorithm, and the three son files are:

$$\begin{aligned} A1 &= [1101101], \\ A2 &= [1110001], \\ A3 &= [001111]. \end{aligned} \tag{86.6}$$

A1 is the first son file, and A2 is the second son file, and A3 is the third son file. According to the recovering algorithm, we can get the original file:

$$A' = [11011001110110100111]. \quad (86.7)$$

Obviously: $A' = A$

## 86.5 Summary

Classical encryption algorithms encrypt a file as a whole, and once the key lost, the secret would be stolen. Even the key does not lost, if the ciphertext is stolen, it also can be decrypted by violence decryption with the improve of computer. So this paper changes the mind of classical encryption, and presents EPA. EPA partitions the file, and the son files are saved as evidently and hidden, and gives the algorithm of EPA and the rules of son files saving. Obviously, evidently saving son file is confused, and hidden saving son files are concealed. And only get all son files and knowing the order, the original file can be recovered. So EPA can reduce the probability of the secrets lost, and the algorithm is simple, and it is easy to realize.

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# Chapter 87
# A Pharmacokinetics Parameter Estimation Mathematical Model Based on Grey Theory

**Jiamou Wang**

**Abstract** The complex human body can be regarded as a grey system based on grey system theory. In this case, the pharmacokinetics mathematical model can be established based on the blood drug concentration data. This is a method of new pharmacokinetics modelling. In this method, there is no need to simplify the complex human body model for a compartment model. Therefore, the established model based on this new method could better reflect the objective reality.

**Keywords** Grey system · Mathematical model · Pharmacokinetics mathematical model

## 87.1 Introduction

The most widely used mathematical model is a compartment model in pharmacokinetics. To the same drug trials, some people were a two-compartment model, the other were a one-compartment model or a three-compartment model. Even for the same person, intravenous injection of the drugs was a two-compartment model, but taking the same drugs orally may be a single-compartment model. Therefore, some clinical pharmacy specialists and researchers have gradually abandoned compartmental model and have used non-compartmental model method to solve practical problems. This paper has explored a new modelling method of pharmacokinetics mathematical model based on grey system theory [1] and logistic model.

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The complex human body can be regarded as a compartment model for the sake of simplicity. In this case, the compartmental pharmacokinetics model can be established based on the blood drug concentration data. This is the traditional method of pharmacokinetic modelling.

At present, although some people study pharmacokinetics model with the grey system theory, they estimated parameters based on the traditional one-compartment or two-compartment model.

## 87.2 New Modeling Method of Pharmacokinetics Mathematical Model Based on Grey System Theory

The time series is $t = \{t_1, t_2, \cdots, t_n\}$, $t_k = t_{k+1} - t_k$. The original serum concentration data sequence is $c^{(0)} = \{c^{(0)}t_1, c^{(0)}t_2, \cdots, c^{(0)}t_n\}$.

Accumulated generating sequence of the original serum concentration data is $c^{(1)} = \{c^{(1)}t_1, c^{(1)}t_2, \cdots, c^{(1)}t_n\}$.

Here, $c^{(1)}(t_k) = \sum_{t=1}^{k} c^{(0)}(t_i)\,\Delta t_i$.

The formula from the accumulated generating sequence to the original serum concentration data sequence is $c^{(0)}t_{k+1} = \frac{c^{(1)}(t_{k+1}) - c^{(1)}(t_k)}{t_{k+1} - t_k}$.

According to changes of pharmacokinetics blood concentration data, we can prove that accumulated generating sequence of the original serum concentration data close to logistic model.

$$C^{(1)}(t) = \frac{A}{1 + Be^{-rt}} \tag{87.1}$$

In order to judge the parameters of logistic model (87.1), the logistic model (87.1) is rewritten as follows

$$L(t) = \frac{1}{C^{(1)}(t)} = \frac{1}{A} + \frac{B}{A}e^{-rt} \tag{87.2}$$

Calculating differential of the Eq. (87.2), we get differential equation

$$\frac{dL(t)}{dt} = -rL(t) + \frac{r}{A} \tag{87.3}$$

How to determine the parameters $A$ and $r$. First, with the following difference equations instead of differential Eq. (87.3):

$$\frac{\triangle L(t_k)}{\triangle t_k} + aL(t_k) = b \tag{87.4}$$

Here, $a = -r$, $b = r/A$, $\frac{\triangle L(t_k)}{\triangle t_k} = \frac{L(t_k) - L(t_{k-1})}{t_k - t_{k-1}} = M(t_k)$, $(k = 2, 3, \cdots, n)$..

Smooth $L(t_k)$ of the difference Eq. (87.4) with the following data substitution $z(t_k) = \lambda L(t_k) + (1-\lambda) L(t_{k-1}), (k = 2, 3, \cdots, n)$.

To be smoothed difference equations is

$$\frac{\triangle L(t_k)}{\triangle t_k} + az(t_k) = b \tag{87.5}$$

Here, $z(t_k)$ is called the background value; $\lambda$ is called the background parameter. There is no best way to obtained background parameter $\lambda$. The background parameter $\lambda$ usually is taken as 1/2 [2]. The parameters $a$, $b$ will be determined with the matrix equation $\begin{bmatrix} a \\ b \end{bmatrix} = (B^T B)^{-1} B^T Y$.

Here,

$Y = [M(t_2), M(t_3), \ldots, M(t_n)]^T$ and $B^T = \begin{bmatrix} -z(t_2) & -z(t_3) & \cdots & -z(t_n) \\ 1 & 1 & \cdots & 1 \end{bmatrix}$.

The parameters $a$, $b$ are substituted into Eq. (87.2). We have obtained grey system GM (87.1) model (87.2) of the data sequence$L(t)$. $L(t) = \frac{1}{C^{(1)}(t)} = \frac{1}{A} + \frac{B}{A} e^{-rt}$.

Second, we re-calculate the parameters $A$ and $B$ of the model (87.2) using parameter $r$ that has been identified and using information re-use method in paper [3].

We rewrite model (87.2) as follows

$$L(t_k) = \frac{1}{C^{(1)}(t_k)} = \alpha e^{-r(t_k - t_1)} + \beta \tag{87.6}$$

Here, $k = 2, 3 \ldots n$. $\alpha$ and $\beta$ are the new parameters to be identified.

Once again, the accumulated generating sequence $c^{(1)} = \left\{c^{(1)}t_1, c^{(1)}t_2, \cdots, c^{(1)}t_n\right\}$ of the original serum concentration data $c^{(0)} = \left\{c^{(0)}t_1, c^{(0)}t_2, \cdots, c^{(0)}t_n\right\}$ and the time sequence $t = \{t_1, t_2, \cdots, t_n\}$ substituted into Eq. (87.6), the parameters $\alpha$ and $\beta$ will be determined with the matrix equation $\begin{bmatrix} a \\ b \end{bmatrix} = (B^T B)^{-1} B^T Y$.

Here,

$Y = \left[L^{(1)}t_1, L^{(1)}t_2, \cdots, L^{(1)}t_n\right]^T$ and $B^T = \begin{bmatrix} 1 & e^{-r(t_2 - t_1)} & \cdots & e^{-r(t_n - t_1)} \\ 1 & 1 & \cdots & 1 \end{bmatrix}$.

The parameters $\alpha$ and $\beta$ be substituted into Eq. (87.6), we have obtained new grey system GM (87.1) model (87.6) of the data sequence $L(t)$ or continuous model.

$$C^{(1)}(t) = \frac{A}{1 + Be^{-rt}} \tag{87.7}$$

The model (87.7) is pharmacokinetics mathematical model. The model (87.7) contains only three parameters: parameter $A$, parameter $B$ and parameter $r$.

According to calculus theory, we can know that the pharmacokinetics mathematical model of the original serum concentration data is derivative of model (87.7). That is

$$C(t) = \frac{ABre^{-rt}}{(1 + Be^{-rt})^2} \tag{87.8}$$

Expanding model (87.8) by infinite series theory, we have get power series expansion of the pharmacokinetics mathematical model: $C(t) = \sum_{n=1}^{+\infty} (-1)^{n+1} nABre^{-rt} = ABre^{-rt} - AB^2re^{-2rt} + AB^3re^{-3rt} - \cdots$.

We can intuitively see that the pharmacokinetics mathematical model (87.8) implies some characteristics from one-compartment model to infinity-compartment model. For example:

Let $n = 1$, which was similar to one-compartment model: $C(t) = ABre^{-rt}$.

Let $n = 2$, which was similar to two-compartment model: $C(t) = ABre^{-rt} - AB^2re^{-2rt}$.

Let $n = 3$, which was similar to three-compartment model: $C(t) = ABre^{-rt} - AB^2re^{-2rt} + AB^3re^{-3rt}$.

## 87.3 The Discussion of the Parameters of the New Pharmacokinetics Mathematical Model

The parameter $A$ of the pharmacokinetics mathematical model (87.7) corresponds to the area under the concentration-time curve. $A = \text{AUC} = \int_0^{+\infty} C(t)\,dt$.

The parameter $B$ of the pharmacokinetics mathematical model (87.7), the area under the concentration-time curve AUC and initial blood concentration $C_0$ satisfy the following relation: $C_0 = \frac{A}{B+1}$.

Namely, the use of parameters $A$ and $B$ can estimate the initial blood concentration $C_0$.

The parameter $r$ of the pharmacokinetics mathematical model (87.7) expresses the intrinsic growth rate or growth rate constant of cumulative plasma concentration $C^{(1)}(t)$. It reflects the relative growth rate. $C^{(1)}(t)$, $C(t)$ have the following relationship.

$$C^{(1)}(t) = \int_0^t C(u)\,du \tag{87.9}$$

The parameter $r$, the area under the concentration-time curve AUC and initial blood concentration $C_0$ satisfy the following relation:

$$r = \frac{\text{AUC} - C_0}{\text{AUC}} \tag{87.10}$$

**Table 87.1** Concentration-time relationship of PVrozoline (20 mg/kg i.v.)

| $n$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| $T$ (hr) | 0 | 0.25 | 0.5 | 1 | 2 | 4 | 6 |
| $C(t)$ (μg/ml) | 12.23 | 2.53 | 2.68 | 2.38 | 1.99 | 1.20 | 0.78 |

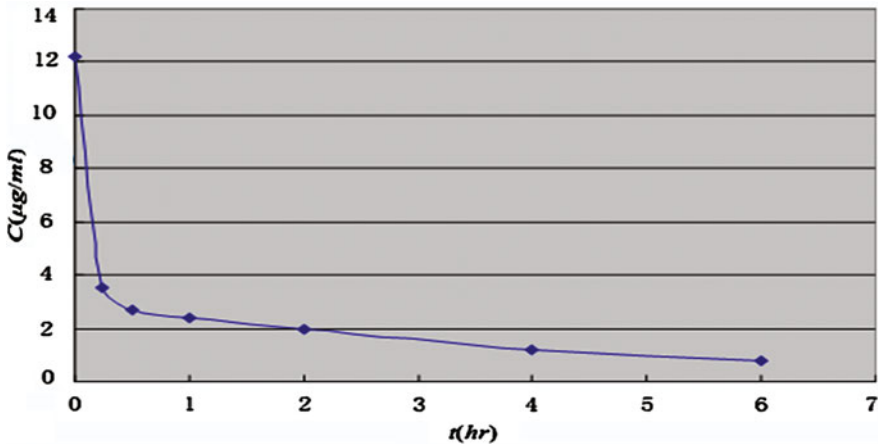


**Fig. 87.1** Concentration-time curve of PVrozoline (20 mg/kg i.v.)

The peak time of the Pharmacokinetics mathematical model $C(t)$ is $\ln B/r$; the peak concentration is $C_{\max} = Ar/4$; the half life is

$$t_{\frac{1}{2}} = r \ln \frac{B}{3 - 2\sqrt{2}} \tag{87.11}$$

The formula for calculation of clearance is

$$Cl = \frac{D_0}{A} \tag{87.12}$$

The parameter $A$ of the pharmacokinetics mathematical model (87.7) corresponds to the zero-order moment of statistical moment analysis of non-compartmental model.

AUC $= A$.

Calculation formula for the first-order moment is

$$\text{MRT} = \frac{\int_0^{+\infty} tC(t)\,dt}{A} \tag{87.13}$$

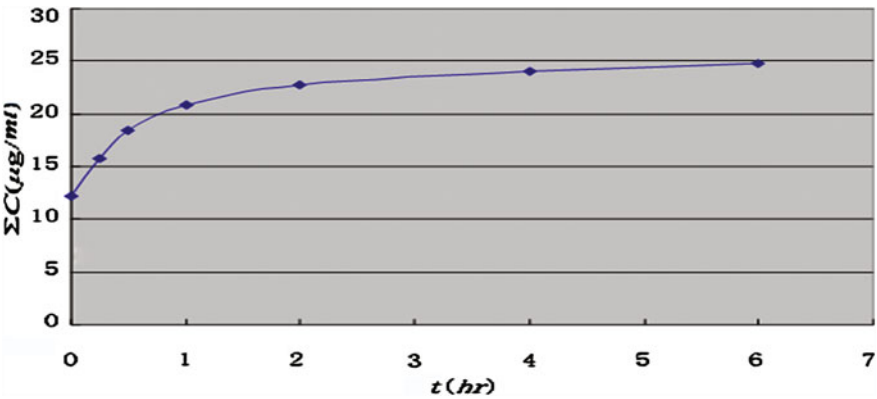


**Fig. 87.2** Cumulative concentration-time curve of PVrozoline (20 mg/kg i.v.)

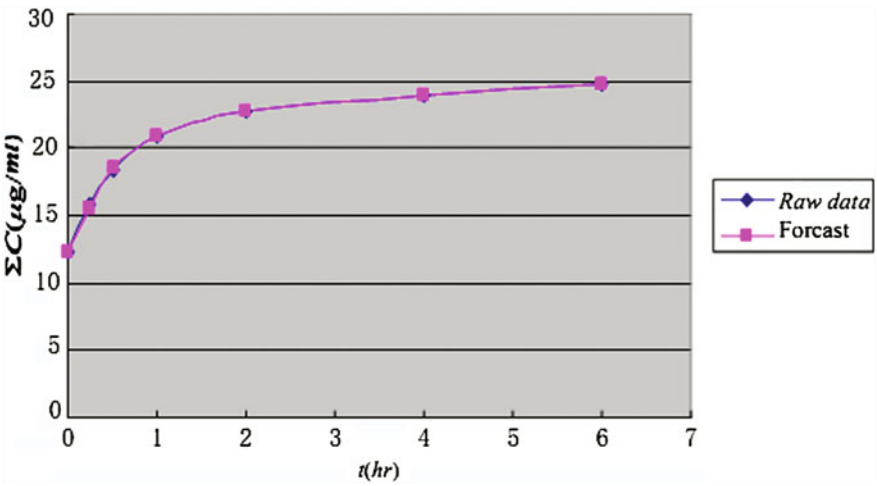


**Fig. 87.3** Fitted cumulative concentration-time curve of PVrozoline (20 mg/kg i.v.)

## 87.4 Case Study

Example: An intravenous injection PVrozoline (20 mg/kg i.v.) for dogs, Table 87.1 is the mean plasma concentration data [4]. (Fig. 87.1, 87.2).

