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Knowledge Management for School Education

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Contents

Chapter 1
Challenges for Schools in a Knowledge Society

Abstract This chapter articulates the challenges facing schools from education and curriculum reforms undertaken to meet the demands of a knowledge society. The challenges include the failure of schools to conduct strategic planning in order to develop student learning capacity for the knowledge society within the competitive global economy. This chapter supports the claims that schools should conduct knowledge management for sustainable development and develop the competency of teachers in personal knowledge management in order to leverage teachers' pedagogical knowledge.

1.1 The Impacts of Knowledge Expansion

Organisations must rely on knowledge to create a strategic advantage for sustainable development in the current trend towards globalisation and competition. For example, the external environment of any organisation is always changing and becoming more complex. The rate of globalisation is increasing, as is the level of competition. Information technology is constantly changing and the workforce is becoming increasingly diverse. The complexity of managerial surrounding is increasing rapidly and the future bears increasingly less resemblance to the past (Drucker 1999). In this state of rapid change, organisations are becoming aware that technology has the potential to enhance knowledge and that this enhancement can only be realised if they have a better understanding of how knowledge is actually developed and shared.

This rapid expansion of knowledge has also dramatically influenced the level of flexibility in the work of teachers and schools. Teachers' work has become less routine and more analytical and requires more collaboration. Teachers require not only data and information regarding student learning, but also individual pedagogical knowledge and teaching experience, as well as collaborative knowledge in task execution, decision making and problem solving. Knowledge expansion forces schools to gain a better understanding of what they need to know and how to obtain that knowledge in order to survive. "Schools are expected to develop

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student learning capacity to support the knowledge society within the competitive global economy, to interact with the education policy environment, and to know how to leverage pedagogical knowledge" (Cheng 2012, p. 577). However, it is not easy for schools to access the highest quality knowledge and expertise that is available for future development. Schools focus on managing knowledge so as to create value and are looking for best teaching practices, innovative ideas, creative collaborations and streamlined processes for making effective use of knowledge. It is important to help schools and teachers manage their knowledge and learn to cope with change. Thus, the issue of how to help schools use their existing knowledge to create new ideas and new knowledge is a critical research issue to be addressed.

1.2 The Challenges from Education Policies

"Schools in Hong Kong have long encountered a variety of impacts and challenges in terms of sustainable development under many education and curriculum reforms undertaken to satisfy the needs of human resources of the knowledge society" (Cheng 2012, p. 577). The education system in Hong Kong has been moving from quantitative to qualitative enhancement in recent years in order to create human resources that are capable of coping with global economic competition (Education Commission 1997, 2000). Under the compulsory education policy in place in Hong Kong since 1978, all children have the right to receive a basic education. Since that time, education authorities have been striving to enhance the quality of school education. In 1991 the Hong Kong Government introduced the School Management Initiative (SMI), which was designed to encourage management to reform aided schools in Hong Kong (Education and Manpower Branch and Education Department 1991). The SMI was a school-based management model that gave schools greater control over their finance and administration and made them more accountable to the public. In 1997, the SMI was modified to become School Based Management (SBM), and schools were not required to adopt this system. In order to encourage more schools to participate, the former Education Department made further changes to the policy in September 2000, providing extra grants and more flexibility.

In 1997, the Education Bureau (EdB) issued the *Education Commission Report No.* 7 (Education Commission 1997) on Quality School Education. The report suggested inculcating a culture of quality in the school system and developing a comprehensive set of indicators to measure and monitor all aspects of a school's performance, educational standards and development. The report also recommended "a two-pronged approach to quality assurance: internal quality assurance done by the schools themselves, and an external quality assurance mechanism" (Education Commission 1997, Chap. 3.1). In accordance with this recommendation, the government established the Quality Assurance Inspectorate (QAI) to monitor the quality of education and to encourage schools to achieve internal quality assurance through self-evaluation using both external and internal means. At

the same time as the quality assurance policy was introduced, the number of students in Hong Kong was reducing. Thus, whereas competition had previously been fierce for school places, as a result of this reduction in student admission parents had more power to choose their child's school, something that schools have had to take into account (Cheng 2011b).

Also, in 2010, a new senior secondary curriculum was implemented in secondary schools to improve student learning. Schools have struggled with implementing this new curriculum, which reduces the number of years of secondary education from seven to six. Taken together, the curriculum reform and reduction in student numbers constitute a concrete threat to the sustainability of a school.

1.2.1 The Knowledge Gap for Self-evaluation and Planning

The quality assurance policy requires "schools to collect data and information for self-evaluation and strategic planning according to the aims of school development" (Cheng 2011b, p. 214); however, many schools fail to make use of the results from school self-evaluation (SSE) in formulating their strategic plan. As part of the quality assurance (QA) mechanism, SSE assists school leaders to identify the "strengths and weaknesses of their schools and provides direction for carrying out strategic management for school improvement" (Cheng 2011b, p. 214). Since SSE focuses on the evaluation of the major concerns and the objectives of school plans, it helps schools develop by improving the quality of education provided. School development depends mainly on a school's self-evaluation capacity; therefore, effective SSE would help schools improve their ability to change (Davies and Rudd 2001).

Effective SSE is characterised by teacher participation in decision making to review, analyse and discuss the collected data and information. However, many schools do not have a culture of teacher participation, and teachers often distrust how data is used. Many teachers consider the manipulation of data in their teaching activities as a job review for accountability rather than development, and therefore they do not trust any data collection processes related to their work (Petrides 2003). In addition, there is lack of qualified staff to conduct data analysis for school self-evaluation. Information collection and analysis is often isolated and not clearly related to the mission of the organisation, which makes it difficult to produce reliable information for formulating an effective strategic plan. As a result, many schools lack a data-driven strategic plan.

Under the competitive environment created by the quality assurance policy, stakeholders must become more demanding in order to survive, and schools must perform better than their competition by improving their understanding of student needs and capabilities. Accountability for student attainment guides the school curriculum toward public examination. Evaluation of the effectiveness of teaching and learning in school becomes data driven and evidence based. Assessment for learning becomes the key aspect of accountability for improving school education. Schools should therefore have the competencies to conduct valid and reliable assessments

and statistical analyses to determine whether the students' achievement meets the national standards (Petrides and Guiney 2002; Lamont 2007). Actually, student assessment is a knowledge management activity that generates information on student learning progress through data mining and data analysis. There is plenty of data generated from quizzes, mid-term tests and final examinations throughout the school years for school leaders to determine the effectiveness of teaching and learning.

Having an efficient and adaptable software product such as SPSS for teachers to carry out statistical analysis is essential, but there is a knowledge gap in using the software to work out a predictive model to determine what factors affect student achievement on tests (Lamont 2007). The predictive model involves individual student achievement surveys, general programme review surveys and self-evaluation. The model measures knowledge, skills, attitude and behaviour, and can be applied to either individuals or groups. Assessment is done both to enhance teaching and learning and to establish accountability (Mitri 2003). Schools should acquire data-mining skills in order to better support assessment for learning.

1.2.2 The Knowledge Gap for Developing a Self-regulated Learner

One of the most important aims of education reform in Hong Kong is to promote a student's ability to learn to learn (Education Commission 2000). In order to achieve this aim, teachers need to teach students both knowledge and skills which will help the students to become capable lifelong learners after they leave school (Cheng 2011a). Thus, appropriate and effective teaching strategies are required. Cheng (2011a) proposed some methods for developing a student's ability to learn to learn. He found that a student's learning performance was closely related to his/her learning motivation, goal setting, action control and learning strategies. Cheng's (2011a) suggestions include "assisting students to set up specific and feasible learning goals, guiding them to choose appropriate learning strategies, helping them learn to accurately self-monitor the learning process, and promoting positive attitudes towards learning outcomes" (p. 14). However, there is still a knowledge gap between what schools need to know to promote the teaching of self-regulation and what teachers actually know about developing self-regulated learners. It is important for school leaders to fill this knowledge gap.

1.3 Developing a Knowledge-Sharing Culture

The 21st century is witnessing a knowledge revolution that highlights the learning organisation. The key factor is knowledge and how to apply it in our daily lives. Within the school context, it is important for school leaders to know how to create an environment to motivate teachers to contribute their knowledge for school improvement. This could be done by helping them make sense of the

context within the school organisation and take responsibility, cooperate, and share what they know and learn from others. The sharing of knowledge is important for school development, but many schools lack a knowledge-sharing culture. As Awad and Ghaziri (2004, p. 247) remark, "secure and mature people are less reluctant to share what they know with others."

The primary limitations to developing a knowledge-sharing culture include difficulty in determining the objectives of knowledge sharing and the lack of interactive knowledge-sharing behaviour within the school culture (Carroll et al. 2003; Tyack and Cuban 1995). Because individual schools have different cultures, knowledge sharing is done differently; thus it may be wise for schools to consider changing the school culture to an organisational learning culture before institutionalising any knowledge-sharing mechanism (Bock et al. 2005).

Organisational learning is the process and outcome achieved when members of a community learn by social interaction (Simons and Ruiters 2001). More than simply group attendance at classes and seminars or shared instructional materials, organisational learning is a process by which the members of a community share their values and beliefs. Organisational learning is synergistic, which refers to a process of continual enhancement of organisational capacities and improvement of team and individual effectiveness (Senge 1990). Organisational learning for teachers allows them to suspend individual assumptions about their pedagogy and engage in a free and open dialogue about the essence, nature, challenges and operations of their work. Teachers learn more effectively when they interact with others and learn together as a team. For this reason, organisational learning is more important than individual learning.