A mathematical model of cumulative plasma concentration is (Fig. 87.3, 87.4).

$$C^{(1)}(n) = \frac{25.13841}{1 + 1.128524\, e^{0.50655(n-1)}} \tag{87.14}$$

It means that the accuracy of model meets the actual needs from Table 87.2.

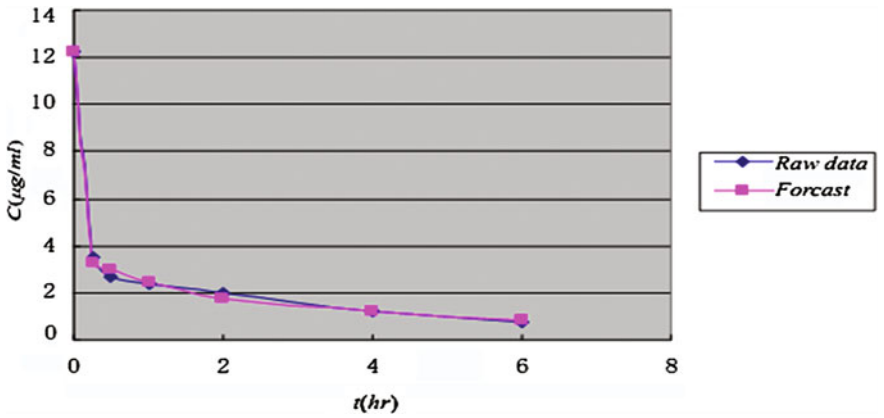


**Fig. 87.4** Concentration-time curve of PVrozoline (20 mg/kg i.v.)

**Table 87.2** Serum drug concentration data analysis

| $n$ | $t$ | $C(t)$ | $C^{(1)}(t)$ | $C^{(1)}(t)$ Forecast | $C(t)$ Forecast | Absolute error | Relative error* % |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 12.23 | 12.23 | 12.27927 | 12.27927 | −0.04927 | −0.40284 |
| 2 | 0.25 | 3.53 | 15.76 | 15.55959 | 3.280326 | 0.249674 | 7.072928 |
| 3 | 0.5 | 2.68 | 18.44 | 18.54306 | 2.983467 | −0.30347 | −11.3234 |
| 4 | 1 | 2.38 | 20.82 | 20.96405 | 2.420993 | −0.04099 | −1.7224 |
| 5 | 2 | 1.99 | 22.81 | 22.75322 | 1.789165 | 0.200835 | 10.09223 |
| 6 | 4 | 1.2 | 24.01 | 23.98613 | 1.232907 | −0.03291 | −2.74229 |
| 7 | 6 | 0.78 | 24.79 | 24.79532 | 0.809194 | −0.02919 | −3.74283 |
| Residual sum of squares | | | | | | 0.200807 | |

## 87.5 Conclusion

This article gives a new modelling method of pharmacokinetics mathematical model based on the grey system theory. We hope to provide some guidance for medicine researchers. We will continue to study the further improvement and experimental verification of this model.

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# Chapter 88
# Study on the Mathematics Course Teaching Model Combining Majors and Strengthening Application in Higher Vocational Colleges

**Haifei Xiang**

**Abstract** In this paper, the current situation and problems of the teaching of the mathematics course in higher vocational colleges are analyzed, and also a new mathematics teaching model combining major and driven by tasks is constructed under the condition that serving for majors and strengthening application are taken as targets. According to the characteristics of different majors and the specific requirements on the mathematical knowledge, the teaching contents of higher mathematics are optimized, for the purpose of strengthening the combination of mathematics with majors, theories, and practices and attaching high importance to the training of application ability.

**Keywords** Combination with majors · Strengthening application · Mathematics in higher vocational education · Teaching model

## 88.1 Introduction

Along with the swift development of the economy in China, a leaping development has also been accomplished in China's higher vocational education. Symbolized by the issuing of the higher education No. 16 document of the Ministry of Education, the higher vocational education begins to shift from the stage of the scale expansion to the stage of the intension development in China. Higher vocational education, as an important part of higher education, features both "higher education" and "vocational education", and is higher than secondary

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education in levels. However, higher vocational education is different from the general undergraduate education in types. The training objective of higher vocational education is to train the front-line application talented personnel, which possess not only the most fundamental theory knowledge and also the more powerful and superior professional skills and practical operation ability than personnel in other educations [1, 2]. Besides, the training objective of higher vocational education plays a decisive role in the direction of the reform of mathematics course in higher vocational education. Therefore, in China's higher vocational education, it is necessary to get rid of the subject theoretical teaching method and regard the training of technical application ability as the objective, and also attach high importance to enhancing the training of the intelligence technology and operation skills and establish a higher vocational mathematics teaching system that integrates mathematical teaching and major courses teaching as well as theory teaching and practice teaching [3, 4].

## 88.2 Current Situation of Mathematics Course Teaching in Higher Vocational Education

Mathematics course in higher vocational education, as one of the public and basic courses, features a wide coverage and powerful influence. However, the teaching of mathematics course in higher vocational education is not closely combined with the major courses teaching. Compared with the demands of higher vocational education on mathematics courses, the problems in the following can be concluded.

First, the types of teaching materials are simple, and also in shortage of professional targets. There are targeted professional mathematics teaching materials for all majors, but the traditional teaching material "Higher Mathematics" used in science subjects is still being applied. Moreover, the contents in teaching materials are the republications of the higher mathematics applied in the general undergraduate education basically. Besides, the characteristics and traces of subject education are rather obvious, and also the abilities to mutually integrate with other majors, digest, and absorb professional knowledge and solve the actual problems with the principles and methods of mathematics are absent.

Second, the teaching contents do not match with the demands of majors. Because of the less class hours for the teaching of mathematics course, the simplified mathematical contents are applied. That is, several papers of higher mathematics are select in teaching, and also the contents in teaching materials are the republications of the Higher Mathematics applied in the general undergraduate education basically. The teaching contents, which are selected in such a way, cannot give consideration to the characteristics and demands of the majors that students are studying. Also, there are a great number of difficulties and contents of higher mathematics. These difficulties and contents have no helps for the learning

of professional knowledge. However, the mathematical knowledge that is required by the majors is not taught at the mathematics teaching classrooms.

Third, high importance is attached to theory teaching, but practice teaching is thought lightly and also the training of practical ability of the students is ignored. The teaching contents in mathematics courses are still traditional, attaching high importance to the proving of theorems, the deduction of formulas and the operation of exercises, but giving a cold shoulder to practice teaching and the application of mathematical in practices.

Fourth, the evaluation model is single, and does not accord with the characteristics of higher vocational education. Because of the influence of the traditional teaching model, the model of deciding the result of a student with exam is still applied in the evaluation of mathematics course in higher vocational education. Therefore, it is difficult to comprehensively evaluate the abilities of students. As a result, there is an unhealthy phenomenon that students predict and recite the questions that may appear in exam and the rate of students to pass exam.

## 88.3 Combining Teaching Contents with Majors

According to the degree of the demands of the follow-up and core courses of all majors on the fundamentals of mathematics, a mathematics course teaching content system, in which theory teaching and practice teaching are parallel and interactive, can be established in higher vocational colleges. The modular teaching contents (fundamental module, major module, and practice module) can be applied in the mathematics course of higher vocational colleges [5]. In the following, the mathematics course teaching in computer science major is taken as an example: its teaching contents are as shown in Fig. 88.1.

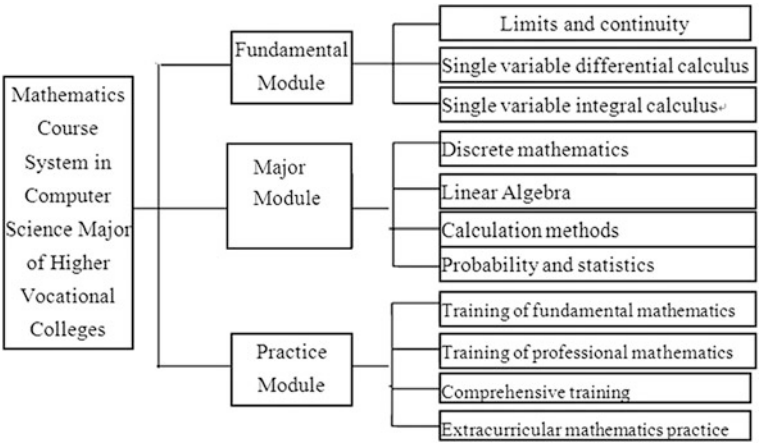


**Fig. 88.1** Teaching contents of mathematics course in higher vocational colleges

### 88.3.1 Fundamental Module

Fundamental module includes the contents of single variable calculus, such as limits and continuity, single variable differential calculus and single variable integral calculus, aiming at laying a solid foundation for students to attain a sustainable development in the future, and also giving a reflection to the "higher education" characteristics of the mathematics course teaching in higher vocational colleges.

### 88.3.2 Major Module

According to the training objectives of all majors and the degree of the demands of the follow-up and core courses of all majors on the fundamentals of mathematics, mathematical modules can be added in major module on the basis of fundamental module, including discrete mathematics, linear algebra, calculation method, and probability and statistics.

### 88.3.3 Practice Module

On the basis of the traditional theory teaching, practice teaching of mathematics is added. Practice module comprises the training of fundamental mathematics, the training of professional mathematics, the comprehensive training, and the extra-curricular mathematics practice. The first three trainings, as the contents of training at classroom, are targeted at all students studying in computer science major. However, extracurricular practice is a platform that is established for students who are highly positive in the learning of mathematics and can easily receive mathematical knowledge to realize a self-development.

In the training of fundamental mathematics, students are required to learn a series of mathematical software such as Mathematica and Excel, and the purpose is to promote students to learn well the basic commands and methods of basic mathematical knowledge operation and analysis.

In the training of professional mathematics, students are required to learn to analyze and solve the mathematical problems in major module with mathematical software.

In the training of comprehensive training, students are required to establish a mathematical model according to the professional problems and the industrial and enterprise problems, and also solve the model by using mathematical software, and finally solve the problems and write an experimental report or small paper.

Extracurricular practice includes the mathematics competitions, the national mathematical modeling competitions for college students, and the competitive

mathematical modeling training for students with a good organizational foundation and an active mathematical thinking way, as well as the participation in the national mathematical modeling competitions for college students.

Such a modular teaching content design can give a better reflection, the principles of attaining practical use and being sufficient in practices of the higher vocational education, thus making the teaching more specific and students' knowledge and ability meet or closer to the demands of majors.

## 88.4 Combining Teaching Methods with Majors

### *88.4.1 Valuing the Teaching of Concepts, Thoughts and Methods, and Neglecting the Deduction and Proving of Formulas and Theorems*

The training objective of higher vocational education is to train the production and service front-line senior technical application talents. Therefore, it is unnecessary to excessively discuss the cause and effect of formulas in the process of knowledge explanation. The visual effect can be enhanced through the vivid descriptions and geometrical instructions, and also the abilities of students to analyze and solve problems with the mathematics knowledge they have learnt can be trained.

In the process of teaching the mathematics concepts, it is necessary to rely on the formation process of analyzing the mathematics concepts with specific problems and the thinking methods hidden in problems, aiming at promoting students to understand that the formation of mathematics concepts is an abstract of all sorts of concrete phenomena.

### *88.4.2 Using Task-Driven Teaching Method for Highlighting the Training of Application Ability*

In the teaching of mathematics course in higher vocational colleges, the task-driven teaching model can be applied, aiming at realizing the perfect combination of mathematics with majors, theory, and practice [6]. In the whole teaching process, mathematical knowledge can be explained by relying on the real cases in life and majors that students will get involved in greatly. Therefore, the whole mathematics course teaching process can be combined with practices, and the teaching contents can be skillfully hidden in each task by taking the completion of each task as clues. Ultimately, under the target of application, theories can be learnt from practice, and also can be applied in practices.

The specific steps of the task-driven teaching method are as follows. First of all, tasks can be provided according to the real cases from majors and industries and

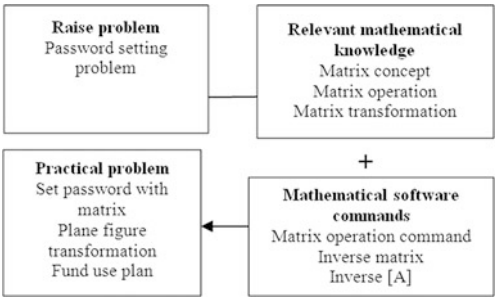


**Fig. 88.2** The task-driven teaching process

the life cases closely related to students. Second, students are asked to analyze tasks and also organized to learn the ideas and methods for completing the tasks through demonstration or explanation, including the mathematics knowledge needed for the completion of the tasks and relevant mathematical software commands for solving problems. Finally, the tasks can be fulfilled by relying on the learnt mathematical knowledge and combining mathematic software, and also other problems in majors and life can be solved further with the learnt. Here, the teaching of relevant matrix knowledge in linear algebra is taken as an example, and its task-driven teaching process is shown (Fig. 88.2).

After an analysis on the whole task-driven teaching process, it is easy to see that the key is to raising "mathematical tasks" for students. It is the principal axis of teaching, and always exists in the whole teaching process. With the purpose of making a good design on "raising tasks", it is necessary to design a feasible teaching task that makes students interested and also is closer to students' majors or actual life by starting from the actual conditions of students according to the teaching objectives of majors, the fields of students' majors or closer to majors, the tasks found from actual production and life, and the characteristics of students.

## 88.5 Combining Evaluation Model with Majors

The application of the method (i.e., basic knowledge evaluation + practical operation ability evaluation + creative ability evaluation) in the mathematics course teaching of higher vocational colleges can evaluate not only the theory knowledge of students and also the abilities of students in practical operation ability and problem solving.

### *88.5.1 Basic Knowledge Evaluation*

In the basic knowledge evaluation, the learning of basic concepts and basic methods is mainly used as evaluation components. Teachers can be allowed to

organize questions independently. The evaluation can be divided into the daily school assignment completion and performance at classroom and the written result in the final exam.

### *88.5.2 Practical Operation Ability Evaluation*

In the practical operation ability evaluation, a student's learning of Mathematica software, the mathematics fundamentals of operation and analysis, the understanding of commonly used mathematical models and the ability to mathematical model are mainly evaluated.

### *88.5.3 Creative Ability Evaluation*

The creative ability evaluation is mainly to verify the ability of students to solve problems with the learnt. Exam questions can be organized and corrected by mathematical teachers and major courses' teachers together according to the several professional problems raised by the major courses' teachers. In the process of organizing exam paper, multiple-choice questions can be applied. In the process of correcting exam paper, multiple solutions can be provided for one question. Then, the major courses' teachers make an evaluation, the professional skills of a student and whether professional knowledge are applied correctly; mathematical teachers can make an evaluation on whether the methods and operations are applied correctly, as well as the advantages and disadvantages of the algorithms.

## 88.6 Conclusion

In the mathematics course teaching model combining majors and strengthening application in higher vocational colleges, the modular teaching contents, task-driven teaching models, and diversified evaluation models should be applied. On the one hand, it is necessary to decide teaching contents and teaching models according to the training objectives of majors, and enhance the integration between mathematics teaching and major teaching. On the other hand, it is necessary to abandon subject the theory teaching in the traditional mathematics teaching. However, it is necessary to take the training of technical application ability as target, attach high importance to the training of intelligence technology and operational skills, promoting students to learn in practice and practice in learning and attain an improvement in the mathematics application ability of students. Also, it is necessary to strengthen the combination of theory teaching with practice teaching. Therefore, a full expression can be given to the "higher education" and

"vocational education" features of the mathematics course teaching in higher vocational colleges.

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# Part X
# Multimedia Technology and Applications

# Chapter 89
# Study of Primary and Secondary Online Schools Based on ASP and PPT Producer Technology

**Ning Zhang**

**Abstract** This paper introduces the methods to develop the primary and secondary online schools management system based on ASP_NET and also how to design and implement a primary and secondary online school system by applying ASP, promoting online school management to be scientific, standardized, and automatic.

**Keywords** ASP_NET · MSSQL · Office management · Online school system

## 89.1 Introduction

With the sustained development of elementary education, the continuously increasing enrollments at many primary and secondary schools, and the deepening of various online school operations, the previous education approaches, training contents and teaching methods are less useful for the needs of student diversification, differentiation, and individuation [1]. This paper designs an innovative primary and secondary online school system based on ASP_NET + MSSQL, which are committed to the settlement of the problems such as online registration, student data registration, curriculum information in the teaching of primary and secondary online schools, allowing their trainings forming a situation of networked office management and standardized process operation, and promoting the system to exercise the information advantages of the schools [2, 3].

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## 89.2 The Basic Plan of the Design

### *89.2.1 All-in-One Management Thought*

The network teaching supporting system has to be closely integrated with the teaching contents, and implement all-in-one management without mutual separation. All-in-one management is to let the teaching supporting system really comply with the requirements of teaching. Within an all-in-one system, all kinds of activities in the teaching/learning process can be completed, unnecessary to conduct switchovers among several systems, and hence decreasing the operation complexity and the learning difficulties.

### *89.2.2 Simplifying the Complexity of Interactive Teaching Designs and Seizing Key Points*

The supporting platform of primary and secondary online schools is established based on the general Internet/Intranet, and provides the all-around service software system specially directed at the remote instruction which is based on the bidirectional multimedia communication network. It includes the services of resource management, network curriculum development, network teaching, and network academic affairs management. The highlight of this system is that students can directly pay the fees when selecting courses and timely make evaluations on the teachers after class.

## 89.3 Structure and Major Modules of the System

### *89.3.1 System Structure*

The paper applies B/S structure and users access servers by Web browser to execute the interactive operations through the forms and databases displayed on webpage, while the server side concentrates the whole system maintenance, modification and other work, which reduce the installation, maintenance, and others of client software. Therefore, ASP.NET+SQL-based dynamic pages design language and relational database management system is employed for design, and the Microsoft Visual Studio 2008 is utilized to develop this system [4, 5].

### *89.3.2 Design of Major Functional Modules*

**Design of Student Registration and Database** Registration authentication: This system accepts user registrations and keeps student archive data. Only the formally registered students can access to the teaching supporting system. New users access to the registration system homepage for registration, and fill in their authentic information in the registration form, and then submit the form, and can check their class grouping information after the administrators approve the registrations (namely after the system groups the classes). Per the functional features of this system, relevant database forms are designed, such as student information form. The student information mainly includes the ID number, name, course selection, gender, registration date, hand-free telephone number, and mobile phones number.

**Course Information Management** After passing the computer-based test, students need to learn within a subject, and hence course information management is provided here. Course information mainly includes the types, teacher information, current state, and so on. Also, it refers to the operations of administrators to check, add and delete course information, to ensure course using states will not conflict between each other.

**Design of Information Management Modules** In the information management modules, the following submodules are included: administrator login, information category management, and information date management. Specifically, the administrator login submodule includes the pages of adminlogin.asp, admincheck.asp, and adminmian.asp; the information category management submodule includes the pages of addtype.asp, addtypeok.asp, edittype.asp, edittypeok.asp, deltype.asp, and deltypeok.asp; the information date management submodule includes the pages of pub.asp, pubok.asp, list.asp, edit.asp, and so on.

**Announcement Management** Release announcement: the administrator updates the information to be published (e.g. course information) in the backend and the system homepage will automatically updates it. Administrative documents management: to manage teaching better, it is necessary to implement the releasing of online school information, and mobilize enormous documents and reports among relevant departments. Therefore, it is necessary to establish quite perfect administrative management system with the purpose to implement the releasing, management, and check functions of various information and documents successfully.

**Renowned Teacher Information Management** Renowned teacher information mainly includes the teacher number, name, and gender, date of birth, working time, hand-free telephone number, mobile phone number, and home address. This refers to the operation of administrators to check, add, delete and update the renowned teacher information with a purpose to ensure better management.

## 89.4 Thoughts on ASP in the Development of Primary and Secondary Online Schools and the Application of Producer Components

First, ASP belongs to a sort of script programming of server side. Except some information technology teachers, most teachers have no knowledge of this technology. If the ordinary teachers program script and the information technology teachers undertake the design and making for the teaching courseware development mode, the courseware design and making will be out of keeping with the classroom teaching. Information technology teachers have little knowledge of the characteristics of other subjects, so the displaying form of the courseware contents is hard to accord with the ordinary teachers. However, the ordinary teachers are often restricted by technology, having no idea of using what forms to describe the teaching contents. The most ideal solution is that the courseware creation and making are independently completed by professional personnel with the ordinary teachers dedicating some suggestions on the subjects.

Second, it is the problem in the design and development of homepage interface. In the webpage design, some information highlighting educational themes such as the main title, everyday-updating information have to be placed on the homepage in general. Of course, the visual process is a kind of feeling but uncertain mathematical formula, which can be flexibly adopted as long as it complies with the psychological sequence in the cognition process of people and the logical sequence of thinking-way development.

The final is the problem in the student online charging and payment modules. Two methods are adopted for students to register a class at this online school. (1) Online registration method whose specific steps are "online registration → payment → conformation to the payment → acquire user name and password → attend the class"; (2) rechargeable card charging method whose specific steps are "user name registration → charging → attend the class" (Fig. 89.1).

## 89.5 Applying Producer Component to Synchronously Integrate PPT and Lecture Video

### *89.5.1 Synchronous Playing of Sound and Video*

There is a blue area at the bottom of chart, referred to as "time line". All elements have to be dragged into the time rail and then can be played. Meanwhile, the ultimate teaching courses will also play the online elements in accordance with the upper time scale. Therefore, it is imperative to drag the voice and video files onto the same scales on the "time line" if the synchronization of voice and video is desired to be implemented. Now the digital videos and cameras are generally

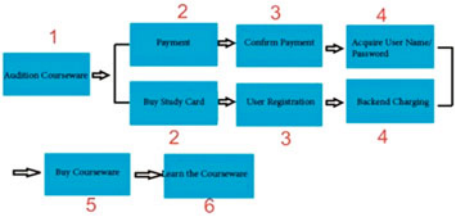


**Fig. 89.1** Chart of registering a class

equipped with a microphone. Thus, the captured video files are with synchronous accompanying sound. At this moment, it only needs to directly drag the video elements into the "time rail", unnecessary to import video files additionally. Moreover, Producer will automatically decompose sound and video.

### *89.5.2 Synchronous Playing of PPT and Video*

Add PPT onto the "time line", click "Tools" menu → "synchronization", and then the system will pop up two windows: one is the left video playing window, and the other is the left PPT playing window. Synchronization needs manual operation: The first is to confirm the "Set up PPT Time" radio button is selected, and then click the playing button at the bottom of the video window and monitor the speech speed of lecturers, and click "Next PPT" button to switch over to next page when the lecturer introduces the content to an appropriate position. Meanwhile, the current PPT content can be viewed at the left preview window. The PPT synchronized by such a method will automatically keep time based on the switchover time, and the different widths of PPT time also represent that the playing time of each PPT is different. If the original PowerPoint file includes the typesetting time, it will remove the original timing data in the synchronization. If you just want to verify whether the original timing and video is synchronous, you necessarily select the "preview PPT timing" radio button and then click the video playing button.

Through the above steps, the archetype of our file can be seen basically. Certainly, there are various mistakes unavoidable in the file, such as PPT words inputting mistakes, and missing of some paragraph. In the Producer, the modification on PPT is fairly easy, only needing click the relevant PPT and selecting "edit PPT" order. Subsequently, Producer will automatically open PowerPoint program for your modification, and new content will be active immediately in Producer after you save the PowerPoint modification.

### *89.5.3 Releasing and Exporting*

Producer supports the files to be sent to the local computer's hard disk, LAN shared folder and web server. The most we use is to export file to a hard disk. Click

"File" menu → "release PPT" → "my computer". After the file importing is completed and saved, there will be a "PPT information" dialog. Then, make selections according to your actual needs and continue to click the "Next Step" to complete the exporting.

## 89.6 Conclusion

The construction of web-based online teaching system is a systematic engineering, involving in the constructions of network infrastructure, teaching resource and management, the specific implementation of online teaching, and so on. In future work, we will continue to deeply study this subject and develop some substantial developments, promoting the education and teaching to be information based. The emergence and development of network education application system is gradually changing the educational models. The integration of network technology and computer multimedia technology provides a fundamental platform for the interactive remote education system. This paper discusses the application of ASP technology in the education field, and hence allows the network education owning unique charm. Along the constant development of network and computer technologies, network education is bound to be unceasingly developed and perfected as well, exerting greater roles in the education field.

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# Chapter 90
# Study of Humanistic Education on English Majors Based on Multi-media Network Teaching

**Xiaohong Wang**

**Abstract** The article begins with English courses to expound how humanistic education penetrates into English teaching combined with characteristics of multi-media network courses and many years' experience of college English teaching and based on previous researches. A large amount of teaching experience demonstrates that using multi-media network teaching is an effective way to carry out humanistic education.

**Keywords** Multi-media network teaching · Shape · Humanistic education · Basic English

## 90.1 Introduction

At present, specific to humanistic education for students in English teaching, many scholars express their own views. Moreover, some educators explore how to carry out humanistic education in English teaching from different angles combined with their teaching experience. They can be summarized as the following aspects:

**Stressing humanistic education from training inter-disciplinary English majors** In retrospection of the training history of English majors in regular institutions of higher learning, Liu [1] points out those humanistic education traditions are the main line that goes through this history. From the analysis and thought of all kinds of problems in the process of training inter-disciplinary English majors in regular institutions of higher learning, it can be concluded that in

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the training of inter-disciplinary English majors in regular institutions of higher learning we should persist in humanistic education traditions.

**Stressing humanistic education from training senior English majors** Scholars who study humanistic education from this aspect consider that senior English majors have mastered certain English knowledge and basic skills of language application. These senior students have transformed from utilitarianism to humanism, so English teaching for them should be transformed from teaching of language skills to teaching of contents. It means that senior English teaching should extend to a wide level and suppress vorstellung of language symbols to make students appreciate the spirit of language through the contents carried by language Liu [2].

Stressing humanistic education from contrastive analysis of Chinese and western cultures. Scholars analyze the current situation of the loss of humanistic spirit in colleges and universities through contrast of Chinese and western cultures to come up with ways to upgrade English majors' humanistic intension from curriculum setting and learning evaluation mechanism [3].

**Stressing humanistic education from second classroom activities** Having second classroom activities is a process of accumulating knowledge in classes and broaden knowledge after classes. There are diversified effective forms of activities, such as reading books and newspapers, British and American films appreciation, drama contest and English speech contest, and so on. Through these activities students can have a knowledge of history, culture, customs, and habits and trend of latest technological culture in English countries. They can also touch local English from different aspects and feel cultural intension in different countries. Therefore, second classroom activities play an important part in improving students' cultural literacy, broadening their way of thinking, and reshaping their personality structure.

**Stressing humanistic education from English examination system** [4] analyzes stipulations in Test for English Majors-band 8 in Colleges and Universities in 2004 and adjustments for Test for English Majors-band 8 in Colleges and Universities in 2005. Fast reading is replaced by test on humanistic knowledge. This transformation is for adapting developing demands in current social trend, training English majors' humanistic literacy, improve students' comprehensive ability, and increase their competitive edges.

It can be seen from the above research aspects that research direction is correct and research results are remarkable. However, there are few analysis about how to penetrate into humanistic education in English teaching combined with training secondary English teachers as the goal, beginning with professional Basic English, and using multi-media network teaching.

The main teaching task in junior stages of English major is to carry out comprehensive and strict training of basic skills to train students' actual ability to use language and help students lay a solid foundation for senior English learning. Obviously, imparting professional and basic skills is important, but carrying out penetration of humanistic education in Basic English teaching cannot be ignored for the following reasons:

The orientation of running our school is to cultivate qualified teachers in secondary education and creative, high quality and practical talents at the grass-roots level. The training of our department aims to cultivate secondary school teachers that have an overall development of morality, intellectuality and psychology, solid professional bases, experienced theoretical skills and strong operational ability and applied talents that can take on foreign, tourist, and translation work. Guided by the above two, we have the necessity to lay stress on humanistic education when freshmen enter colleges. The quality of graduates will have a direct influence on future secondary school students and teachers with extensive and profound humanistic quality will also have great influence on students.

Teachers should consciously penetrate humanistic education into teaching in the Basic English course in order to that students can understand the importance of humanistic education and how to study.

Many freshmen in our school come from rural areas or small towns, so secondary schools have few opportunities to create a multi-media teaching environment for them. On the contrary, college English teaching can apply different effective teaching methods, such as inspiring method, discussion method and so on, and can also apply multi-media as assistant teaching.

## 90.2 Fully Taking Advantage of the Characteristics of Network Courses and Penetrating Humanistic Education from Different Aspects

### *90.2.1 Optimizing Course Design and Create an Harmonious Learning Ambient*

With its modern, scientific, flexible, intuitive and extensive character, multi-media network teaching provides a good mental environment and a brand-new teaching method for the operation of humanistic education. Therefore, when using multi-media as assistant teaching, teachers should change the traditional teaching method imparting Basic English knowledge simply, optimize course design, and fully develop students 'dominating position, create a harmonious and equal ambient, lay stress on students' all-around development and improve students' creative sense and creative ability.

### *90.2.2 Penetrating Humanistic Education from Network Textbooks*

When teachers teach students lessons through multi-media network PowerPoint, they pay attention to imparting language knowledge, intensifying training of basic

skills such as listening, speaking, writing, translation, and so on. Meanwhile, they emphasize imparting stylistics, textual knowledge, from which students can master different genre, and discourses with different structures. Through analysis on text and stylistics, students can understand westerners' mentality and morality, values, and so on. They can also have a better understanding and awareness of Chinese culture, and a better appreciation of western culture. Blindly accepting values of western cultures can be ignored and correct values and worldview can be established to reshape perfect character.