Organisational learning is important for both school development and professional development of individual teachers. School development and teacher organisational learning depend on one another. Views on school improvement have made it clear that the development and realisation of policies and reforms in schools require organisational learning among teachers (Verbiest et al. 2005). These learning processes must be supported by the school administration in order to be successful. School leaders should seek ways to develop the professional competency of teachers and empower them to exercise their expertise to promote school development. Facilitating teacher organisational learning in a school organisation through strategic management is therefore critical to school development. Chapter 3 will examine the role of the organisational learning culture on knowledge sharing and provide a case study to illustrate how to manage culture change in a school organisation.

1.4 Sharing of Best Practices by Social Learning

Without an effective mechanism to retain teachers' experience and knowledge, schools may have to pay for knowledge loss due to teacher retirement or leaving the profession. If best practices are identified and applied to similar situations elsewhere, school effectiveness can be enhanced. Traditionally, the undertaking of collaborative action research by teachers embodies the sharing of professional

practices. Their reflections could be provoked by justifying their belief in their teaching practices with the evidence collected from student learning or feedback from peers. Teachers who conduct collaborative action research can work together to improve the rationality and justice of their own educational practices by self-reflective enquiry or answering peer queries (Kemmis 1988). Therefore, throughout the action research process, teachers can learn cooperatively and become reflective practitioners (Schon 1983) by practising theories postulated from others.

As a form of collaborative action research, lesson study aims to provide a knowledge-sharing platform for teachers to share pedagogical content knowledge so as to improve their teaching practices. Lesson study can be defined as action research conducted by teachers, in which they work collaboratively to reflect on their lessons and improve their teaching (Wiburg and Brown 2007). Lesson study has adopted the mechanism of action research, but has shifted the focus to student learning. Cultivating a lesson study community for capturing best practices could help fill the knowledge gap. Chapter 4 will describe the theories and practices for cultivating a knowledge community in schools for promoting teacher learning.

1.5 Teachers as Knowledge Workers

A teacher should be a knowledge worker who creates pedagogical content knowledge that could enhance the learning capacity of their students under the learning-to-learn policy. In order to develop students as self-regulated learners, teachers need to have a deep understanding of not only the subject matter, but also the teaching strategies that will develop student competency in self-regulation. Teachers can then help students create useful mind maps or concept maps, relate one idea to another and address misconceptions. To do this, teachers need to develop their pedagogical content knowledge (PCK), which will enable them to make ideas accessible to others (Shulman 1987). The process of pursuing PCK creates more professional roles for teachers and results in constructive knowledge that is useful for both practice and ongoing theory building (Darling-Hammond 1994). A recent OECD report entitled *Preparing Teachers and Developing School Leaders for the 21st Century: Lessons from Around the World* (Schleicher 2012, p. 10), echoes and promotes the concept of knowledge worker as a professional role for teachers:

> The kind of teaching needed today requires teachers to be high-level knowledge workers who constantly advance—their own professional knowledge as well as that of their profession.

However, a platform still does not exist for teachers to work together and become knowledge workers, mainly due to the professional and bureaucratic conflict (Cheng 2009) that still exists in many school organisations. It is not surprising that the OECD report highlights the conflict:

> But people who see themselves as knowledge workers are not attracted by schools organized like an assembly line, with teachers working as interchangeable widgets in a bureaucratic command-and-control environment. To attract and develop knowledge workers,

> education systems need to transform the leadership and work organisation of their schools to an environment in which professional norms of management complement bureaucratic and administrative forms of control, with the status, pay, professional autonomy, and the high quality education that go with professional work, and with effective systems of teacher evaluation, with differentiated career paths and career diversity for teachers. (Schleicher 2012, p. 11)

It seems that school leaders should reduce bureaucratic conflict and nurture a culture of professional autonomy in their schools so as to create an environment conducive to developing knowledge workers.

Advances in information technology create a knowledge gap in the theory and practice of applying information technology in teaching. Many schools are allocating resources to information technology without considering how to effectively integrate those technologies into existing teaching practices to improve instructional events. Many teachers do not have time to upgrade their information technology skills; thus, they often adopt a hands-off approach to technology issues, leaving these issues to experts who might know a great deal about hardware but very little about the information needs for curriculum planning, instruction design and classroom teaching. Besides, because hardware and software must be updated and replaced regularly, the advances in technology further widen the knowledge gap.

In order to develop teachers' competency in managing knowledge, Cheng (2011b) has constructed an empirical model for articulating the personal knowledge management (PKM) competency of pre-service teachers for instructional design. The PKM competency model for pre-service teachers is identified as a four-factor structure, which consists of retrieving, organising, analysing and collaborating on skills. Chapter 5 will articulate how the PKM model explains the ability of teachers to learn to learn and how it serves as a framework to support lifelong learning and the sustainable development of teachers as professionals.

1.6 Capitalising on School Knowledge

Schools have to increase their capital of providing quality education and accountability to the public. As mentioned before, school education is expected to develop students' learning capacity for the knowledge society within the competitive global economy, to interact with the policy environment of the global economy, and to know how to manage pedagogical knowledge (Cheng 2012). It is also a great challenge for schools to continuously attract quality students and maintain the school brand in the eyes of their stakeholders. Following the impacts and challenges of curriculum reform and the rapid emergence of knowledge resulting from the curriculum reform, school leaders are expected to strengthen the professional competency of teachers and staff, formulate school policy to tackle curriculum reform, and build collaborative relationships with external parties to develop more supportive resources. These supportive resources could be conceptualised as

school intellectual capital (Basile 2009). Building intellectual capital in order to create value is an important knowledge management process in all organisations (Stewart 1997), and schools are no exception (Kelly 2004). Thus, knowing how to build the intellectual capital of a school organisation in order to create value is vital to the survival of the school in the context of education reform.

School intellectual capital is at the core of what society supposes to be the purpose and definition of effective school education (Kelly 2004). It is the intangible resources that come from relationships between the school and its stakeholders, from the school organisational learning capacities to innovate and manage change, from its organisational structure and culture, and from the knowledge and experience and transferable competencies of its staff (Kelly 2004). Since student and parent populations are by definition transient, the greatest potential long-term resource at the disposal of a school is its collective experience and expertise, and the competencies of its teaching staff (Basile 2009). These assets must be put to best use if schools are to operate at their full potential, and therefore managing the knowledge resources of the school organisation becomes a significant research agenda to be addressed.

Intellectual capital measures the value of the knowledge that has been managed through knowledge management (KM). KM supports organisations to create a mechanism that measures, stores and transforms knowledge into intellectual capital. At the individual level, KM enhances staff competence at knowing how to carry out their knowledge tasks. At the organisation level, KM enhances collective decision-making and problem-solving capabilities to improve organisation performance (Sallis and Jones 2002). Similarly, KM in schools can be conceptualised as strategic management activities that support teachers to retrieve, apply, share, create and store pedagogical knowledge for improving their teaching and the tasks assigned by their schools. It strengthens staff professional competency and improves the organisation's structure and policies. If school leaders really want to apply KM for school development, they should develop a set of policies and practices or processes to facilitate the data and information-collection process and a knowledge-sharing culture so as to achieve an improvement in teaching and learning outcomes (Cheng 2012). Many school organisations lack a tacit knowledge repository; therefore, schools should implement KM to build their tacit knowledge repository and transform knowledge resources into their intellectual capital. Chapter 6 provides practical suggestions for how to develop a knowledge management system in the school organisation.

1.7 Schools Need Knowledge Management

In the face of significant education policy challenges such as emerging skills shortages and the need for teaching and learning innovation, schools are seeking ways to enhance school effectiveness. By assisting teachers to better understand student learning processes and education policies, schools can improve teacher

effectiveness and address the looming teacher shortage resulting from retiring baby-boomers and staff who leave when their term contracts end. To survive these shortages, schools must put processes in place before teachers leave and their pedagogical knowledge leaves with them. Because of the ageing workforce, it is critical to have effective succession planning in place to capture this knowledge. Schools should then effectively and efficiently convey this vital information to teachers in a way that maintains the teaching quality.

Knowledge management is a management strategy that makes use of the information and knowledge for enhancing organisational performance, management and operation. It aims to support organisations in creating a capable structure that retains, creates and applies knowledge not only for problem solving but also for the sustainable development of the organisation. Applying knowledge management in school education may help schools improve planning capabilities and better cope with the challenges posed by the recent educational reforms. It also helps schools provide quality education for their students and quality services for concerned stakeholders. If schools want to survive in the competitive market and sustain themselves throughout the reform, they could institutionalise a knowledge management mechanism for their core business, which is teaching and learning. To cope with these changes, schools can redesign the curriculum, instruction and assessment, including utilisation of information and knowledge to support the scholarship of a professional practice within a global learning environment. Chapter 7 introduces a normative management model to support strategic planning for school development.

1.8 Summary

Knowledge expansion, curriculum reform and changing education policy environment together create impact and challenges to schools. Knowledge on how to help students develop to become self-regulated learners and accountable to society through self-evaluation and strategic planning are critical issues for schools' sustainable development. Schools should cultivate a knowledge-sharing culture, support teachers to have a professional identity as knowledge workers and capitalise on existing knowledge recourse to address the issues. Schools should implement knowledge management practices for tackling these challenges.