### *90.2.3 Penetrating Humanistic Education from Rich Learning Resources*

Learning resources will be richer if Basic English Network PowerPoint is connected with Internet. In case that a large number of teaching-related extra-curriculum knowledge are brought into English classes, undoubtedly it will stimulate students' learning motive and interest, cultivate students' independent thinking, and improve their creative ability and problem-solving ability. In conclusion, it is a best way to improve students' humanistic quality and reshape personality structure.

### *90.2.4 Penetrating Humanistic Education from Audio–Video Materials*

All Basic English network PowerPoint apply lively flash. Lessons in every unit are attached with film video related to texts, which is appealing and expressive. A large amount of audio and video materials and dialogue and exchange carried out based on audio–video contents can not only cultivate students' comprehensive ability to use English, but also let students to taste original and local English.

### *90.2.5 Penetrating Humanistic Education from Background Knowledge*

Background Knowledge is a main way to pass on and compare Chinese culture and western culture. As language materials, every article in Basic English courses involves cultural traditions, customs, and habits in British and American countries. Therefore, when we make Basic English network PowerPoint, every unit is made with pre-class preparation contents with lively and colorful pictures, which will stimulate students' senses directly.

## 90.3 Intensify Students' Self-Learning Ability and Truly Representing Humanistic Education

### *90.3.1 Systemizing Course Contents to Make it Convenient for Students' Independent Learning*

Based on knowledge structure and teaching contents of English courses, we make a layout hierarchically and orderly, preview every unit in basic English network PowerPoint, explain the text in detail. Some contents of exercises and knowledge extension after texts have links of related pictures to show up unit theme. The whole operation interface is clean, visualized, thus it is convenient for students to learn independently. Students' listening and speaking ability and operational ability of English language are improved.

### *90.3.2 Teachers' Meticulous Instruction and Students' Exchange*

Students are the main body of learning, thus students' subjective status should be established in teaching. We should fully stimulate students' motive for independent learning, bring their intuitive into full play, and let them exchange in classes and express their own views, and experience the happiness of sharing knowledge. Meanwhile, teachers should fully consider students' individual differences and potential of independent learning, guide students, get to know problems that students come across during independent network learning and progress that students master knowledge.

### *90.3.3 Improving Students' Independent Learning Ability Through Self-check*

In order to that students can have convenient independent learning and examine their learning process and conditions of mastering knowledge, we pay particular attention to interactive functions of PowerPoint when making Basic English network PowerPoint. For example, contents of exercises are designed based on features of different questions. In the exercises of dictation, explanation, and translation, answers will come up when mouse is tapped. True-or-false, choice and fill-in are designed as online test. Students can see the correct answers and scores through submit button after they finish exercises. This rich human–computer interaction feedback function facilitates students' independent learning greatly.

Moreover, the self-check and self-scoring method enriches students' after-class exercises greatly, further strengthen students' knowledge they master in classes and train students' independent learning ability.

### *90.3.4 Actively Carrying Out Extra-curriculum Activities to Cultivate Students' Teamwork Spirit*

We should organize students to actively carry out second classroom activities, such as English movie dubbing contest, English drama contest, English speech contest, English songs contest and English composition contest, reading club, British and American film appreciation, and so on. These rich extra-curriculum activities can break the limit of classroom teaching. Students can explore and exchange to have a broad and clear thought. These activities can not only strengthen students' interest in English learning, broaden their scope of knowledge, improve their independent learning ability and problem-solving ability, but also cultivate their teamwork spirit and creativity.

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# Chapter 91
# Study of Course Resource Construction and Innovation in Distance Education

**Feng Wang**

**Abstract** This article makes a deep thinking from innovative course resource, innovative teaching design, innovative teaching contents, innovative teaching model, innovative team building, and innovative course-building assessment mechanism.

**Keywords** Distance education · Course resource construction · Innovation · Thinking

## 91.1 Introduction

Resource is the core of distance education. With the continuous development of distance education, course resource construction in distance education has achieved breakthrough development [1]. A large number of innovative achievements have been achieved. However, some outstanding problems are existing in the construction of course resource in distance education demand research, exploration, and innovation [2, 3]. In order to better adapt to the requirements of lifelong education system and the construction of the learning society, further improve talents cultivation quality, and continuously promote sustainable development of distance education, we should make innovative practice and exploration on course resource construction in distance education [4, 5].

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## 91.2 Construction in Distance Education is the Promoting Sustainable Development of Distance Education

Course is the main carrier for realizing the goal of education and plays an important part in talents cultivation. In essential, distance education is the spread of teaching information. The provision of rich teaching resources is the fundamental requirement of distance education. Course resource construction in distance education solves the problem similar to that "there is car on the road" and "there is commodity in the car", moreover its quality and level directly speculate and play a role in teaching model, management system, teaching quality, and talents cultivation quality in distance education. Without qualified teaching resources, we cannot achieve good effects of running school no matter what forms and means we apply to run our school. At present, our modern distance education development has transformed from square expansion into intension construction phase. Owning a group of high quality and distinctive course resources that can really satisfy learners' demands and their independent learning is an important factor for realizing intension development and basics for owning the rights to learn. It is also the inherent requirement and fundamental guarantee for distance education schools to build their core competence.

## 91.3 Main Problems Existing in Course Resource Construction in Distance Education

With the development of distance education, television universities and network educational school in colleges and universities lay stress on course resource construction. Teaching resources are richer and richer while a number of excellent elaborate course come out. However, there are still some problems in course resource construction in distance education mainly represented in the following aspects. First, course positioning and design idea are unclear without complying with rules of distance education, which is not suitable for students' independent learning. Design and organization of teaching activities, learning supporting services, and assessment means are lacking. Second, understanding of characteristics and demands of adult learners is not probed into. Some schools do not carry out reform of teaching contents and course system, lack integration of teaching contents and media resources. The contents copy written textbooks and video classed, lacking pertinence, feasibility, and practicality. Third, course construction lacks elaborate teaching design failing to take advantage of network resources. In these courses, teaching strategy and teaching media are not well applied. The text is long, audio contents are always the same, and online interaction is formalized, leading to bad instruction, and inspiration.

## 91.4 Innovative Thinking of Course Resource Construction in Distance Education

Specific to the existing problems in course resource construction in distance education, following innovative aspects should be stressed and promoted in order to that course resource construction can better adapt to the requirements for distance education by the construction of the learning society.

### *91.4.1 To Innovate Course Resource Concept*

Innovative concept is the spirit. Course resource concept is the people's attitude and views on course resources. Specific to adult learners in distance education, we should provide course resources in distance education that is rich and able to be continuously fulfilled and updated. Also these course resources should adapt to social education demands and the demands of diversified and individual lifelong learning [4].

### *91.4.2 To Innovate Teaching Contents. The Reform of Teaching Contents is the Core of Reform of Talent Cultivation Model*

In the past 30 years, the focus of education reform in distance education is how to build effective teaching network, how to transfer course resources conveniently, how to let learners study conveniently and flexibly, and how to provide learning support instead of innovative teaching contents. Therefore, adults' on-the-job learning contents cannot satisfy the demands of changes of post and updated knowledge. In order to further adapt to more extensive educational objects and more diversified educational demands, distance education should realize innovation of teaching contents. On the one hand, we should learn from results of teaching reform of higher education. On the other hand, we should carry out new exploration based on requirements of distance education positioning and cultivation goal.

Course resource construction in distance education should center on students. And based on it, course resources that can best promote students' development should be discovered. Moreover, functional advantages of different media should be taken of and dynamic integration and rational matching of different types of resource contents should be stressed to foster strengths and circumvent weaknesses and win complementary advantages.

### 91.4.3 To Innovate Teaching Design

The development of course resources in distance education should lay stress on scientific and rational teaching design. Excellent teaching design can guarantee the realization of teaching goal and actualization of learning process to steadily improve teaching quality. Teaching design we mention here refers to omnibearing teaching design of contents, including design of teaching goal, teaching contents, teaching media, learning process, learning test, and so on. Teaching design that suits students' learning and is scientific and rational should be able to do the following aspects. It should collect enough requirements by learners. Whether the setting of course system suits adults' learning and whether course contents are practical and timely should be taken into consideration. The phenomenon that contents in textbooks lag behind and teachers cannot come up with changes of course contents should be avoided. Integration of text resources, digital resource, and teaching activities should be considered. Students are required to use media provided with clear and detailed learning goal. The setting of guide is convenient while written texts are kind. Learners are able to check their learning results timely and provided with many cases and models for reference and usage. Analysis resources should stimulate learners' studying motive, help learners develop basic learning skills and provide learners with ways to assess their improvement.

### 91.4.4 To Innovate Teaching Model

Teaching model is a firm structural form of teaching process under the guide of certain teaching concept, teaching theory, and learning theory. Teaching model of distance education involves four factors which are student, teacher, material, and environment. These four factors interact with each other, forming a firm teaching model structure of distance education. Course resources construction in distance education should consider the above four factors. Application of teaching method, teaching means, and teaching resources is the core of teaching reform. In terms of teaching method, innovative teaching model is supposed to discover participation-based, case-based, inspiration-based and inquiry-based teaching methods and implementation strategy of cooperative learning and lay stress on improving students' actual ability to discover, analyze and solve problems. In terms of teaching means, innovative teaching model is supposed to actively apply modern educational technology. In terms of teaching resources, different kinds of resources should be applied together. Especially in the process of learning, effective learning interaction should be carried out, including interaction between teachers, interaction between teachers and students, and interaction between students. Teachers should exchange teaching experience and inspire each other; teachers and students, teachers should guide students to learn, answer students' questions, stimulate students' learning motive and understand their demands; and students should exchange learning experience and help and learn from each other.

### 91.4.5 To Innovate Course Construction Team

A good course resource construction in distance education requires a course construction team with rational structure, elaborate quality, practical experience, mastery of theory and practice, and combination of specialty and part time. The characteristics of course construction team are that all team members should participate in course development and the whole process of teaching, including development and manufacturing of teaching resources in prophase, optimization and integration of teaching resources in the teaching process, and supporting services of resource application. It means team members participate from the development of course media materials to teaching summarization after term tests. Team members accomplish different tasks in the teaching process in accordance with the principle of division and cooperation. Network schools in colleges and universities can develop teams with the help of teachers of its school. In the Open University of China, project management is implemented in course construction. Members are made up by project manager, assessment expert, chief editor, lecturers, and technicians. The making of course involves the following procedures: implementation of teaching plan, formulation of course construction plan, course team building, formulation of multi-media textbooks, results examining and acceptance, building and acceptance of test warehouse, trial, and conclusive assessment of courses. In provincial broadcasting and television colleges, course development team is made up by provincial responsibility teachers, authorized experts, tutors, teaching designer, technician, and information managers. Responsibility teachers act as team leaders and take the responsibility of teaching design, resource integration, teaching implementation, and process monitoring. Tutors are responsible for supporting services such as answering question and marking papers. Technicians are responsible for realizing the formulation of media resources and technical functions. Information managers are responsible for platform management, teaching resources update, and information handling. For teachers, manager and technicians who take part in course resource construction, we should not only improve their understanding of rules of teaching design, but also improve their ability and level of teaching design.

### 91.4.6 To Innovate Assessment Mechanism of Course Construction

Construction mechanism including guarantee mechanism such as institutional guarantee, capital guarantee, and management guarantee and so on, and course sharing mechanism and assessment mechanism are required to carry out innovative discovery. In terms of assessment mechanism, traditional educational assessment and teaching assessment do not involve indexes of this aspect in course resource construction. In case that assessment mechanism lags behind, it will affect

schools' and teachers' enthusiasm to take part in course resource construction. Therefore, the main task is to set up the assessment mechanism of course resource construction and application. Course assessment involves assessments in terms of course design, implementation, and implementation. Course assessment has two direct goals: one is to judge the advantages and disadvantages of the course, and the other goal is to improve course quality. Distance education institutions in many countries formulate corresponding assessment standards. There are two relatively influencing standards: one is *E-learning Certification Standards*, which is teaching design with Doctor Lynete Gillis as its lead author and certification standards built by Application Professional Committee while the other one is *E-learning Courseware Certification*, which organized and developed by American Training and Development Association. As students taking part in distance learning rely more on course textbooks than students in other educational departments and rely less on face-to-face teaching, the focus of course assessment should transfer from teaching to learning. In other words, the main contents of assessment are that whether the course provides all resources, environment, means, technology, and so on in order to that students accomplish learning activities to realize expected learning goals. Only in this way, can course resources be automatically recognized, developed, applied, and managed through main course carrier and equipped with course potential and further transformed to constituent parts of course or course implementation.

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# Chapter 92
# Research Online Sports CAI Teaching

**Hua Zhang**

**Abstract** After having analyzed for the disadvantage of CAI software, currently, an online teaching sports CAI manufacture and application has been proposed. It has pointed out the basic principle and method of this software manufacture courseware. Combined with the actual situation of the teaching, the design research has been conducted through the living example. The advantage and benefits in the aspects of strong interactive function and animation processing function have certain significant guidance for wide educators.

**Keywords** Sports CAI · Flash 8 · Network animation

## 92.1 Introduction

With the development of information technology, the computer has been increasingly and widely applied in the teaching field as new teaching equipment and the computer assisted instruction (CAI) emerge as the times require [1]. We could achieve the teaching purpose of various courses with the assistance of CAI. CAI courseware has vivid, visualized, and intuitional features in teaching [2, 3]. It is convenient for the learners to receive the education information through the sense organ, from the understanding through the thinking process and rise to the rational knowledge from the perceptual knowledge [4]. Network multimedia CAI courseware is the courseware depending on the network operation. The feature of network

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multimedia CAI is the resource sharing ability is the multimedia CAI courseware depending on the network operation and uses the network to achieve the modern education model which could not be achieved through one machine [5, 6].

## 92.2 Principle to Adopt the Network Animation to Manufacture the Courseware

We introduce the specific working principle from the aspects of words, picture, animation and video, and so on.

### *92.2.1 Words*

The display of the teaching content is achieved by the words. It could achieve the accurate, meticulous, and complete explanation. Macromedia flash is good vector graphics edition and animation production software. It provides anti-aliasing compensation function to keep the wordy edge smooth and make the animation and film broadcast more smoothly. It could easily achieve the diversified changes of size, color, and character font of words to completely satisfy the manufacture requirements of the courseware.

### *92.2.2 Picture*

In teaching, some content is not convenient to express with words even could not express with words. It will be clear at a glance to express with picture. The Fireworks software in Dream wear, Flash and Fireworks developed by Macromedia could well treat the picture and easily manufacture and treat the picture in Gif and Jpg formats and Flash 8 could well interact with it to finish the picture's treatment.