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Chapter 2
Knowledge Management for School Development

Abstract This chapter critically reviews essential concepts, theories and practices of knowledge management and explores the feasibility of applying KM to school education. It addresses the nature of knowledge and the definition of KM. It articulates the application of Nonaka and Takeuchi's knowledge conversion model at individual, group and organisational levels in schools to manage knowledge, and describes how school culture, knowledge strategies and processes, staff competencies and information technology affect the implementation of KM.

2.1 What is Knowledge?

Knowledge is one of the most important assets of a school organisation, and is critical for school sustainability. Sallis and Jones (2002, p. 8) defined knowledge as "information in use, and the interaction of information with the human mind, which gives it meaning and purpose." Knowledge is constructed through an "accumulation of facts, procedural rules or heuristics through our daily experience and study". It also involves the intelligence to acquire and apply what one has understood through learning and experience. The knowledge management glossary of the National Electronic Library for Health (2010) provides a comprehensive definition of knowledge: "Knowledge is derived from information but it is richer and more meaningful than information. It includes familiarity, awareness and understanding gained through experience or study, and results from making comparisons, identifying consequences, and making connections." Distinctions are often made between data, information, knowledge and wisdom. Knowledge is information combined with experience, context, interpretation and reflection (Davenport et al. 1998). In organisations, knowledge often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms (Davenport and Prusak 1998, p. 5). Knowledge could also be defined as a form of capital, as Stewart (1997) states that transformation of information into knowledge is a critical step in value creation, which determines what kind of advantage an enterprise has in competition.

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Knowledge is the understanding that people develop as they react to and use information, either individually or as an organisation. Nonaka and Takeuchi (1995) distinguish between explicit and tacit knowledge. Explicit knowledge refers to knowledge that is transmittable in formal, systematic language which is more precisely and formally articulated, and removed from the original context of its creation or use. Tacit knowledge has a personal quality, which makes it hard to formalise and communicate. Tacit knowledge is subconsciously understood and applied, developed from direct experience and action, and usually communicated through informal conversation and shared experience.

2.1.1 Positivist Perspective of Knowledge

The classification of explicit knowledge and tacit knowledge is based on the positivist and non-positivist perspectives on what is the nature of knowledge (Vo 2012). The positivist perspective defines knowledge as justified true belief that can certainly be achieved. Vo (2012) considers knowledge to be a commodity, which "exists prior to and independently from the knowing subject" (p. 79). Knowledge takes an explicit form to represent a collection of objects and events in the world; therefore, "it is possible to codify, store, and transmit knowledge between people" (p. 79). For example, *know-what* is a form of explicit knowledge that can be explained by knowledge workers to others. Knowledge could be translated into actions so as to help solve practical problems and advance organisational practice (Tranfield and Starkey 1998). These characteristics enable knowledge workers to acquire, apply, share, store and even create knowledge. Knowledge management makes sense as a management approach or strategy to develop the organisation through managing knowledge resources.

2.1.2 Social Constructivism Perspective of Knowledge

The social constructive perspective views knowledge as a process and exists in tacit form. Lave and Wenger (1991) articulate situated learning through participation and observation in their book *Situated Learning: Legitimate Peripheral Participation*, remarking that the social construction of knowledge is rooted in practice and practice articulates how knowledge could be used to organise a practical task. Knowledge is socially constructed and held collectively in organisations and is embedded in situated practices of the individual (Gherardi 2000). Although knowledge is situated in the historical, social and cultural contexts of the organisation, it can be acquired through participation and created through mutual engagement in the negotiation process (Wenger 1998; Nicolini et al. 2003). The knowledge worker's practice articulates what knowledge is. The phenomenon under inquiry for capturing knowledge cannot be separated from the knowledge process, but is instead contextual. Table 2.1 compares the knowledge view from the positivist and non-positivist perspectives.

Table 2.1 Positivist and social constructivism perspectives on knowledge

Knowledge	Positivist perspective	Social constructivism perspective
Definition of knowledge	A justified true belief Possessed by people "A collection of representations of the world, which is made up of a number of objects and events" (Chiva and Alegre 2005, p. 53)	Socially constructed as a process Created by people Not as a representation, but as constructing or creating acts (Vo 2012) "Neither universal nor abstract, rather depends on context" (Chiva and Alegre 2005, p. 58)
Existing form	Visible, objective and rational Explicit knowledge Can be codified and stored	Unseen, subjective and experience based Tacit knowledge Shared through communication
Location of knowledge	Locates at written and verbal information recorded in video, audio, databases and documents	Resides in knowledge individuals' minds and/or communities of practice
KM strategies	Codification	Personalisation

2.2 What is Knowledge Management?

Knowledge management (KM) can be defined as a systematic and integrative process of coordinating the organisation-wide activities to retrieve, use, share, create and store knowledge, actionable information and expertise of individuals and groups in pursuit of organisational goals (Cheng 2012; Rastogi 2000). These KM processes support organisational processes involving innovation, individual learning, collective learning and collaborative decision making. The fundamental principle underpinning KM in organisations is that by managing knowledge as a resource to fill the existing knowledge gap, the organisation's performance will be improved (Davenport and Prusak 1998). KM enables the maximisation of organisational knowledge-related effectiveness and prosperity (Wiig 2004) and provides a sustainable competitive advantage (Hatch and Dyer 2004). KM supports organisations in creating a mechanism that measures, stores and transforms knowledge into intellectual capital. It increases the capability of staff to solve problems and the ability of the organisation to make improvements (Sallis and Jones 2002).

The areas and foci of study in knowledge management are far more extensive and sophisticated than those of information management (IM), as "KM is the systematic, explicit, and deliberate building, renewal, and application of knowledge and other intellectual capital assets to maximise the enterprise's knowledge-related effectiveness and prosperity" (Wiig 2000, p. 6). It supports knowledge workers to make decisions and carry out effective actions by providing them with insights and experiences through socialisation processes and/or information retrieval from using computers and communication tools. While information management serves the function of collecting and distributing information to people, the socialisation process for knowledge creation differentiates KM from IM. KM concerns the

socialisation process of knowledge, organisational learning and reflection, while information management focuses on data processing, constructing computer architectures and building taxonomies. However, KM needs to be built on effective information management, because managing knowledge is harder than managing information.

The development of knowledge management is partially motivated by intellectual capital theory and organisational strategy research (Baskerville and Dulipovici 2006). These economics and strategic management perspectives provide a theoretical foundation to the development of KM theories. Intellectual capital is individual or collective knowledge in an organisation that can be used to gain a competitive advantage and to enhance the value of other types of capital (Casey 2010). It consists of a variety of things beyond know-how, procedures, lessons learned, and all of the other instantly recognisable repositories of knowledge. It also includes reputation, brand recognition, trust, and many other qualities that ultimately are based on knowledge. KM strengthens the professional competency of the staff and improves the organisation's structure and policies. Therefore, implementing KM could help an organisation build up intellectual capital by transforming the knowledge resources into intangible values.

Models for exploring intellectual capital and assessing its value tend to break it down into a number of component elements. A "tripartite model" disaggregates the intangible resources into three components: human capital, internal capital and external capital (Kelly 2004; Sveiby 2001; Guthrie and Petty 2000). The three components are interlinked, and they support and reinforce each other when an organisation has a shared sense of purpose combined with an entrepreneurial spirit, and management places a high value on agility and governs more by carrot than stick (Stewart 1997). Since KM is concerned with simplifying and improving the processes of sharing, distributing, creating, capturing and understanding knowledge (Gottschalk 2006), it serves as the process of creating value from an organisation's intangible assets (Liebowitz and Megbolugbe 2003); therefore, the implementation of knowledge strategies could build intellectual capital.

2.3 How Does KM Contribute to Schools?

KM in schools can be conceptualised as strategic management activities that support teachers to collect information or make use of the organisation's knowledge resource to carry out their teaching and tasks effectively. These knowledge management practices can help capture, codify and distribute knowledge in school through the application of information and communication technologies or human interaction so that it can be shared by all teachers. Therefore, KM provides schools with adequate communication channels for teachers to discuss school issues with management. Teachers can reflect on and review feedback from others and develop further strategies and plans for improving school-based policy and

teaching effectiveness. School policies can be adjusted in light of teacher feedback for maximising student learning.

Leung (2010) conducted a KM study on schools in Hong Kong. He found that KM not only provides a platform for teachers to discuss different ideas for teaching and to post resources for student learning, but also retains the expertise of experienced teachers, increases their effectiveness in terms of teaching and learning performance, supports the development of a knowledge community in schools, and fosters the culture of learning. KM helps to capture and retain experienced teacher knowledge in the school and strengthen the novice teacher's knowledge through knowledge transfer in administrative work and teaching. KM can strengthen the knowledge-sharing culture and build collegiality into the school organisation.

KM supports innovative teaching and effective learning. Through conducting data mining in student test scores, teachers can identify students' strengths and weaknesses for effective instructional design. A few communities of practice on lesson study can be cultivated by the KM system for capturing, sharing, storing and creating pedagogical knowledge and pedagogical content knowledge. As a result, teachers' professional development can be enhanced (Cheng 2009). With the building of a knowledge repository for student affairs services, KM provides a one-stop service to teachers and students to achieve information on student study advancement and career guidance, and teachers can be better equipped to provide student guidance and counselling.

Applying KM in school education is a new concept; thus, we need a KM model to help us conceptualise the disparate elements of the complete picture in a way that leads to a deeper understanding of how the knowledge process works within the school organisation. For example, it is important to have a solid foundation of understanding about what KM is, what the key KM cycle processes are, and how these processes feed into a model, in order to interpret and set up a causal relationship.

2.4 The Nonaka and Takeuchi KM Model

The Nonaka and Takeuchi KM model focuses on knowledge spirals that explain the transformation of tacit knowledge into explicit knowledge and then back again as the basis for individual, group and organisational innovation and learning. Nonaka and Takeuchi (1995) suggest that Japanese companies have been successful because they make use of their skills and expertise to create knowledge for innovation. Nonaka and Takeuchi's study theorised that Japanese companies survived in the turbulent external environment by building a knowledge management system to create knowledge for renewal. Knowledge management in this sense is regarded as the means to manage rapid change within the organisation. The fundamental question underpinning the proposed theory is how to build a knowledge management system to convert tacit knowledge in the market and the organisation to explicit knowledge, and then to crystallise it into an innovative product. The

theory also includes the ideas of re-conceptualisation of organisational design and strategy from the perspective of knowledge creation.

The Nonaka and Takeuchi KM model is basically a two-dimensional matrix depicting four possible scenarios of tacit and explicit knowledge interaction or conversion. The SECI model is a descriptive theory that is rooted in a dialectic epistemology of tacit and explicit knowledge. The SECI process outlines the conversions between tacit and explicit knowledge: explicit knowledge can be converted to tacit knowledge and vice versa. Nonaka and Takeuchi's four modes of knowledge conversion—socialisation, externalisation, combination and internalisation—create a dynamic process for organisational knowledge creation (see Fig. 2.1). Socialisation is a process of creating common tacit knowledge through shared experiences. Externalisation is a process of articulating tacit knowledge into explicit knowledge as concepts and/or diagrams. Combination is a process of assembling new and existing explicit knowledge into systemic knowledge, such as a new curriculum implementation plan and teaching methods. Internalisation is a process of embodying explicit knowledge into tacit, pedagogical knowledge such as having the "know-how" to teach.

The Nonaka and Takeuchi KM model has been widely applied to examine the knowledge process in educational organisations. Wu et al. (2013) applied the case-study method to interview and observe members of an educational organisation that was using the SECI model, in order to explore the knowledge transfer and creation process of an educational organisation. They found that internal organisational knowledge flow can be obtained through mutual interaction and sharing by the organisation's members, thereby strengthening the organisation and the teaching skills of individual members. Joia (2002) conducted a case study to evaluate a programme that aims to train in-service teachers without a teaching qualification in Brazilian K-12 public schools by using the SECI model. The programme aims to give these teachers the skills and expertise to do their job. Joia found that only

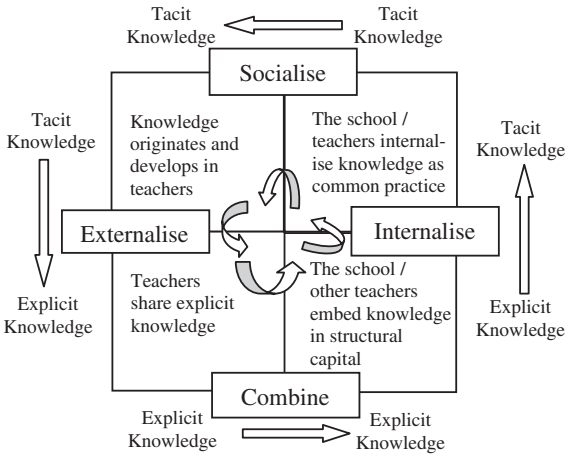

Fig. 2.1 Nonaka and Takeuchi's four modes of knowledge conversion in a school context

the socialisation process (tacit to tacit knowledge) of the SECI model worked well. This finding illustrates the tacit nature of teacher knowledge which is to be transferred via social learning.

2.5 The SECI Model and Japanese Lesson Study

Nonaka and Takeuchi's four modes of knowledge conversion model can be applied in schools to explain how teachers share their tacit and explicit knowledge through lesson study (see Fig. 2.2). Lesson study is seen as a type of action research and professional development activity in which teachers collaborate to create effective lessons and examine their practice (Fernandez 2002; Lewis 2002). *Jugyou kenkyuu*, which is a method of teachers' professional development, has a long history in Japan (Yoshida 1999; Watanabe 2002). A lesson study involves a group of teachers meeting regularly for a few months to a year to work on the design, implementation, testing and improvement of one or several research lessons (Stigler and Hiebert 1999, p. 110). The focus of the research lesson lies in a specific teacher-generated problem, goal or vision of pedagogical practice, which is carefully planned in collaboration with one or more colleagues, observed by other teachers, recorded for analysis and reflection, and discussed by all members of the lesson study group, other colleagues, leaders or invited commentators (Lewis and Tsuchida 1998).

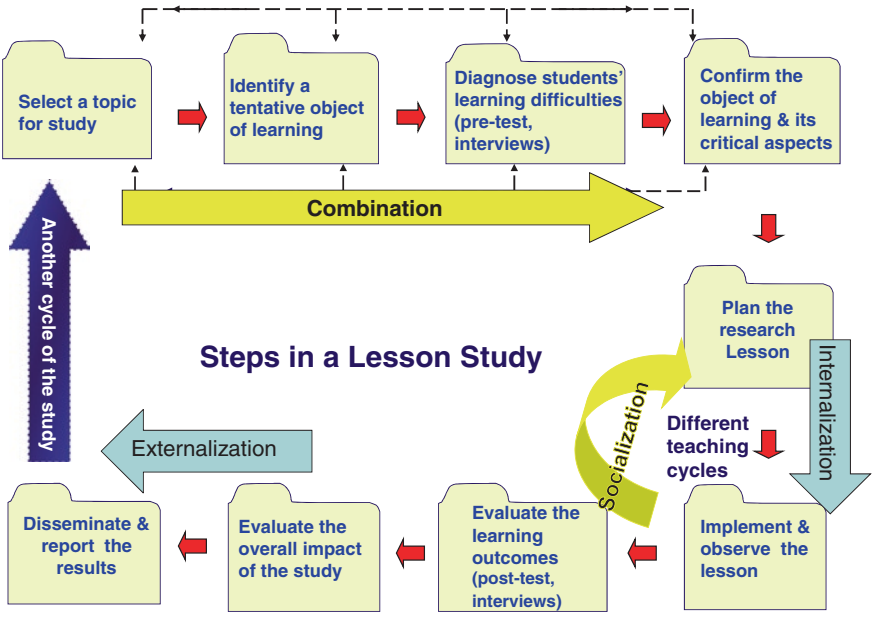

Fig. 2.2 Nonaka and Takeuchi's four modes of knowledge conversion in a lesson study

The concrete steps of a lesson study which are thought to lead to increased professional knowledge and skills are (Stigler and Hiebert 1999, pp. 112–115):

- Defining and researching a problem.
- Planning the lesson.
- Teaching and observing the lesson.
- Evaluating the lesson and reflecting on its effect.
- Revising the lesson.
- Teaching and observing the revised lesson.
- Evaluating and reflecting a second time.
- Sharing the results.

Adaptations of any imported innovations often have a life of their own. Thus, attempts to adapt the practice of *Jugyou kenkyuu* vary widely across countries, especially since information about it is mostly published in Japanese.

2.5.1 Combination

Combination is a process of converting explicit knowledge into a more usable form. In planning a lesson, teachers work together to choose the topic, define a research problem, and plan the lesson. This collaborative lesson planning process involves the combination of teachers' own conceptual understanding of the subject knowledge and how they dealt with the subject knowledge in the past. The combination of explicit knowledge allows teachers to design learning activities that will tackle student learning difficulties.

2.5.2 Internalisation

Internalisation is a process of understanding and absorbing explicit knowledge, thus turning it into tacit knowledge held by the individual. After the planning stage, the research lesson is taught by one of the teachers in the group and observed by others. The teachers who enact the lesson plan and explicit teaching theories can then internalise the tacit knowledge through enactment of the lesson plan. Tacit knowledge is actionable by the owner via actually doing or through simulations. The enactment of the lesson plan is an internalisation process that transfers school and team explicit knowledge to the individual. As teachers apply the knowledge shared in the lesson planning in their teaching practices, the explicit knowledge is being internalised to become the teachers' personal knowledge (Kolb 1984).

2.5.3 Socialisation

The process that transfers tacit knowledge from one person to tacit knowledge in another is socialisation. It is primarily a process between individuals. It involves

capturing knowledge by direct interaction and sharing experience with individuals outside and inside an organisation. The lesson implementation is videotaped for detailed analysis in the meeting. Immediately after the lesson, a post-lesson conference is conducted, where the teachers reflect on the lesson and suggest improvements. A second teacher will revise the lesson plan, taking into account the suggestions and the post-test results, and teach the revised lesson to another class. This lesson will also be videotaped, discussed and revised. This process is repeated until all the teachers have taught the lesson to their respective classes. Teaching practice articulates how pedagogic knowledge could be organised to a practical teaching task in order to enhance student problem-solving ability. Since tacit knowledge is situated in a lesson study committee, it is acquired through some form of participation, and is continually reproduced and negotiated. Participation in lesson planning, teaching and the post-lesson conference is a socialisation process in which tacit knowledge is extracted and co-constructed through discussion and collaboration. Since tacit knowledge is situated in a lesson study committee, it is acquired through some form of participation, and is continually reproduced and negotiated, as shown in the study by Nicolini et al. (2003).