### *92.2.3 Animation and Video*

Flash's animation works are belonged to the vector animation. In Flash, the users could make various objects to produce the animation, make them appear or move on the stage and also could change the size, color, shape, transparency, rotation, or other properties of those objects. The users could freely set up frame and frame animation according to their own situation through the time shaft on the main interface and also create the gradual change animation. The so-called "frame and frame animation" means the initial and end frames of the animation that the

manufacturer creates, and then the transition frame in the middle is automatically generated by the Flash. After we create the object, we could achieve the action and shape change animation through the property board of the object on the timer shaft. It could infinitely expanded but without losing the distortion. Moreover, it could also directly lead the video document in AVI format and make compile treatment for QuickTime document to broadcast the animation or video.

### *92.2.4 Audio*

In the courseware, the voice is often needed to make for the explanation. Sometimes the background music is needed to activate the class atmosphere. We could use the audio documents in WAV, MIDI, MP3, and other formats in the manufacture.

## 92.3 Manufacture Method of Back Style High-Jump Sports CAI Courseware

### *92.3.1 General Design*

It is planned the subject of the theme, the content, expression layer, and structure contained in the system and the content contained in each page. The most important is the connection relationship among the design pages to form a unity with rigorous structure. In the aspect of content manufacture, it adopts the manufacture form of frame animation and uses the component elements to make detailed explanation for the technology in the back style high-jump step by step. It uses the ActionScript scripting language to display the grace of the technical action for the technology of jumping angle and stretching, etc. It needs to pay attention to make the important teaching for the places that the students are easily making mistakes to timely correct and analyze for the students' easily made mistakes. Moreover, it needs to select and arrange the teaching content according to the students' feature to reasonably arrange the teaching time.

### *92.3.2 Word Design*

The word information is the major resource for the students to get the knowledge. When designing, it needs to reflect the course's process and meanwhile pays attention to the word's conscientiousness and reflect the course's focal and difficult parts. It is to use the words to highlight the basic requirements and action principle of the technology and also makes the words move.

### *92.3.3 Sound Design*

The voice is the major content and structure of the expression course. Different background music is chosen to strengthen the infection. Choose a section of beautiful sound effect from the voice and compile for it to make it reasonably cooperate with the action technology. Meanwhile, the music is also increased on the button to improve the students' learning interests.

### *92.3.4 Animation Design*

The design for the animation adopts the component element as the major form thus to reduce the animation's capacity and convenient for the animation's spread and broadcast. In the component element, it decomposes the basic technical actions for the back style high jump, adopts the gradual frame form and puts the decomposed action in each frame thus to form a complete technical movement. In conducting the whole compile, it needs to decompose again for the difficult and important points according to students' feature to make students clearly understand the details of the action technology. In particular, for the moment action through the pole, here it could conduct the reasonable interaction through action script in Flash 8.

The animation design needs to consider the repeated broadcast function to make students have a comprehensive recognition for the technology through the pole. It could teach students in accordance with their aptitude in light of their different situations through setting up the repeated broad button. It may improve the learning effect to make the students easily master the technical action.

The animation design requires the teachers to make reasonable design according to the teaching content and target, especially analyze and summarize for the technical movement for the important and difficult parts.

## 92.4 Teaching Experiment of the Courseware

### *92.4.1 Experimental Object and Method*

#### 92.4.1.1 Experimental Object

There are 20 male and female students respectively in three grades of 2006, 2007, and 2008 of sports education major in Sports College of Chongqing Technology and Business University. The male and female students in each grade are respectively divided into Class A and Class B. Among that, Class A is the experiment group and Class B is the comparison group. Each class has 30 persons.

**Table 92.1** The comparison table of body shape and physical quality of the students in two groups before the experiment (male) (N1 = 30 people; N2 = 30 people)

| | Body shape | | | Physical quality | |
|---|---|---|---|---|---|
| | Age (years old) | Weight (kg) | Height (cm) | Standing long jump (m) | Run-up reach (m) |
| Experiment group | 22.4 ± 0.87 | 69.3 ± 4.3 | 174.8 ± 2.5 | 2.52 ± 0.13 | 3.01 ± 0.14 |
| Comparison group | 22.3 ± 0.67 | 70.2 ± 5.4 | 174.6 ± 3.1 | 2.51 ± 0.15 | 3.02 ± 0.12 |
| *P* | >0.05 | >0.05 | >0.05 | >0.05 | >0.05 |

*Note* N1 is Experiment group and N2 is the comparison group

#### 92.4.1.2 Experiment Group

In order to ensure the objectiveness and truth of the teaching experiment and avoid the difference of each experimented group before the experiment to affect the internal validity and reliability of the experiment, we conduct the equalization treatment for the body shape, physical quality, etc., of the students in the experiment group and comparison group before the experiment. We have conducted two unrelated small sample T tests for each indicator and there is no significant difference. Table 92.1 is the comparison table of body shape and physical quality of the students in two groups. Table 92.2 is the comparison of the technological evaluation and achievement of the experiment group and the comparison group after finishing the teaching task.

### *92.4.2 Results Analysis*

It could be seen from the table that the technological evaluation and achievement of the experiment group are obviously higher than that of the students in the comparison group. The test results indicate the students in two groups have obvious difference. We believe that the reason for the difference between the technical evaluation and standard score among the students in two groups is the result of the students in experiment group to adopt the comparison teaching of the CAI teaching and camera. On the other hand, it takes advice in the forms of teaching effect and students' questionnaire. The results indicates that all students have the affirmative attitude to adopt CAI courseware, based on this, we think this kind of teaching method is suitable for the teaching reality and for the students' receivable level.

**Table 92.2** Comparison situation of the performance examination of the teaching experiment

| Program | Grade | $\bar{x}$ | $p$ |
|---|---|---|---|
| Technological evaluation | Experiment group | 77.69 ± 5.09 | <0.05 |
| | Comparison group | 73.04 ± 5.21 | |
| Standard score | Experiment group | 157.72 ± 10.45 | <0.05 |
| | Comparison group | 150.16 ± 10.58 | |

## 92.5 Taking Network Animation Software as the Advantage and Benefit of Sports CAI Courseware

### *92.5.1 Better Interactive Function*

The current courseware made by the manufacture tool takes broadcast as the main form. Although those courseware made by those software have certain interactive function, after all, they do not have the major role. The courseware made by the dynamic webpage could proceed through the navigation chart and enhance the interactive function. The Flash could be used to create the interactive film that the visitors could use the keyboard and mouse operation to skip to different parts of the film; move the object; enter information in the sheet or carry out other requirements. The interactive design of Flash needs to use action script to compile the script. Just as the button form adopted in above courseware manufacture to enable the learners to freely choose the learning content, it undoubtedly strengthens the students' initiative and enthusiasm for learning.

### *92.5.2 Linear Process*

Flash 8 has increased UI component and template function that it could invoke other teaching parts at any time. It makes the learners easily master the learning process, which could not be compared by other courseware manufacture software. The dynamic webpage could compose the line type, layer type or web type relationship. Through the hyperlink among different webpages, it could achieve the purpose of self study of the learners and make them study selectively. The manufactured courseware is no longer the broadcast form in one direction. Moreover, this function could make different students to study selectively according to their own learning effect; be helpful to achieve the discriminating teaching, the purpose to teach students according to their aptitude and the effect to yield twice the result with half the effort.

### *92.5.3 Enhance the Open Teaching*

Taking the commonly used courseware manufacture software Author ware and PowerPoint as the example, their combination with Internet is relatively poor. Although through the development, their new edition has enhanced the function in this aspect, after all, it has many disadvantages in this aspect not to make it fully use various convenient conditions on the Internet. However, the courseware made in webpage form has been greatly enhanced in this aspect, since its form is to serve Internet. The courseware of back style high-jump technology that we made could be directly put on the internet in the webpage form and naturally combine with the teaching website. In this way, the learners in different regions could conveniently learn the back style high-jump technology.

### *92.5.4 Enhance the Animation Effect*

We could see that, comparing with the usual courseware manufacture, the above courseware manufacture has obvious enhancement in the dynamic aspect. In the whole manufacture process, we completely display with the animation form, especially the manufacture of a series of animation through the pole. The treatment of other courseware software has obvious restriction in this aspect.

## 92.6 Conclusion

There are many soar, high speed, and rolling over technical movements in the sports teaching materials. Students are difficult to see clearly those movements completed within a moment and also difficult to rapidly establish a complete movement representation.

It could vividly and lively display those technical movements with the courseware made by Flash 8. Moreover, the movement is standard, unified, and convenient for students' repeated learning.

It could foresee, develop, promote, and apply this online teaching CAI courseware, which surely and greatly change the traditional sports education structure and sports way. The combination of the teaching and Internet will be closer and closer.

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# Chapter 93
# Study on the Integration of Information Literacy Education and PBL Teaching

**Tian Min Sun, Bai Chun Yao, Jin Cheng He, Ping Chen and Jun Wang**

**Abstract** The purpose of this paper is exploring the functions of information literacy competency (ILC) in problem-based learning (PBL). Total 333 students, who entered a university in 2007 from two classes majored in clinical medicine, were randomly selected in the anatomy teaching. In terms of class, the students were classified into PBL-ILC group (153 students) and PBL group (180 students). PBL and information literacy education were applied to the PBL-ILC group, while PBL was used for the PBL group. The students' information literacy competency and abilities of applying specimens, analyzing models and resolving problems as well as their academic records and learning attitudes were analyzed and compared. Three experimental results were attained: (1) the PBL-ILC group consulted the data more frequently than the PBL group ($P = 0.004$); (2) the PBL-ILC group more significantly increased in the abilities ($P = 0.0370$) of evaluating and using the document information and the abilities ($P = 0.0345$) of proposing, analyzing and resolving problems through the specimens, models, and anatomy operation VCD than the PBL group ($74.28 \pm 11.34$ per capita) ($P = 0.000$). Therefore, it can be thought that the organic integration of the information literacy education and PBL can produce the resonance effect, and has more obvious advantages than the sheer PBL teaching, and is suggested to be applied in the medical teaching.

**Keywords** Information literacy competency · PBL teaching · Self-learning · Anatomy · Integration

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## 93.1 Introduction

Information literacy is a dynamic concept. In 1989, American Library Association defined it as "a person with information literate is able to know when information is needed and the ability to search, evaluate, and use effectively the needed information" [1]. It mainly include the information recognition, information ability, and information ethics. Problem-based learning (PBL) is a student-centered pedagogy which was created by American neurology professor Barrows in 1960s, in which the learning is advocated to be in the context of complex and meaningful problems and helps students solve the realistic problems through all kinds of resources and learn the scientific knowledge hidden in the problems, forming the skills to resolve problems and cultivating the abilities of self-learning and life-long learning [2]. In the PBL teaching of anatomy, it was found that the abilities of most students to utilize library to locate, evaluate, and use the information are quite weak, so that the normal discussion of the PBL group suffered from the impact. Therefore, how to correctly guide students to improve information literacy competency (ILC) has become an important link in the PBL teaching. From 2007, we tried to integrate the information literacy education into the PBL teaching process, and achieved good teaching effects.

## 93.2 Objects and Methods

### *93.2.1 Research Objects*

Total 333 students, who entered a university in 2007 from two classes majored in clinical medicine, were randomly selected in the anatomy teaching. In terms of class, the students were classified into PBL-ILC group (153 students) and PBL group (180 students). The students of two classes were enrolled through the national unified entrance exam, so there were no statistical significances for the differences of the entrance academic records and sex ratio. The teachers, teaching contents, and teaching materials, total learning hours were all the same. Also, the teachers and students in the PBL-ILC group were trained in the PBL and ILC teaching contents and methods, while the students in the PBL group were trained only in PBL teaching.

## 93.3 Research Methods

### *93.3.1 ILC Training*

Contents related to information literacy education were added into the PBL courses, and were taught or lectured by the subject librarians or documentary

retrieval teachers; each PBL course was trained in the ILC for an hour once a time. The contents mainly included the library resources, database and network resources related to major courses, as well as their searching and evaluation methods. Through the trainings, students had a command of how to utilize their major subject information sources and the information retrieval system.

### *93.3.2 Basic Steps of PBL Teaching*

Step 1: Teaching and research office composed the anatomy PBL teaching handbooks for teachers and students, including the formation of clinical medical cases, well-designed questions, and so on.
Step 2: The students were grouped to clearly recognize the problems to be resolved and confirm the learning plans.
Step 3: The students personally read the teaching materials, search references, observe the specimens and models, dissect the corpses, and evaluate and integrate all kinds of information. Then, the preliminary results were achieved.
Step 4: The students were grouped to respectively assign presidents and recorders who were responsible for hosting the group discussion meetings in which the group members presented their opinions around the problems and teachers gave guidance, promotion, and maintenance.
Step 5: The recorder made reports on behalf of his group and introduced the group ideas clearly.
Step 6: The teachers made comments and conclusions based on the discussion.

Each PBL lesson was conducted for three times (3 hours for each time).

## 93.4 Evaluation Indexes

The first was examining the students' abilities to search documentation information and the grades of the selected and acquired information sources. Each student needed to fill in the "problem analysis list" in which the documentation source, title, abstract, and the solved problems were included. Also, the medical question analysis list filled by the students was summarized and analyzed; the searched documentations were classified into papers, overview, and medical case report. The second part was the questionnaire survey [3]. The questionnaires were formulated and distributed to the students, with the purpose to the students' abilities of evaluating and using the documentation information and solving the problems through the searched information. At last, the uniform proposition examination was carried out, in which the fundamentals and the abilities of analyzing and solving the problems were included.

### 93.4.1 Statistics Processing

Means was used to the data of both the PBL-ILC group and PBL group; the "$t$" of the SSPS13.0 software package was used in the statistical test, and its significance level was $P < 0.05$.

## 93.5 Results

### 93.5.1 Results of the Searched Documentation Information

For the sake of the easy statistics processing, the papers with a higher documentation information source grade was used as the first type, the overview as the second type, and the medical case reports as the third type. The number of the collected medical problem analysis lists through the students' documentation information searches reached 1110. The results indicated that the documentation information source grade of the students in the PBL-ILC group was higher than the PBL group ($P = 0.004$). As shown in Fig. 93.1.

### 93.5.2 Results of the Questionnaire Survey

The abilities of students in the PBL-ILC group to evaluate and use the documentation information significantly increased ($P = 0.0370$) when compared with the PBL group, and so did the abilities ($P = 0.0345$) of proposing, analyzing, and resolving problems through the specimens, models, and anatomy operation VCD ($P = 0.0345$). As shown in Fig. 93.2.