2.5.4 Externalisation

The process for making tacit knowledge explicit is externalisation. When all teaching cycles are completed, teachers conduct an evaluation meeting as part of the final evaluation stage. This involves data triangulation among the test scores, student interview data, and video analysis of the teaching practice, with the aim of finding a relationship between how teachers handled the subject and what the students learned. In the evaluation meeting, the teachers will suggest further improvements and revise the lesson design for future reference. They are encouraged to reflect on what they have learned through the lesson study by conducting a public presentation, thus turning their tacit knowledge into transferable explicit knowledge (Nonaka and Takeuchi 1995). Finally, the whole experience is written up as a case report, which becomes a transferable and shared inventory of the school. The pedagogical content knowledge is coded in the form of a teaching manual, meeting records and the case report.

The application of the SECI model to schools is illustrated by the lesson study. The SECI model could be adopted to create pedagogical knowledge by building a knowledge-sharing platform or knowledge management system. School leaders should consider nurturing a set of conditions that support and sustain the knowledge creation process (e.g. creating an organisational learning culture, developing teacher PKM competency, cultivating a professional learning community, and institutionalising a knowledge management system). In Takeuchi and Nonaka's (2004) discourse, knowledge management is framed as a management perspective and not as a set of tools and methods to leverage knowledge. They believe that knowledge management is at the centre of what management has to do in a fast-changing, complex and uncertain world. They also state that since knowledge creation is at the heart of management in today's knowledge society, that model will serve as the universal model for management at large.

2.6 Knowledge Management Strategy

Knowledge management strategy refers to the overall approach an organisation intends to take to align its knowledge resources and capabilities for enhancing organisational performance (Zack 1999). KM strategies can be divided into two categories: codification for knowledge storing; and interpersonal interactive knowledge sharing (Hansen et al. 1999; Zack 1999). Codification for knowledge storing emphasises the capability for storing, sharing and using an organisation's explicitly documented knowledge. In such instances, individuals strive to explicitly encode their knowledge into a shared knowledge repository, such as a database, and also retrieve knowledge they need, which other individuals have added to the repository. These strategies usually apply information technology to facilitate the processes of knowledge retrieval, knowledge storage and knowledge utilisation.

Interpersonal interactive knowledge sharing emphasises the use of dialogue through social networks, including occupational groups and teams, and knowledge can be obtained in this way from experienced and skilled people (Swan et al. 2000). In such instances, individuals can provide their insights to the particular person or people in need of them (Snowden 2002). It helps to share knowledge through person-to-person contact (Hansen et al. 1999). This strategy attempts to acquire internal and opportunistic knowledge and share it informally (Jordan and Jones 1997). It involves the knowledge processes of retrieval, sharing and utilisation.

In school education, KM not only provides a platform for teachers to discuss different ideas for teaching and to post resources for student learning, but it also retains the expertise of experienced teachers, increases their effectiveness in terms of teaching and learning performance, supports the development of a knowledge community in schools, and fosters the culture of learning (Leung 2010). It strengthens the professional competency of the staff and improves the organisation's structure and policies. Leung (2010) conducted a qualitative study of schools in Hong Kong to identify the factors that support or hinder the implementation of knowledge management in education. He found that leadership and change management, strategies and goals, organisational learning, technical support, school culture and trust among teachers are the critical factors affecting knowledge management in the school context. He concluded that successful knowledge management in a school involves different aspects such as accessibility of information technology, strong leadership, cultural influences, organisational structure and human characteristics. Cheng (2012) conducted research on knowledge management and organisational learning in a school context and explored a knowledge strategy that could be applied effectively in an educational organisation. He discovered that the effective knowledge strategies for building school intellectual capital tend to be knowledge sharing via interpersonal interaction (Zack 1999), rather than the codification strategies for knowledge storing.

Studies conducted in schools in other countries have also emphasised the importance of knowledge strategies in decision making and organisational learning. For

example, Schechter (2008) conceptualised the process of implementing knowledge strategies that represent the management of distributed knowledge throughout the entire organisation as an organisational learning mechanism. Abdul Hamid (2008) conducted a study to explore the personal knowledge strategies of school leaders and teachers. She found that personal knowledge strategies are highly correlated with the perception of positive knowledge management environments in schools, the quality of data kept within schools, and the extent to which decision making in schools was information-driven. Personal strategies also tend to influence the knowledge culture within schools. Abdul Hamid (2008) concluded that personal strategies can manipulate the way people seek and tolerate new knowledge, and how ideas are valued and used. Higher levels of personal knowledge strategies are also likely to result in a stronger belief in the quality process of decision making in schools. The study included the strategies of seeking, receiving, analysing, using, storing, retrieving and disseminating information.

2.7 Summary

School knowledge management is a set of relatively new organisational activities that make use of knowledge as an important resource to improve organisational behaviours, decisions, student learning, teaching processes and collegial relationships that enable schools to improve their overall performance. The knowledge management and conversion process between tacit and explicit knowledge in the Japanese lesson study is illustrated by Nonaka and Takeuchi's SECI model. In the SECI model, knowledge is an important asset to support schools' sustainable development. The different perspectives on knowledge, between social constructivism and positivism, have led to the formation of personalisation and codification knowledge management strategies respectively.

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Chapter 3
Managing Culture for Knowledge Management Implementation

Abstract This chapter examines the role of culture in promoting knowledge sharing and the cultural change processes involved in implementation of knowledge management in school organisation. Strategies based on Senge's (The fifth discipline: the art and practice of the learning organization. Doubleday, New York, 1990) empirical study outline five disciplines for developing a culture of organisational learning. A case study on fostering a knowledge-sharing culture in a school is illustrated by using Kotter's (Leading change. Harvard Business School Press, Boston, 1996) model. Management strategies on policy, cultural and leadership domains for developing organisational culture are presented.

3.1 School Culture and KM Implementation

School culture is the knowledge and values shared by a school organisation. It involves the belief and behaviour of teachers, which depends upon their capacity to create, absorb and transfer knowledge to succeeding generations. Schools have a set of values that are explicitly stated and aligned with their mission statements. Knowledge develops over time, through experience. Managing knowledge can be referred to as paying attention to an individual teacher's experience. As a result, KM implementation can only be carried out successfully if it is accompanied by corresponding management of individual, as well as organisational, behaviours. Organisational culture and knowledge management remain closely connected and mutually dependent. Organisational culture is one of the critical success factors for KM implementation; alternatively, when KM implementation evolves with time and begins to reflect the values of the organisation, KM becomes a part of organisation culture (Figurska 2012).

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3.2 Organisational Learning

The main role in creating an organisational learning culture is to support knowledge sharing and innovations in the organisation. KM leaders should be aware of and understand the culture of their organisations, and then take appropriate actions that aim at building an organisational learning culture to support KM (Figurska 2012). Taking a knowledge management perspective, Nonaka and Takeuchi (1995) stressed the significance of organisational vision for knowledge creation within an organisation. To facilitate organisational learning, Senge (1990) suggested that school leaders should exercise shared leadership to build a shared vision with teachers.

Organisational learning is a process by which the members of a community learn by social interaction (Simons and Ruiters 2001) and share their values and beliefs for enhancing collective capacities and improving team effectiveness (Senge 1990). Organisational learning is a critical factor for teacher professional development and school development. An organisational learning culture enhances professional competence in teachers and creates the pedagogical content knowledge necessary for implementing the new curriculum (Cheng 2009). In organisational learning culture, teachers are able to suspend individual assumptions about their pedagogy and engage in a free and open dialogue about the essence, nature, challenges and operations of their work. Teachers learn more effectively when they interact with others and learn together as a team. For this reason, organisational learning is more important than individual learning. Teacher professional development is critical to the sustainable development of schools; therefore, schools should seek ways to enhance the professional competency of teachers.

Organisational learning is important for both the school's development and the individual's professional development. Views on school improvement have made it clear that the development and realisation of policies and reforms in schools need the organisational learning of teachers (Verbiest et al. 2005). These learning processes must be supported by the school administration to be successful. School leaders should seek ways to develop the professional competency of teachers and empower them to exercise their expertise to promote school improvement. Facilitating teacher collective learning in a school organisation through strategic management is therefore critical to school improvement.

3.3 Strategies for Promoting Organisational Learning

Senge (1990) defined organisational learning as a group of people continually enhancing their capacity to create what they want to create. He defined a learning organisation as one that possesses five core learning disciplines: personal mastery, mental models, shared vision, systems thinking and team learning. These five disciplines together form a collective learning school organisation. More detail on the five disciplines (Senge et al. 1994, p. 6) follows.