### 93.5.3 Results of the Uniform Proposition Examination

The usual evaluation scores of the PBL-ILC group were 28.77 ± 3.16 per capita and that of the PBL group was 20.82 ± 3.42, from which it can be seen that the difference of the two groups was of no statistical meaning ($P = 0.000$). The final examination scores of the PBL-ILC group were 59.55 ± 8.31 per capita and that

**Fig. 93.1** Searched information distribution

| Group | Student number | Papers | Overview | Case report |
|---|---|---|---|---|
| PBL-ILC group | 153 | 204 | 180 | 228 |
| PBL group | 180 | 72 | 132 | 294 |

| Abilities | Ability to Evaluate & Use Information | | | Ability to Propose, Analyze & Solve Problems Through Samples, Models & Anatomy operation VCD | | |
|---|---|---|---|---|---|---|
| Ability Changes | Highly Improved | Ordinarily Improved | No | Highly improved | Ordinarily Improved | No |
| PBL-ILC Group | 81 | 138 | 9 | 76 | 168 | 42 |
| PBL Group | 18 | 78 | 102 | 30 | 86 | 24 |

**Fig. 93.2** Results of the questionnaire survey

| Group | Student Number | Usual Evaluation Scores | Final Exam Scores | Total Anatomy Scores |
|---|---|---|---|---|
| PBL-ILC Group | 153 | 28.77=3.16* | 59.55=8.31* | 84.87=11.89* |
| PBL Group | 180 | 20.82=3.42 | 49.46=7.69 | 74.28=11.34 |

**Fig. 93.3** Comparison on the anatomy exam scores and the students' learning attitude evaluations. (Comparison between the PBL-ILC group and the PBL group ($P = 0.000$))

of the PBL group was 49.46 ± 7.69, from which it can be seen that the scores of the PBL-ILC group were significantly higher than that of the PBL group. The total anatomy scores of the PBL-ILC group reached 84.87 ± 11.89 and that of the PBL group was 74.28 ± 11.34, from which it can be seen that the total anatomy scores of the PBL-ILC group were significantly higher than that of the PBL group ($P = 0.000$). As shown in Fig. 93.3.

## 93.6 Discussion

Information recognition "when problems are encountered, and information resources are needed immediately" of students is trained through the Integration of Information Literacy Education and PBL Teaching.

The most basic purpose of the information literacy education is to cultivate the information recognition of students and exploit their potential information needs which can be transformed into the real information needs through education. Thus, the students can utilize the appropriate information resources to solve all kinds of problems possible in life. In the PBL teaching, the problems are taken as the primary clue, by which the learning interests of students can be stimulated, and their learning behaviors can also be promoted and maintained.

Ability of students to "acquire, evaluate and use effectively the information" can be cultivated through the Integration of Information Literacy Education and PBL Teaching.

The results of this study suggested that the ability of students in the PBL–ILC group to evaluate and use documentation information and the searched information grade were significantly higher than those of the PBL group ($P = 0.000$), proving that the offering of the information literacy courses can provide the "information competence" for the PBL–ILC learning.

After the ILC training, the ability of students to search documentation information and the searched information source grade were raised, and so the abilities were used to evaluate the information. Also, they can acquire the most valuable documents to resolve the actual problems in the PBL teaching in the vast sea of medical references through the library, document retrieval system and Internet, achieving the purpose to make them initiative to construct their knowledge system. Therefore, the information competence is the important part of information literacy.

Multiple practice abilities of students are cultivated through the Integration of Information Literacy Education and PBL Teaching. The results of this study further proved that the abilities of students in the PBL–ILC group to propose, analyze and resolve problems through the specimens, models, and anatomy operation VCD significantly increased ($P = 0.0345$) when compared with the PBL group. In the PBL teaching, the clinical cases were taken as the "problem" engine to create a context and way similar to scientific research, in which students were motivated to initiatively discover problems, collect, analyze and process information, explore problems, and acquire conclusions, but not receiving the existing conclusions; therefore, they can actually fell and experience the problem solving process, and then learn how to learn, share, and cooperate, and foster the abilities to analyze and resolve the clinical problems with the anatomy knowledge; ultimately, their scientific research recognition, innovative spirits and practice abilities can be trained [4]. Also, the results of this study indicated that the usual evaluation scores, final examination scores, and total anatomy scores of students in the PBL–ILC group were significantly higher than those of the PBL group ($P = 0.000$), which proved that the subjective consciousness of students was progressively intensified after the ILC training; subsequently, their self-learning abilities were fostered; the interests and confidences in the major were intensified; therefore, it was natural that the learning effect was so good [5]. Besides, the PBL teaching constantly impels students to collect the best research references to solve the problems in clinical cases, and this keeps consistent with the "the treatment measures for the patients should be based on the integration of the cautious, accurate and wise collection of the currently best research evidences, the clinicians' professional skills and clinical experiences, and the consideration on the patients' values and wishes" proposed by Professor David Sackets, which is also named as the "evidence-based medicine" [6]. Then, the PBL teaching can not only train the clinical thinking ability and ILC of students, but also it is of highly important promotion role in the practices of evidence-based medicine.

## 93.7 Indivisible Information Literacy Education and PBL

Medicine is a rapid developing discipline. The traditional biomedical model is transforming into the modern "bio-psycho-social medical model". Also, the medical education model is changing from the traditional teaching to PBL model. American association of medical colleges (AAMC) stressed that the students are necessarily fostered to actively learn and resolve problems, but not receive information passively in the published book "The twenty-first century's doctors" [6]. The PBL teaching, information literacy education, and evidence-based medicine (EBM) are called as a troika in the medical education reform. The PBL teaching and information literacy education have the same construction concepts (i.e. theories) and similar ideas. In other words, the student abilities of proposing, analyzing, and resolving problems and self-learning and lifelong learning are targeted to be trained. The information literacy education is introduced into the PBL teaching, namely, the two are organically integrated and arouse the resonance effect by the mutual actions. Also, the sheer PBL teaching, possessing distinct superiorities, is suggested to be applied in the medical education.

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# Chapter 94
# Efficient English Teaching Scheme Based on Multimedia

**Pingping Liu**

**Abstract** The twenty-first century is not only an information age, but also the era of knowledge economy. The twenty-first century knowledge-based economies require personnel with practical ability, interpersonal skills, and ability to innovate. With the surge in today's information and in-depth development of education reform, the traditional education increasingly faced with enormous challenges, teaching methods and teaching methods of reform are imperative, As a new form of education and modern teaching methods of multimedia technology to the traditional education has brought new hope and influence to urge educators to every thought, to practice. From multimedia in the teaching of English on the edge in English teaching how to make full use of a computer as the core of information technology, training students in self-learning ability, and the analysis of the process of teaching to pay attention to the problem.

**Keywords** Multimedia · English teaching · Interest in learning

## 94.1 Introduction

Nowadays, information technology has rapidly developed and knowledge economy has begun to appear. Entering the twenty-first century, we face another huge leap in human civilization from industrialized society to information society. The twenty-first century has brought us not only new opportunities but also new

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challenges-countries all over the world face more intense competition in the international market. The competition in the twenty-first century is the competition in economy, in science and technology; in the final analysis, the competition of talents, which depends on education. Therefore, the current development of education and the application of information technology in education have gained unprecedented attention by countries all over the world. They all try to make education in the very front rank in future information society to ensure the unassailable position in international competitions. Such a competitive situation is a severe challenge to education. Modern education technology will play a key role in the challenge. Under this circumstance, Minister of Education in our country seizing the opportunity puts forward that make modern education technology (mainly refers to audio–visual means) a "commanding height" and a "point of breakthrough" as the entire educational reform. Utilizing multimedia to improve and enhance quality of teaching is one direction for current educational reform. On the one hand, it provides a variety of external stimuli, which are beneficial for the acquisition of knowledge; on the other hand, man–machine conversation helps to stimulate students' interest in learning and exerting cognitive subject effect. "Computer and English" are known as two keys to open the door to the twenty-first century [1]. Since the day computer exists, it is inextricably linked with English. How to utilize computer, this modern intelligence tool, and bring multimedia teaching to English classroom becomes an inevitable trend for the development of English teaching. This paper focuses on stimulating students' interest in learning, increasing class size and exerting the main role of students, and so on. After that, it explores full use of computer technology, with computer at the core, in English teaching to develop students' independent learning ability. Lastly it analyses the problem needed attention during teaching process.

## 94.2 The Advantage of Multimedia in English Teaching

### *94.2.1 Conductive to the Creation of a Real Situation, to Stimulate Students' Interest in Learning*

Language is the tool for communication while language communication is a multilateral and multi-directional activity. English teaching requires students to participate in language practices while language communication activities must be carried out in certain scenarios, without which it is hard to carry out. Only in real language environment or imitated situations can students better understand the information passed which arouses students' deep feelings and stimulates strong desire to express. In previous dialog teaching, teachers mostly made use of pictures or props to create practice scenarios, which have a feeling of unreality. Multimedia teaching is both visual and dramatic bringing together text, sound, images, and animations. Sometimes it is able to create scenarios that hardly mentioned in

teaching material, such as shopping, borrowing, asking for directions, and so on. It can improve teaching environment and optimize structure of teaching [2]. The making of multimedia courseware combines language and context of words, which not only makes students have an immersed sense, but also enables them to do a large amount of language practice quickly in a short period of time. While making the courseware, repeat dialogs and then press mute to let students dub voice.

### *94.2.2 Increase Class Size and Provide Various Forms of Training Methods*

The central task of teaching is quality of classes. In the past, students received English teaching were less involved and had fewer opportunities to practice. The language ability, however, counts on practice. Computer-aided instruction, combined teaching methods with learning methods, can fully mobilize students' initiative, accelerate the pace of classroom, increase class size, and increase the amount of language input. We can compile courseware emphasis, difficult points, vocabularies, test reading, and exercise. Making use of its hypertext function, use the courseware repeatedly at will, which significantly saves explaining and writing time. Teachers can teach only the essential part and ensure plenty of practice, which increases the density of training and improves efficiency. Images attractively set in the media make students feel as they were right on the scene. Authentic language situations greatly inspire students' initiative and aspiration to English learning. In addition, large class size not only expands students' knowledge vision but also enlarge their sphere of knowledge.

### *94.2.3 Man–Machine Conversation, Timely Feedback, and Monitoring: Help Students to Play the Main Role*

For students, the acquisition of knowledge is passive acceptance or active learning. We should advocate students to obtain knowledge actively inspired by teachers. This requires teachers to study the learning rules of students, change the situation of emphasis on "Teaching" and neglect of "studying", and apply multimedia technology appropriately. They can strengthen the guidance of learning method, which enables students to grow from ignorance to knowledge, and then to more knowledge. Simultaneously, learn the way to learn while obtaining knowledge, such as query difficulties according to their own situation; or learning authentic voice and tone by reading while watching. Animated screens instead of traditional blackboard, slides, and still images and text in books stimulate the curiosity of students. In such pleasant environment, the ability to speak English largely increases. Teachers can control and find out the study condition of students to

provide helps by monitoring, talkback, and switching functions. Some exercises can be done as games with computer making judgments on students' answers. If it is wrong, "sorry" or "again" will emerge; if it is right, a smiley face or applause. Feedback at any time like this can make students feel joy of success during learning process, and thus enhance interest and confidence in learning [3]. Images excellent in voice and affection set by the media give students an immersed sense. Real language situation greatly improves students' initiative and aspiration to knowledge. At the same time, we pay special attention to the feedback of information and adjust the research contents and teaching contents at any time. Regular communication between teachers and students greatly enhances their friendship and arouses their motivation to learn English. For example, we do as follows: if students do a good job, the computer will say, "well done. You are very clever. Congratulations." If it is not, the computer will appear encouraging words to enable students to gain courage, "Please try again. Please think it over." If students do a good job after careful thought, the computer will appear motivating words like "This problem is difficult, but you've done it very well." Multimedia fully mobilizes the student's eyes, ears, brain, and hand, which stimulates students' enthusiasm for learning nonintellectual factors. We also pay special attention to ideological education, teaching students' to advocate science, and encourage them to participate in all aspects of English activities [4].

### *94.2.4 To Fully Mobilize Students' Enthusiasm*

According to information theory, the acquisition of new knowledge for human beings experiences such stages as perception–understanding–memory–application. CAI brings multimedia technologies like graphics, text, sound, animation, and sound together. They mutually or jointly emerge which can attract students' attention for a long time. It allows them to use simultaneously their ears, eyes, mouths, and hands, greatly shortens their perception process, arouses their aspiration for knowledge and mobilizes their initiative.

## 94.3 Some Reflections on Multimedia Teaching

"It's like a range when you look at the mountain from the front. But it's like a peak when you look at it sideways." This might be the best portrayal of multimedia teaching [5]. Indeed, the rapid development of computer technology has brought us huge convenience as well as much to think about.

### 94.3.1 The Making of Courseware Requires Studying Teaching Materials Carefully and Preparing Lessons Elaborately

The making of courseware requires studying teaching materials, preparing lessons elaborately, and collecting information with a large amount of energy and time. Only in this way can result in the best effect. It needs to draw attention in the following aspects.

(1) Study teaching material, design closely links to textbook content, and give prominence to key areas. Attention to follow the thinking rules of students and guidance and coaching from the outside to the inside, and from the easy to the difficult and complicated.
(2) The making of courseware center on the teaching steps, collect materials carefully and create necessary communication context. Only in this way can make multimedia contagious, brings together all information and functions such as text, images, sound and animation, and so on.
(3) Based on the actual level of students, provide and create a certain situation which provides a lot of opportunities for language practice and develops students' language learning ability.

### 94.3.2 The Leading Role of Teachers is of Great Significance to Multimedia Teaching

Teachers, as the manipulators and organizers of multimedia, play a significant role in multimedia teaching. On the one hand, teachers have to grasp the use of media platform and the chances; on the other hand, teachers have to control the rhythm of the classroom and make the classroom active but not in confusion. It has to stimulate interest of students and to achieve the purpose of teaching. Do not let courseware lead you around by the nose.

### 94.3.3 Multimedia has Special Effects that Cannot be Replaced by Other Medias

But it does not mean that innovation has to abandon tradition. Traditional teaching approaches have their existence values. There is no need to accomplish a situational designing with gif or flash animation if it can be done in a few minutes in classroom. Do not use multimedia for multimedia. The purpose of using multimedia is to make teaching better. All teaching methods should center about this purpose. Moreover, not every class is suitable to use courseware.

## 94.4 Existing Phenomenon

Nowadays, many self-made coursewares are demonstrated. Training opportunities providing to students are few. Interactive training designed for students like role play and question-and-answer drills are lacking. Many classes have no communication and no interaction at all. Often a class becomes "picture show class" or "music appreciation class".

## 94.5 Break with the Conventional Idea: Knowledge has No Limit

Many English teachers have little knowledge and understanding of CAI. They are ideologically ill-prepared about rapidly developed information technology and its effect to English teaching. Some teachers hold the suspicious attitude toward the feasibility of multimedia courseware. This affects teachers to reach out to new ideas, and new technologies. Another factor that affects the progress of CAI is the low usage level of computer. Shortcomings mentioned above are largely related to the low usage level of computer [6].

Multimedia is a newborn thing in its application of English teaching. Its application in teaching embodies the influence of modern technologies to teaching. It has a bright and board development prospect in English teaching. As an English teacher in the New Age, we need to grasp the pulse of the times, learn modern information technologies, and update teaching concepts and teaching methods, in order to make English teaching better.