Personal mastery refers to the ability to continually focus one's energy on understanding the reality of the work. With personal mastery, members are willing to deepen their vision of the work and objectively seek the reality and future of the work. They are patient in their learning about the work. Investing in teacher professional development could be an effective strategy for developing personal mastery in teachers (Hord and Sommers 2008). When the professional competency of teachers is enhanced, teachers will have the capacity to contribute their personal knowledge to the learning community during the collective learning process. School leaders can create job requirements and provide opportunities for professional development that make learning about learning mandatory. School leaders may formulate certain job-embedded professional development policies or set up working teams to deal with the practices of the discipline of personal mastery. Job-embedded professional development strategies should be based on the principle that adult learners respond best when dealing with real-life situations and problems, a fundamental professional development approach in facilitating teacher collective learning (DuFour 2004). Teachers may be invited to share experiences among colleagues, or even to demonstrate to their colleagues what they have learnt on courses or in seminars. The establishment of a community of practice (CoP) is a good way to enhance teacher personal mastery. In a CoP, experienced teachers can serve as mentors to novice teachers, so that novice confidence in areas of expertise and knowledge can be built up and reinforced as time goes by. The establishment of communities of practice will be further discussed in Chap. 4.

A *mental model* consists of the deeply ingrained assumptions or generalisations that influence how one understands the world and takes action (Senge 1990). In building a mental model, there is a willingness to examine and re-examine the relevance and usefulness of one's ideas about the work in general and/or the particular area of one's work. Members effectively scrutinise their assumptions and generalisations about the work and leave these open to the scrutiny of others. The knowledge possessed by an individual teacher and their mental model of knowledge sharing will affect their collective learning. The sharing of a mental model is based on trust, which is a building block of an organisation (Wheatley and Kellner-Rogers 1996). Building a mental model based on trust is an essential factor in building the high-quality relationship needed to foster collaboration in schools. It assists in the creation of a shared vision and eventually the nurturing of systems thinking. Implementation strategies for improving the mental model include the cultivation of trust and inquiry-based reflective learning for knowledge sharing.

Trust is an essential element in any knowledge-sharing activity (e.g. Mayer et al. 1995; Dirks and Ferrin 2001). Teachers require the existence of trust in order to respond openly and share their knowledge (Gruenfeld et al. 1996). School leaders should promote trust in their schools by first fostering trust between themselves and their teachers. The literature on trust supports the view that when there is a higher level of trust, people are more likely to share knowledge (Zand 1972; Andrews and Delahay 2000) and to absorb knowledge (Mayer et al. 1995). Effective knowledge transfer between people requires mutual trust (Politis 2003;

Panteli and Sockalingam 2005). Effective communication at work is based on trust, and thus trust among people in an organisation can be a significant predictor for knowledge transfer. Trust among staff in a school organisation is a critical element necessary to increase student achievement (Bryk and Schneider 2002); with trust, collective learning will take place and learning communities will be built.

Shared vision refers to the continual building of a consensus view of what the work should be and how it should be done. The essence of building a shared vision among teachers is in sustaining an ongoing process that aims to instil a sense of commitment in the whole school, and having a desire to achieve recognised goals and create a sense of ownership. School leaders must have a personal vision regarding how leadership will be provided in the school before working with staff to develop a shared vision for the entire school (Owens 2004). The transmission of the vision is usually done via official meetings, the school annual plan, disseminated documents, or by frequent reviews of student performance and school effectiveness. Members focus on fostering genuine commitment and enrolment rather than compliance.

Senge (1990) stressed the fact that vision cannot be sold. If a shared vision is to develop, members of the organisation must cooperate in the building of such a vision. School vision must not be created solely by school leaders or imposed from the top; rather, vision must be created by means of a comprehensive interaction among the individuals in the school and through challenging and ongoing dialogue. It is only by reaching a compromise among the individuals and by further developing the vision as a common direction that teachers will commit to a shared vision. When teachers have actually participated in building the mission and vision of the school, they will possess a strong sense of ownership, which in turn will encourage them to work towards the school goals with enthusiasm. School leaders must, on a continuous basis, share their own vision with the teachers, be assessed on their commitment to the vision, and be sufficiently open-minded to accept and welcome divergent opinions. Implementation strategies to articulate a shared vision could include engaging staff with school leaders in conversation about a new practice and discussing why it could be useful to the school or how it will meet some agreed-upon need.

Systems thinking refers to being able to see interrelationships among the parts in the work system rather than only linear cause-and-effect relationships. Members are able to see continuous processes rather than snapshots of work activity. Seeing the school organisation as a whole rather than a collection of parts is essential for collective learning. School leaders should strive for regular collegial interaction in the face of system problems and school resistance to change. Shared decision making should aim to reform educational practices by creating conditions in schools that facilitate improvement, innovation and continuous professional growth. The literature on restructuring generally favours shared decision making (Cheng 2008). Shared decision making is perceived as forging links between school leaders and teachers (Sergiovanni 1992). Teachers from different groups with different value systems can be invited to share their values with the administration team to exercise systems thinking. This will help build a holistic appreciation of the domain of work as well as the processes that make up the bigger work system.

Team learning refers to the continual enhancing of collective capacities and the improving of team effectiveness (Senge 1990). Under a process of collective learning, teachers are able to suspend individual assumptions about the work and think collaboratively. They must also engage in a free and open dialogue about the essence, nature, challenges and operations of their work. In the present study, the discipline of team learning is conceptualised as teacher collective learning. In team learning, teachers have to work in collaboration with one another, to learn from one another, to learn together, and to reinforce the team's learning (Leithwood 1998). Teachers learn more effectively when they interact with other teachers and learn together as a team.

3.4 A Study of Senge's Five Disciplines

Cheng (2011) conducted a study to validate a theoretical model for developing teacher organisational learning by using a quasi-experimental design, and explored the management strategies that would provide a school administrator with practical steps to effectively promote collective learning in the school organisation. A self-response quantitative questionnaire was designed to collect data from secondary school teachers in Hong Kong. The data was collected directly from target subjects through the questionnaire. He conceptualised team learning as organisational learning, which will be predicted by the other four disciplines.

Personal mastery in an individual teacher is conceptualised as the element at the individual level of learning that is expected to predict collective learning. Senge (1990) advised people to put aside their old ways of thinking, and to learn to share their personal knowledge with others. Individual ability and a willingness to learn are necessary conditions for teacher collective learning. Elements at the collective level that predict collective learning include the mental model, a shared vision and systems thinking. Building a mental model based on trust among team members is the fundamental basis for articulating a shared vision. A shared vision provides a working direction for teachers and enables them to understand the organisational arrangements, routines and systems. If school leaders involve teachers in articulating a shared vision and in participating in decision making, then systems thinking (i.e. the capacity to see the whole and the parts) will be nurtured. Based on the articulation of Senge's five disciplines, a theoretical model of teacher collective learning is constructed (see Fig. 3.1).

The study's results showed that the theoretical framework is validated by structural equation modelling in which the concepts of Senge's five disciplines of organisational learning co-exist in school and could be explained by the proposed model. The path model shows that systems thinking depends on creating a shared vision, while a shared vision is based on a mental model built on trust. If based on trust, a shared mental model can lead to a plan everyone can agree on, and this eventually creates a shared understanding of how the organisation really works. Members can then work together to achieve that vision. The essence of building a

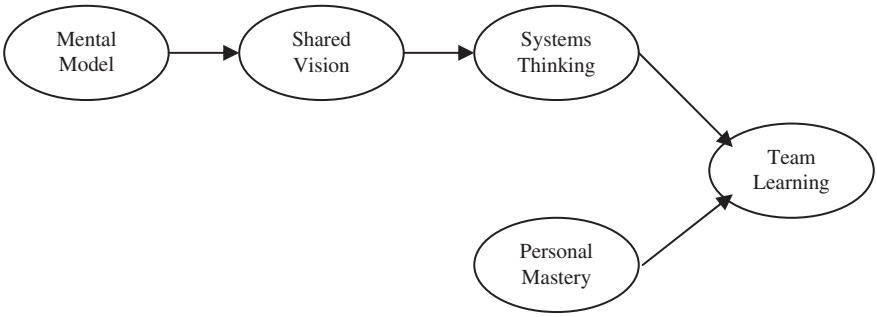

Fig. 3.1 Cheng's (2011, p. 36) empirical model of Senge's five disciplines

shared vision among teachers is to sustain an ongoing process that aims to instil a sense of commitment in the whole school, a desire to achieve recognised goals and a sense of ownership. Creating a shared vision is critical to developing in teachers a holistic appreciation of the domain of the work as well as the processes that make up the bigger work system.

If school leaders want their teachers to see interrelationships among parts of the school organisation, the path model suggests that the school leaders themselves should be handled strategically in the school policy, cultural and leadership domains, which will allow teachers to collectively acquire, analyse, disseminate, retrieve and use successful professional practices relevant to their performance in school (Popper and Lipshitz 1998). School leaders need to formulate school policies, exercise shared and supportive leadership (Hord 1997) and nurture a collegial and trusting culture (Hord and Sommers 2008) in order to promote the development of the five disciplines.