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# Chapter 95
# Study on Teaching Reform for University Computer Information Technology Curriculum

**Bin Zhang**

**Abstract** Currently, our country's basic computer education reform is in an important turning point, a transition to the starting point of information technology education popularization is from university to primary and secondary school. Since in primary and secondary schools, there are "information technology education" courses, how to reform the university information technology, how to reflect the course of information technology education in university, how to link primary and middle schools education, and how to follow the rapid development of information technology, all of these are urgent in basic computer teaching reform in colleges and universities.

**Keywords** University computer · Information technology · Teaching · Current situation · Strategy

## 95.1 Foreword

With the rapid development of information technology, computer and network have come into people's work and life deeply, and to be familiar with and master the basic knowledge and skills of computer information process technology is one of the essential conditions to be qualified for the job and adapt to the social development. Just like the higher mathematics and university physics, computer information process technology is a public basic course that the higher school must offer. Recently, with the rapid development of computer information technology and

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increasing popularity of computer application, Chinese middle and primary schools have gradually opened the course of information technology, which makes the higher school freshmen have some basis for the computer knowledge and operation. In this situation, how to correctly position the university computer information technology curriculum, organize course contents, and the model of teaching and make up the differences of knowledge and skills of zero point and nonzero starting point students is a task that we need to strive to study and solve [1].

Recently, Chinese middle and primary schools have gradually opened the course of information technology, which makes the higher school freshmen have some basis for the computer knowledge and operation, then how to correctly position the university computer information technology curriculum? We need to pay attention to the following points:

First, clear and define the differences between university learning and high school learning. The university learning process needs more information technology which means not only learning some simple computer basic knowledge and skills but also paying more attention to cultivation of college students' thinking ability, innovation ability, and autonomous learning ability. In the teaching process, many undergraduates may have a doubt that computer information technology curriculum is to learn some basic computer skills which have been taught in junior high and high school. In addition, many undergraduates also think to know how to operate the computer is enough, and there is no need to learn theoretical knowledge. As for that, before classes begin, teachers must let undergraduates understand information technology is not equal to computer operation and they need to constantly excavate their innovation ability and thinking ability.

Second, colleges and universities teach according to subject classification, and different subjects require corresponding information skills. In addition, different subjects require different information skills, but middle and primary schools have just taught some basic concepts and skills, so schools need to further cultivate students' ability to use information technology to learn professional curriculum in university study [2].

Third, as information technology has a very wide range and update quickly, which can help undergraduates understand the newest current information technology at home and abroad to keep up with the pace of the era development. Hence, it is necessary for undergraduates to learn knowledge and skills of information technology.

Through this course, teachers must help students get the ability to obtain, analyze, and use information, cultivate their good information literacy, encourage undergraduate to take information technology as a method for their lifelong learning and cooperative learning to lay a good foundation for adapting to the future study, life and work.

## 95.2 Current Situation of Teaching of University Computer Information Technology Curriculum

At present, current situation of teaching of university computer information technology curriculum mainly displays in the following points:

First, college students' computer level are uneven. As we all know, college students are all derived from various provinces where the level of economic development and education is not balanced, so the popularity and speed of computer knowledge are also different, which make the freshmen have big otherness in computer basic knowledge level. Even in the same class, students' computer basic knowledge and operation application ability are still different. Some students have been able to use the computer skillfully, while others have never seen a computer. Students with good foundation and high level generally reflect the content is not enough and hope teachers to teach more. But those students with weak foundation reflect that it is difficult to understand teacher's normal teaching, which make each side has complaints. That college students' computer level is uneven has increased teaching difficulty. What is more, with the popularization of computer knowledge, more and more freshmen have once used the computer, if we still use the traditional teaching mode, there will be some negative effects.

Second, in most Chinese colleges and universities, computer information technology teaching materials adopt the book university computer information technology tutorial with single target and multifarious content. The situation increasingly does not adapt to the teaching characteristics of different disciplines and majors. It is difficult to achieve teaching goals of different subjects without reform of the traditional teaching mode.

Third, the curriculum content is more, lesson is little. Generally speaking, college students' computer information technology curriculum include principle of computer form, computer network, computer software, multimedia technology, database and information system and other course knowledge, and knowledge capacity is great, but universities only allocate very little time, which makes students feel the contents are so much that it is difficult for them to understand and absorb the knowledge. The situation will cause two tendencies that students with good foundation want more knowledge while students with weak foundation feel hard to learn.

## 95.3 How to Reform Teaching of College Computer Information Technology Curriculum

Through the above situation, the traditional teaching mode has not been able to satisfy the existing teaching requirements, so it is imperative to reform teaching of college computer information technology curriculum.

First, use the multimedia teaching. In the teaching practice, the teacher is a guide to students' learning, and also the promoter for the students' exchange and the advocate of students' learning interest. Modern multimedia technology is the best tool for teachers to play the leading role. With multimedia, teachers can show students the work principle of computer CPU, virtual memory principle and some boring, drab, abstract and difficult knowledge, which make the work mechanism process and visualization so that it is convenient to students to understand. In addition, multimedia technology can provide students colorful and illustrated interface, which breaks the traditional teaching mode like teacher speak—students remember—recite after-school and the expression of teaching content is more intuitive.

At the same time, teachers also need to note using method of multimedia technology. If they only transfer all of the knowledge that will make it hard for students to focus on priorities and impression is not deep just like watching movie. So teachers need to supplement some traditional teaching methods to combine two ways organically to improve teaching efficiency radically.

Second, improve the teaching content. The refresh rate of Introduction to computer technology is so fast that no matter hardware or software change quickly. However, university teaching content is always relatively slow. So the model of teaching for introduction to computer technology should not only grasp the teaching material, it should be based on it while not get bogged down in the teaching [3]. What is more, we need to properly update the teaching contents and permeate new ideas, new methods, and new knowledge. In theory teaching, teachers can appropriately collect some new products and technology that are not mentioned and show them in class. For example, when teaching mobile communication system, teachers can combine with the actual situation and explain present most popular 3G technology, which can greatly improve students' interest in study and learning initiative.

Third, implement the layer teaching. The layer teaching means in teaching process determining teaching goals of different levels from students' actual conditions and arranging different levels of teaching contents and teaching tests. The teaching method can make different students have learning interest and obtain something so as to accomplish the teaching task. Universities should first classify students according to arts and science to make students study the content selectively and teachers can also teach them selectively. Then schools can arrange different learning goals that should be achieved by all levels of students in teaching activities according to different situations of students' computer basic knowledge to enrich their knowledge structure, so that they can adapt to future informatization social environment.

Fourth, complete the teaching evaluation. In the course system, curriculum evaluation plays a role of quality supervision and incentive guiding. In the teaching process of university computer information technology, we need to timely evaluate the teachers' teaching and students' learning, which can get the two-way information of teaching and learning, find the issues on time and adjust the teaching method to improve the teaching quality continuously. Introduction to

computer technology is a practical course, and teachers must evaluate student's study and operation on time and couple back information, so students have a correct understanding of their own learning and continually get feeling of success to increase confidence and improve the learning interest.

In a word, the major objective of introduction to computer technology is to cultivate students' application ability of information technology and to obtain analysis and process information with modern information technology. University computer teachers should fully combine characteristics of this course and use all sorts of software and hardware resources to help undergraduates firmly master the operation ability and the innovation ability that are needed by information society. Only the contemporary university students', information literacy is comprehensively improved, can be the overall quality of Chinese society improved, so that we can have a brighter future!

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# Chapter 96
# Study on Integrated Problem Centered Higher Education System Based on Information Technology

**Wen Ying Li**

**Abstract** In this paper, the author tries to report for the development of a possible concept of higher education, based on the computer system, applicable to demand changes in current higher education and the environment. In the current education system, it is not having proper method of processing content education projects. In the system of higher education, the process put forward in this paper is placed in an environment of human, knowledge, and professional software.

**Keywords** Education system · Information technology · Integrated

## 96.1 Introduction

In the long-term development of the information technology and communication technology application in higher education, new methods of engineering, discovery and the ability to solve problems, and as the center consistent computer-based education system is not really high. Meanwhile, highly integrated and organized education system is required as applied to advanced computer system environment. At present, the higher education systems based on computer application of various software products achieve more and more. They represent a high level of information technology. However, they are not good at processing the education project content. This paper reported in recent years work is as a contribution to improve the situation. To do this, the more advanced recent information technology and

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software tools must be applied in recent year's constant growth. Some publications below support the above conclusions.

The conclusion is a study in the literature [1] of integrated model, using six dimensions. These dimensions are students, teachers, course, technology, design, and surroundings. Key factors in modern distance education analyzed during the satisfaction survey learners. The results showed that the study manner, the teacher computer anxiety e-learning, learning flexibility, learning quality, perception usefulness, perceived ease of use, and the diversity of key factors influencing the perception of the evaluation is learners with satisfaction.

The authors [2] explain, many university teachers and students have limited formal academic use information and communication technologies. Focuses on the use of computer technology are being constructed in limited, linear, and rigid terms from creative, production, and given purposes. Literature [3] is a report about a study to investigate the influence of participation in microcomputer visualization of collaborative learning (CSCL). The results show that visual participation can contribute to success CSCL.

Methods based on model, some of the relevant engineering problem is solved. Information product definition model controls the human intention and other content entity model defines the use of human intent. Introduction of the method of product definition model, model human control information about human intent, and auxiliary-based human intent in human decision background defined problem solving.

This paper preliminarily analyzes and discusses the author cooperation technical management personnel and management virtual classroom. They published the practice guide of class concerned concepts of things and process of higher education practice to consider. They also discussed in the network environment virtual teaching procedure, local and global view and main advantage of virtual environment, and virtual education. They investigated an earlier published structure characteristic and construction of classroom model and the integration of possibility and engineering system is modeled classroom. They also recognize that one of the most important issues, for a better defined organization course description is organized activities for course processing system. They analyzed the definition and organize activities, the application of control of course definition and curriculum program execution process. Several typical processes, including sequence of activity process, teaching, and learning in a virtual classroom environment, are discussed.

The author [4] emphasizes problem-based learning has been as the core of engineering education major development in recent years. In the learning environment problem drives learning. Students realize that they need to learn new knowledge, which can solve the problem before. Thesis [4] shows experience method structured problem-based learning introductory learning teaching module in heat transfer of the first electronic engineering graduate course.

This paper first discusses the processes of higher education, as they work with human, knowledge, and software environment. Proof of this changed concept and

related new and implementation method was introduced. Finally, the ability to solve problems of higher education for core is about the change of style draws the outline of engineering.

## 96.2 Integrating Higher Education Processes into Consistent Computer Systems

The answer to the first question, education system must be hot integrated into the current relatively typical computer system. Figure 96.1 shows the higher education process, as they work with human, knowledge, and software environment. It shows students and teachers, the participants, knowledge source, communications, industrial education system, and using the exchange process teacher. This requires communication software. In order to meet the demand, classical education industry resistance engineer should be replaced based on case studies and education projects. The above communication with students completes this process project, Processing student project, project progress to evaluate produce results solving the problem. Coordinated engineering education plan, problem-solving methods, and tools for setting meet course.

Consistency is the most important education system emphasizing to take full advantage of these important characteristics, in current computer system application. Consistency analysis reveals the entities and relationships, but does not include required parameters in education system.

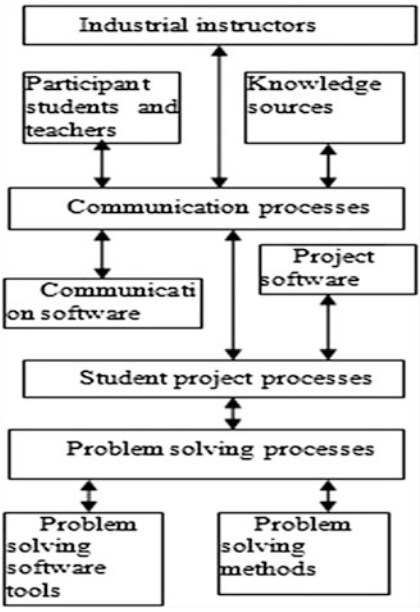


**Fig. 96.1** Processes in integrated higher education system

## 96.3 Changing Concepts and Methods

Changing concept, consistency, problem solving, and higher education course project needs a new method, on the basis of new bonds and the existing education activities.

The teaching process and procedure combine with ongoing projects, because it is in Fig. 96.2. The teaching process is for lectures, laboratories, and problem-solving seminar. Laboratory procedures are the basic teaching arrangement and problem solving. Laboratory needs problem-solving skill, gets basic teaching laboratories. Teaching programs include usual elements. This course teaching plan is according to the definition. These plans are expounded according to the teaching requirements for authentication files. Quality management and audit and system authentication are closely linked. Material is different from the traditional matching algorithms. The education is mainly based on the core of preparation material program. Some of the material is connected to different purposes. Materials are defined experience case study and project. Materials are collected during the student projects.

Consistency, problem solving, and on this basis to the project's computer systems require a high degree of organization structure of course objects in a curriculum mode (Fig. 96.3). This structure is authentication course requirements by the program structure, organization form, and plans including course description.

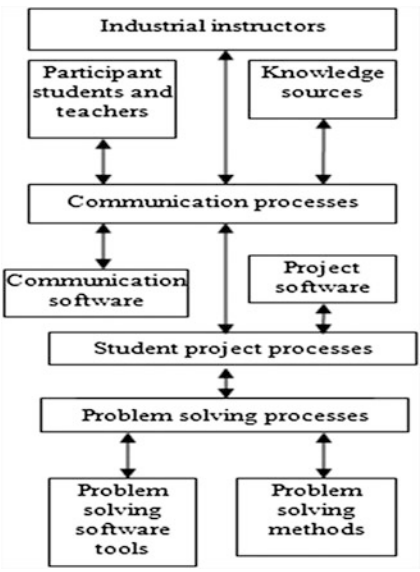


**Fig. 96.2** Teaching processes and programs in connection with ongoing projects

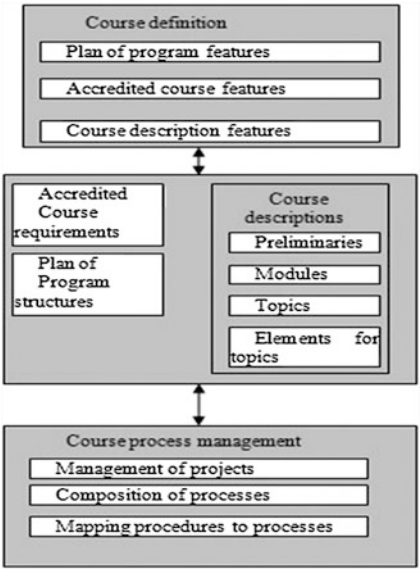


**Fig. 96.3** Definition and management of course objects

## 96.4 Problem-Solving Centered Higher Education for Engineering

In a higher education problem, "for the center system, course objects and their structure" have been defined as curriculum and project management (Fig. 96.4). The third function is mapping process object program. This structure is conceptualized because it can make the treatment project activities, and traditional curriculum together activities. Complete curriculum activities are according to the student file. Method is introduced in the student's archives process modeling. Project is auxiliary case studies from the latest best industry practice.