3.5 Kotter's Model for Culture Change

This section presents a case study of creating a community of practice (CoP) for promoting teacher professional development and effective student learning in a secondary school in Hong Kong. Kotter's (1996) model of leading change has been adopted as the analytical framework of the case study. In order to maintain the competitive advantages of the school and to tackle the challenges generated by the education policies (see Sect. 1.2), the LS College principal wanted to enhance the effectiveness of teaching and learning. He decided to seek support from tertiary education institutions to provide school improvement projects aimed at developing an organisational learning culture for teacher professional development. He considers teaching to be a profession and values teacher professional development at the school. He researched school improvement projects from universities, and found that Learning Study, a Hong Kong model of lesson study (see Sect. 2.5), can improve teaching and learning. He therefore supported

the implementation of Learning Study at his school. He created a sense of urgency for the change, shared a vision of improving student learning, and communicated it with the teachers so they also sensed the need to launch the Learning Study project. He alerted the teachers to the challenges facing the school and shared his view on improving teaching and learning continuously. He invited Learning Study experts to bring their knowledge to the school.

After creating a sense of urgency and sharing the vision with colleagues, the principal promoted Learning Study by forming a powerful guiding coalition team. Resources and administrative support were provided by the school to facilitate the development of the CoP. The school granted financial resources for conducting the Learning Study; supported teachers in attending the Learning Study training courses; scheduled common time slots for meetings, lesson observations and post-lesson conferencing using a tailor-made timetable; and purchased additional audio-visual equipment to record the research lessons for analysis. A senior teacher (Mr L.) was designated to coordinate and promote Learning Study. Mr L. is responsible for curriculum development in the College. When he became aware of Learning Study, he wanted to promote it to all departments. He was then enrolled in a 90-h mentoring course to equip himself with the skills to facilitate a learning community. The principal and Mr L. wanted to start the project in departments with the least resistance. Eventually the principal chose the Department of Chinese and the Department of Mathematics for the project because of their collaborative culture. The teachers of both departments were then asked for their consent to undertake the project. Teacher empowerment strategies were applied throughout the Learning Study process. Teachers from the two departments were empowered to decide their own topic for the research lesson. To strengthen the confidence and commitment of teachers to Learning Study, a short-term win was generated by scheduling an internal presentation on staff development day to disseminate the findings and outcomes gained from Learning Study with colleagues from other panels. In this way, Learning Study could be progressively promoted to teachers of other subjects.

Progressive strategies were applied to develop a Learning Study community at LS College. Learning Study was promoted progressively at the subject level through a divergence development strategy. Routine Learning Study case presentations on the annual staff development day, as well as non-regular public presentations, were conducted to disseminate the effective teaching practices. Eventually the CoP of Learning Study was institutionalised at the school for teacher professional development. Teachers reported that their professional development was enhanced through engaging in the learning activities of the Learning Study community. They could learn from others and their teaching competencies were improved. They found that they could focus more on the object of learning and student learning difficulties, and were able to reflect on effective ways of teaching.

Support from a learning-focused leader was identified as a critical condition for cultivating an organisational culture. The idea of institutionalising a Learning Study community at the case school was initiated by the principal. It is almost impossible to cultivate a CoP without the support of a school leader who has the vision of enhancing teacher professional development in order to improve student

learning, and who provides resources and administrative support to initiate change. The strategies for establishing a sense of urgency and creating a shared vision are critical to make the school organisation ready for change. Creating a sense of urgency can alert members to the need to focus on the problems in the organisation, which supports the leader in creating a vision that can be shared with the members. The leader must express things simply in order to communicate the vision to the teachers and to enable the successful adoption of the change.

The strategy of forming a powerful guiding coalition team is important for empowering the team members to act on the vision and to get rid of obstacles to change. It is similar to John Adair's model (1987) of team motivation, which claims that the task for the team should be as clear as possible, and the accomplishment of the team task depends on whether the personal needs of the team members are satisfied. Through teamwork and dispersed leadership, they build the professional capacity to solve problems and make decisions expeditiously (Senge 2000).

The strategy of showcasing successful frontrunners aims to publicly recognise those who made the change possible and to enhance the confidence of other teachers, which is effective in enhancing student learning. Planning and creating early successes is a proactive strategy that looks for ways to obtain clear performance improvements. These strategies help leaders to implement the new culture in the school organisation. Progressive implementation strategies in a long-term professional development policy are identified as an important factor for cultural change. This is the same as a plan for change proposed by Hall and Hord (2006). The leader should include in the long-term professional development policy the adoption of Learning Study as the teachers' professional development model. Forming a powerful guiding coalition team, empowering the team, creating a short-term win and implementing the change in a progressive way were identified as the implementation strategies for initiating change. All of these leading strategies are advocated by Kotter (1996) so that leaders can avoid failure during the change process. These findings from the LS school case suggest that Kotter's change model provides a proactive model for leaders to cultivate an organisational culture for a knowledge-sharing platform. Using these strategies, school leaders can make the school organisation ready to initiate Learning Study, implement the change, and then make Learning Study part of the school culture.

3.6 Management Strategies for Developing Organisational Learning

3.6.1 Strategies in the Policy Domain

School leaders may formulate policy in the area of teacher professional development, in order to deal with the practice of personal mastery and to foster reflective practices via the development of professional learning communities, which will improve the mental model. Staff professional development programmes should be

coupled with a formative staff appraisal system to identify teacher needs related to formulating activities for teacher learning at both the school and individual levels. It would be desirable if teacher participation in profession-related training activities could be stated in the school's annual plan as an essential requirement fully supported by the school authority. School leaders should encourage teachers to participate in school-based reflective learning activities which target the creation of pedagogical content knowledge that will help teachers meet the challenges of the new era. Schools that intend to enhance the practice of personal mastery among their staff members should aim to offer support and encouragement for an individual's ongoing learning.

School leaders should also create a school structure and routines that support learning, and encourage regular collegial interaction in the face of system problems and school resistance to the practice of systems thinking. School leaders would need to be committed to the school-based management policy, which ensures that staff share a clear vision for the school that involves all teachers in decisions about goals and missions. School leaders should also formulate strategies to help teachers acknowledge the relationship between part and whole. The most compelling of these strategies is the ability to see the world as a complex system. When teachers are able to appreciate the interrelationship between the components of an event or an idea, they will then be able to make better-informed decisions. Teachers will not be interested in participating in decision making if the annual school plans are determined by senior management alone. It should be in the interest of the school leaders to encourage opportunities for teacher participation in planning and policy formulation, which will facilitate and commit teachers to systems thinking (Alavi and McCormick 2004). Such involvement increases the chance for consensus on goals and priorities, and broadens the horizon of teachers, as many teachers have a limited vision when they are isolated in the classroom. Shared decision making could therefore be a way to develop systems thinking.

3.6.2 Strategies in the Cultural Domain

School leaders are not only responsible for institutionalising policies and resources that support collective learning, but also for nurturing a culture that ensures the productivity of collective learning (Popper and Lipshitz 1998). Cultivating a culture of trust and organisational learning could be an effective method for developing a mental model built on trust and reflection-based learning. School leaders should aim to nurture a culture of trust that encourages communication, support and collective thinking as a part of the learning process. All real collective learning efforts must come from within the members of the community for those efforts to be effective. Trust is based on relationships. Trust building is a journey that starts from a professional relationship in which clear roles and responsibilities are defined, first in terms of the team, and then in terms of more personal relationships. Trust between people is associated with professional relationships rather

than individual relationships. With a professional relationship, trust between team members is underpinned by a clear understanding of each team member's roles, aims and responsibilities.

School leaders should also foster a culture of organisational learning in which members of staff are able to present their points of view in thorough discussions before decisions are made. The shared mental model among members is crucial for the creation of a cohesive type of organisational culture. Relevant structures such as dual channels of communication, evaluations, reflections and experience sharing would best suit the purpose of providing opportunities for teachers to work collaboratively, and to learn from one another.

3.6.3 Strategies in the Leadership Domain

Any changes in a school must be accepted, appreciated and nurtured by the leader. In order to promote teacher collective learning, school leaders should be committed to their leadership role as change agents. Teachers have to be supported and equipped so that they are able to make change happen. School leaders have to cultivate an organisational culture that facilitates both the formal and informal learning processes which are intrinsic to a learning organisation (Marsick and Watkins 1996; Marsick 1987). They need to exercise a shared and supportive leadership to sustain collective learning that keeps the shared vision alive in communication and actions, and align professional development to support the change. School leaders must share their own vision with the teachers, be assessed on their commitment to the vision, and be sufficiently open-minded to welcome and accept divergent opinions. They need to empower teachers to make changes in their schools, promoting and publicising the ideas put forward by members of staff, and reinforcing work and initiatives across different boundaries, which is crucial to strengthening the professional development both of individual teachers and of the whole school (Marks and Louis 1999).

If the school leaders are to implement management strategies based on Senge's five disciplines for promoting teacher collective learning, there is considerable work to be done. First, school leaders need to review the existing teacher professional development programme and shared decision-making policies in their schools to ensure that personal mastery and systems thinking are being developed in teachers. Otherwise, they should formulate a school-based policy that involves teachers in professional development and shared decision making. Second, they should nurture a culture of trust and empower teachers to create a shared vision with them. School leaders could build trust with teachers and school staff by always placing the interests of the pupils first, carrying out what has been agreed upon, and acting in the interests of teachers. School leaders must have a personal vision regarding how leadership will be provided for the school before working with staff to develop a shared vision. Third, school leaders should exercise a supportive and shared leadership role. They must act as learners and work with

teachers openly to discuss instructional problems and explore solutions to the problems that are identified. The implementation of management strategies in school policy, cultural and leadership domains could be a way to promote organisational learning in the curriculum reform in Hong Kong.