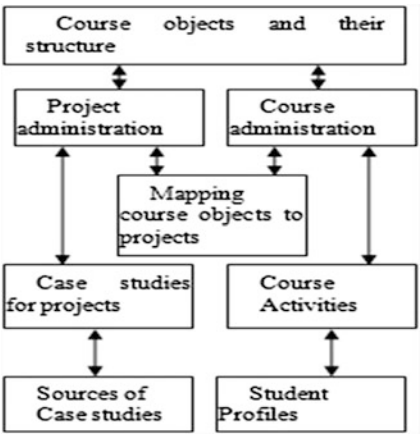


**Fig. 96.4** Definition using course and project administration

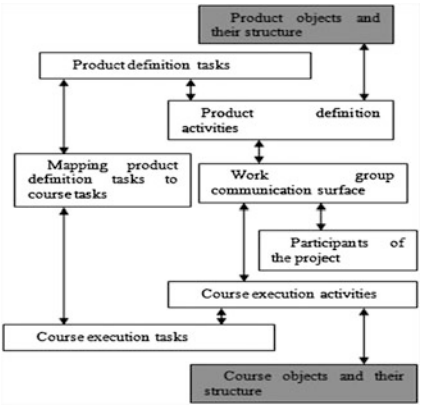


**Fig. 96.5** Integrated engineering-education system

A case study is special role of higher education courses proposed. The main objective is to improve students' ability to solve problems. Therefore, case studies are examples of how to deal with problems in engineering tasks. Meanwhile, ability is typically given indirectly through a case study. For this purpose, case studies must be processed into a special kind of teaching content.

Processing data structure course process management for curriculum mode. This activity is supervised by the system management, and it is under the control of the authentication combined with quality assurance (Fig. 96.2), they define virtual classroom teaching and learning resources and control procedures.

Application of advanced modeling and information system life cycle management engineering product information is necessary, because the engineering is entering this virtual system.

An integrated concept engineering—complete system are summarized in Fig. 96.5. The structure of the objects and their products is defined in engineering system, suitable for development, analysis, production planning, and marketing, application, and recovery project activities. On the other hand, the curriculum objects and their structure of higher education are to carry out the system. Object definition in products field and executed courses base on task definition. These objects related activities connected are the function of the product definition to the curriculum task mapping. Participants in the program communication product are defined and curriculum implementation of group communication through the work surface. This surface is available in advanced engineering system.

## 96.5 Rework

Three scientists in future possible outcome of the main principle are proposed for the foundation of higher education of computer system. The first definition in the physical is model of education object implementing the existing in current higher

education process description. The second is for object structure conceptualizing those suitable for solving problems of higher education process . The third is a detailed integration with the concept of industrial engineering system.

## 96.6 Conclusion

In teaching link project is, combined with continuous student projects. Consistency, problem solving, and the project of the computer system need highly organized and registered the course requirements applicable object structure in a course process model. Processing project activities serve special structure, together with the traditional curriculum activities. Engineering—complete the concept of integrated system including object definition and executive process in products field, on the basis of the side task definition.

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# Chapter 97
# Study on the School-Enterprise Cooperation Teaching Model for Digital Media Major in Scientific and Engineering Programs

**Li He, Hai Cao, Yun Deng and Changyou Fu**

**Abstract** In accordance with the characteristic that the professional knowledge of the scientific and engineering programs is integrated with market in depth, the author establishes a school-enterprise cooperation teaching model that fits the actual conditions of China's higher learning schools and the characteristics of majors by introducing the international school-enterprise cooperation teaching model and under the educational guidance of the educational concept taking the innovation cultivation as the purpose, and orienting at the employment and combing the education, production, and research in this paper, and also pushes forward the cultivation on the application-oriented digital media talents and the enhancement to their employment competitiveness from the perspective of practices.

**Keywords** Scientific and engineering programs · Digital media major School-enterprise cooperation

## 97.1 Introduction

As the digital media industry is one of the core industries of knowledge economy in the twenty-first century, the society needs increasingly more talents day by day, and simultaneously the requirement on the talent quality constantly becomes

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higher, which drives the higher learning schools continue to transform their talent training models with the purpose of adapting to these needs. The digital media integrated by software and design art is a crossed new branch of science, and obviously possesses the interdisciplinary characteristic, in which the practice training of the school-enterprises cooperation greatly differs from the practice model of the traditional single program. Thus, exploring a new school-enterprises cooperation practice teaching model fitting this discipline, and cultivating the inter-disciplinary talents to meet the needs of the information market development are necessary and inevitable.

## 97.2 Problems in the School-Enterprises Cooperation for Digital Media Major in Scientific and Engineering Programs

### *97.2.1 Institutional Constraints on the Talent Cultivation of Schools*

#### 97.2.1.1 Difference in Study, Practice Method, and Emphasis of the Digital Media Course System Between Home and Abroad

In the foreign digital media course system, the fundamental core courses for the undergraduates are of universality and similarity, and include the major research areas of the digital media, which drive their students to be able to know the primary contents of multiple digital media research areas in an all-round way. In the core courses of the digital media major, great importance has been attached to the integration of theoretical and practical studies; the rate of the theory and practice has reached to 1:1; the cooperation between schools and enterprises is highly emphasized, and relevant enterprises have been contacted to provide internship opportunities for students as well. However, China's domestic digital media education started very late; due to the crossed characteristic and emerging of the discipline, there are no series of teaching materials and well-improved course system plan which are designed to the digital media education in China at the present time, and also its practice model and corresponding implementation plan are lacked in the new period. All these have posed a direct restriction on the rapid development and cultivation of inter-disciplinary and innovation talents of China's digital media education [1].

#### 97.2.1.2 Insufficient Scientific Foundation for the Construction of the Course System

In the cultivation of the digital media talents, the higher learning schools in China prefer the trainings on the inter-disciplinary talents, and make the greatest efforts for this objective. For this reason, a majority of higher learning schools learn from and imitate each other, and offer diversified courses as well, producing a desultory situation with no system in China. Moreover, they have seriously similar structures and tend to pursue a comprehensive course system in the setting of courses. Besides, different higher learning schools attach equal importance to the technologies and art, which, however, results in a common tendency of the technologies and art integration structure in the setting of courses, totally neglecting their own advantages and orientations as well as the due characteristics of the students from different majors.

#### 97.2.1.3 Weak Faculty to Contain the Development of the Digital Media-Oriented Major

In view of the discipline emerging and crossed characteristics of the digital media, the single computer science structure in the software major can no longer adapt to the development of the digital media oriented major. As the higher learning schools in China usually classify the different departments based on the disciplines, the obstacles certainly exist in their mutual communication, and the interconnection and cooperation between different disciplines are in shortage as well. Besides, a few of opportunities are provided by the schools for the teachers to participate in the external trainings on the digital media, so that the education ideas of the teachers do not keep pace with the times highly and also lack a long-term significance.

#### 97.2.1.4 Divorcement of the Talent Cultivation Plan from Market

As there is a great gap at the employment market in which the talents from the computer technology programs such as the digital media-oriented major are urgently needed, the graduates from higher learning schools are still confronted with a severe employment situation. The reasons for this phenomenon can be concluded after analyses: the education at school cannot joint with the social needs; the knowledge necessarily known by students is updated too slowly and cannot adapt to the new requirements of the times; the purpose, profession, and application of the course settings are barely satisfactory, in which the practical operations of the specific projects are rare, and the theories and practices are not integrated organically; the difference between the requirements of the employing units and the needs of graduates is highly large, and has changed into a barrier for graduates to step into society.

### *97.2.2 Bottleneck in the Cooperation Between Schools and Enterprises*

#### 97.2.2.1 Shortage of the Mature Cooperation Recognition

A majority of enterprises are limited in the instant profit; they only desire to apply talents but not to train them, or do not or rarely participate in the talent trainings, and are unwilling to send their engineering and technological elites to give lectures to the students at higher learning schools. Besides, many companies have short-term behaviors, and regard the cooperation with schools as a method to solve the temporary employment difficulty [2]. As the enterprises concern about the multiple problems such as the security accidents, production cost, and technical confidentiality in the core positions after the participation of students from higher leaning schools, they usually establish the traditional single and loose internship bases for the cooperation with schools, which does not achieve the purpose of enhancing the practical abilities of students and systemically training the project procedure within enterprises.

#### 97.2.2.2 Insufficient Motivation for the Cooperation with Schools

The enterprises, as the main body of market, often pursue the maximum economic benefit unilaterally, and do not integrate the education function of higher learning schools into their value chain, and also do not take the initiatives to undertake the trainings of high-quality laborers for society [3].

## 97.3 Exploration on the Diversified and Multi-Level School-Enterprise Cooperation Models

### *97.3.1 Integrating the Software and Art Skill Trainings to Establish a Scientific Market-Oriented Course Structure*

In accordance with the principle of the quality-oriented education and major-oriented education being equally important, the teachers from software and art majors can be organized to discuss the student fostering plans, teaching program, and the talent training orientation and characteristics, and so on. However, the experts from enterprises are necessarily fired to participate in the argumentation on the specialized talent training plan and the evaluation of the teaching program. Thus, the teachers can seriously know the industrial technological development and listen to the suggestions from the industrial or enterprise experts, and then

continuously absorb the professional elements. Subsequently, the schools can integrate the new requirements on the abilities of the professional positions, and formulate a scientific and reasonable course structure by referring to relevant engineer qualification standards [4]. Besides, the technological personnel and the professional teachers can compile, check, select, and prove the teaching materials together, aiming to ensure the teaching contents closely keep pace with the industrial developments.

In face of the needs of the digital media industry and society, it is necessary to establish a digital media course structure that adapts to the practices of the cooperation between school and enterprises, aiming to train the engineering talents, so that they can attain a coordinated growth in knowledge, ability, and quality, and are equipped with solid and broader theories and practical abilities of the digital media engineering, and then become the inter-disciplinary talents competent in the effective integration of computer technology and art.

### *97.3.2 Establishing a Faculty in Crossed Disciplines and with the Complementary Advantages of Schools and Enterprises*

The digital media major is an emerging discipline. The knowledge in digital media field integrates the digital media technology and art. The teachers in relevant digital media courses shall not only be equipped with a profound humanity and artistic quality, but also can skillfully use the digital media technology. Thus, the plan of establishing a faculty in crossed disciplines and with the complementary advantages of schools and enterprises is put forward. In this plan, the training of the discipline leaders for the young and middle-aged teachers is the core; through multiple methods such as introduction, training, and supplement, an effective mechanism with a reasonable allocation of faculty resources and an excellent talent development can be established, and the excellent young teachers can be selected to further the study in the digital media education program at foreign countries. Also, the existing teachers can be grouped to be regularly trained on the new technologies and knowledge for a short term. In the aspect of the construction of the part-time faculty, the schools can hold an open recruitment to employ some enterprise engineers and technicians with rich development experience and senior talents in digital media as the part-time teachers for the digital media-oriented major, aiming to ensure catching up with the social needs.

### *97.3.3 Establishing a Digital Media Experimental Platform to Share Resources within School by Relying on Enterprises*

Digital media is a discipline featuring strong practicality and operability. In the course of teaching, how to train the digital media talents better based on the characteristics of the discipline is a key issue in the research of the practical teaching. Thus, both the schools and enterprises can establish an experimental platform within school by complying with the principles of "complementary advantages, well-defined ownership, resource sharing and mutual benefit".

In the course of establishing a digital media experimental platform within school, the strengths of enterprises can be used, such as the introduction of their equipments with advanced operation functions. During the running period of the platform, the sharing mechanism for the teachers and technicians to combine the teaching trainings with the production process and share equipments and benefits can be developed as well; at the mean time, it is necessary to be oriented at the market and then develop the project trainings, and therefore the practical abilities of students can be fostered from practices. Ultimately, the integration of education, production, and research can be enhanced in the teaching practices with the systemic practice teaching and training model, and the students can be fostered into the inter-disciplinary talents meeting the market need in which the quality-oriented education and major-oriented education are equally important.

The opening-up of the school digital media experimental platform to students can be carried out on the basis of its successful establishment. However, there are two necessities for this opening-up: (1) the existing experimental devices can applied high efficiently, which can provide a good experimental platform for the students with ample spare times and to take part in multiple scientific and technical innovation contests and project developments; (2) the existing experimental teaching resources can be integrated through the development of the laboratory, and the consistent allocation and purchase can be strengthened, avoiding the repeated purchases, and achieve the goals of maximizing the utilization of resources and sharing them.

### *97.3.4 Education, Production, and Research Cooperation Between Schools and Enterprises*

#### 97.3.4.1 Building Good Cooperative Senses

The sustainable development in the modern time must be equipped with innovation concepts as well as technological research and development. Making full use of the huge science and technology research and development bases (schools) can help the enterprises reduce a great deal of research and development cost on the

technological innovation. Usually, the higher learning schools desire to train the application-oriented talents, and hence focus on the "industrial demands, actual application", so as to foster the abilities of students to comprehensively apply the theoretical knowledge and methods to resolve the actual problems. Thus, the further education, production, and research cooperation between schools and enterprises are a win–win achievement, and the establishment of good cooperative mechanisms is of a profound significance for the development of both sides.

#### 97.3.4.2 Talent Training Model of Integrating Education, Production, and Research for the Digital Media-Oriented Major

The education, production, and research cooperation between schools and enterprises for the digital media-oriented major adopts the innovation training plan of "100 % Employment Rate and Full Participation of Enterprises", which accords with the "two-way demand" talent training model between schools and enterprises. After the implementation of the school-enterprise cooperation, both sides are oriented at the employment; the enterprises give students internships during the summer and winter vacations as well as pre-graduation period, which can achieve the cooperation in the science and technology and the human resources mutual sharing. In addition, the students at higher learning schools can go to the production front lines of enterprises, and undertake the tasks that they can do; especially, as the enterprises are urgently in shortage of relevant personnel, the students can provide a great deal of assistant work, helping the enterprises save part of resource cost.

To realize the school-enterprise cooperation in the digital media, it is necessary to cultivate the practical abilities of students in practices, and improve the education, production, and research cooperation level during the teaching through the systemic practice teaching and training model, and also enhance the teamwork abilities of students. All these boost the exchange and communication between disciplines, allowing the students from different major backgrounds to comprehensively know the whole process of implementing the digital media project and then exert their own role in the project more effectively.

## 97.4 Conclusion

To realize the purpose, innovation and practical applicability of the talent training for the digital media-oriented major in the scientific and engineering programs, the school-enterprise cooperation model is an inevitable result of the modern market demand development. Besides, the in-depth researches by the higher learning schools on the major construction and the education, production, and research cooperation model promote the development of the application-oriented teaching system; and the practice integration teaching model makes the training of the

innovation engineering application-oriented talents come true. Therefore, it is essential to set up a well-improved school-enterprise cooperation mechanism, and explores the diversified, multi-level and in-depth cooperation between schools and enterprises, so as to drive the application-oriented professional discipline structure on the right track, and truly accomplishing the objective to train high-quality digital media talents who can fulfill the social needs.

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