3.7 Summary

Organisational learning culture is a critical success factor for KM implementation in schools. The practice of Senge's five disciplines of organisational learning in schools supports school leaders to cultivate a culture of teacher collective learning and to pave a path for successful KM implementation. As school cultures are usually stable, it is not easy to change ways of doing things without a deliberate plan. Cultivating a community of practice (CoP) for leveraging knowledge by using the lesson study approach is illustrated with Kotter's model for cultural change. Kotter's model provides practical guides to school leaders to formulate strategies in policy, cultural and leadership domains for managing change.

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Chapter 4
Cultivating Communities of Practice for Leveraging Knowledge

Abstract The chapter discusses the application of Communities of Practice (CoPs) as a knowledge management strategy to manage pedagogical knowledge in school. An ethnographical study that focuses on developing joint enterprise, mutual engagement and shared repertoire of a CoP in a school is described. Learning Study, a teacher development approach, is presented as an example to illustrate the cultivation of a CoP for leveraging pedagogical knowledge. After action review, the ORID model and process-content facilitation for cultivating a CoP and facilitating the knowledge sharing are described.

4.1 CoP as a KM Tool

Knowledge transfer through social learning in communities of practice (CoPs) has increasingly grown in popularity among the teaching profession (Kirschner and Lai 2007; Kimble et al. 2008; Brouwer et al. 2012). CoPs have been shown to encourage member participation in collaborative learning and to enhance knowledge acquisition from each other (Wenger 2004). Previous empirical research indicated that CoPs had significant positive effects on both the process and the outcome of collaborative learning (Holland 2005), as well as reciprocal relationship with teacher professional development and instructional improvement interventions (Schlager and Fusco 2004). CoPs could be a prerequisite to designing social learning infrastructure that supports knowledge transfer of education professionals. It brings teachers together for rigorous conversations that are conducive to knowledge sharing and enables teachers to make connections with other teachers so as to create powerful learning experiences for them and will lead directly to powerful learning for students (Cheng 2009). However, to launch a CoP in any organisation is difficult, for it cannot be mandated or created, but can only be coordinated, facilitated and cultivated (Wenger et al. 2002).

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4.2 What Are Communities of Practice?

The term "community of practice" was first coined by Jean Lave and Etienne Wenger in a research project on social learning for the Institute for Research and Learning in 1990, and subsequently published as a book, *Situated Learning: Legitimate Peripheral Participation* (Lave and Wenger 1991). They used ethnographic approaches to understand how people acquired knowledge in informal work settings, by using informal social relationships. "Community of practice perspective suggests that knowledge construction is relational and dynamic and that learning is an inseparable aspect of social practice. It is to be found in the relationship between people and the context of their activities" (Leshem 2007, p. 290). "Learning involves engagement in social activities and it is seen as an evolving form of membership" (Lave and Wenger 1991, p. 53). The knowledge-sharing themes reflected in communities of practice have increasingly grown in popularity among practitioners. Notably, the communities of practice approach has been used by organisational learning approaches in workplace learning (Boud and Middleton 2003).

Wenger et al. (2002) define communities of practice as "a group of people who share a concern or passion for something they do and learn how to do it better as they interact regularly" (p. 4). This implies that three principal characteristics need to be satisfied for a community to be defined as a community of practice: joint enterprise, engagement in mutual learning and shared repertoire of resources. Wenger (1998) argues that it is only by development of these three characteristics in parallel that one cultivates a community of practice which allows for co-construction of knowledge.

The first characteristic, joint enterprise, provides common ground for communication and a sense of common identity for the members. If the domain is well-defined, the purpose and value of the community will be legitimised by the members and the stakeholders. The members know what to contribute and how to participate. "Knowing the boundaries and the leading edge of the domain enables members to decide what is worth sharing, how to present their ideas and which activities to pursue" (Wenger et al. 2002, p. 28). Wenger (1998) suggested that the joint enterprise arises out of negotiations, is defined in the process of pursuing it and creates a pattern of mutual accountability.

The second characteristic, mutual engagement in the community, constitutes a social fabric of learning. If the community is strong and mature, it fosters interactions and relationships based on mutual respect and trust. Members are willing to share ideas, expose one's ignorance, ask difficult questions and listen carefully. Wenger (1998) considers mutual engagement as the most critical characteristic that constitutes a social fabric of learning in the CoP. In his words, "practice does not exist in the abstract. It exists because people are engaged in actions whose meanings they negotiate with one another" (p. 73). This means that a CoP is based on, and in, a social relationship which is related to collaborative learning activities among teachers.

The third characteristic, shared repertoire of resources, refers to a set of frameworks, ideas, tools, information and documents that members share. It is the specific knowledge members develop, share and maintain. It enables members to deal effectively with the domain of knowledge. These characteristics create a driving force to the community at different stages of development. When they work together well, the community will produce its own structure which encourages the developing and sharing of knowledge. Wenger (1998) suggests that the repertoire "includes routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions or concepts that the community has produced or adopted in the course of its existence and which have been part of its practice" (p. 83). He suggests that the shared repertoire is the joint pursuit of an enterprise which creates resources for negotiating meaning. The repertoire includes the members' way of thinking and doing things produced in the course of meetings. According to Wenger's (1998) advice, an organisation may launch a CoP by providing guidance and resources. The CoP also helps to connect the shared domain to the organisation's strategic focus, to encourage the members to move forward with the agenda, as well as remain focused on the shared domain.

4.3 Applying CoPs in Schools

In an educational setting, Wenger's (1998) CoP framework emphasises the importance of collaborative learning among teachers and the contribution of knowledge sharing for professional development (Kirschner and Lai 2007; Cheng 2009). Teacher learning occurs within the context of social relationship with other members of the CoP who have shared interest and common concern from the realm of practices.

Wenger's work enlightens the investigation of the formulation and development of a community of practice among the teachers who participated in the Learning Study project (see Sect. 3.5). Cheng (2009) conducted a study to examine knowledge-sharing activities among teachers in a primary school who participated in the Learning Study project and their professional development by using the framework of community of practice. Learning Study is a school improvement project which aims to improve the quality of student learning via enhancing teacher professional development by creating communities of practice among teachers, researchers and educators involved in the design, implementation, evaluation and dissemination of a research lesson, with the ultimate goal of developing a Learning Community in the school.

The results of the study showed that Learning Study creates a community of practice for knowledge sharing and teaching practices which promotes reflective practices on teaching and learning for enhancing teacher professional development. He found that mutual engagement, joint enterprise and shared repertoire seem to be embedded in the Learning Study project. The CoP did not merely support communications and interactions between teachers; it also transformed knowledge into tangible, sharable,

durable and transferable resources. The teachers created knowledge in the lesson plan and teaching aids, but they also turned knowledge into intangible resources such as accepted practices of inquiring student thinking in the design of the lesson plans, routines and a set of shared specialised terminologies in classroom research. They gained insights into teaching practices and these insights reflected conceptual changes in their knowledge about teaching and learning. These were resources for the community, models or frameworks for approaching problems or making sense of situations.

4.4 Knowledge Transfer in a CoP

Wenger's CoP model conceptualises learning as social participation. The model incorporates four deeply interconnected and mutually defining components that conceptualise learning. These components are: community, identity, practice and meaning:

> Community is the social configuration in which the organizations are defined as worth pursuing and the participation is recognizable as competence. Identity is how learning changes who each one is and creates personal histories of becoming of the communities. Practice is the shared historical and social resources, frameworks and perspectives that can sustain mutual engagement in action. Meaning is the changing ability – individually and collectively – to experience the life and world as meaningful (Loyarte and Rivera 2007, p. 69).

These components are key to analysing the knowledge sharing and learning experience. Cheng's (2009) study also drew on these four key components of Wenger's social learning theory to explore how a CoP contributes to knowledge transfer among the teachers. A community of practice is understood through the behaviours and activities that the members engage in every day and by the roles that they play in different situations. They work collaboratively and engage with the life of a community and all that that entails, including a diversity of social relations and interactions. The engagement involves all kinds of relations, conflicting as well as harmonious, personal as well as political, competitive as well as cooperative. These engagements are what Wenger defined as participation (1998, p. 56). This finding reflects that the Learning Study experience was more than just a project team. Teachers' mutual engagement fosters their commitment of time, energy and perhaps something of themselves. Their experiences in knowledge sharing, to different extents, were intertwined with their interpersonal experiences and relationships. "These knowledge sharing experiences have the potential to do much more than develop their professional expertise; they can contribute to or even transform their identities as educators" (Niesz 2007, p. 607).

The philosophies of improving student learning help shape the teachers' identities. Their joint enterprise describes how they worked together in the project, knowledge sharing for solving common difficulties in teaching. Their membership in the community defines a part of their identity, but they also take on a range of

specific identities within a community. This, in a fairly straightforward sense, describes the knowledge transfer activities of members in engaging with other community members and in the learning life of the community. They carry their participation with them wherever they go. It is part of who they are, and participation is part of their unfolding history of knowledge sharing.

Teaching practice takes professional development of the teachers beyond talk about practice and into the realm of learning by doing. "Engaging in the project and then coming together to share their opinion enables the group members to learn from one another's inquiry" (Cheng 2009, p. 99). Teachers indicated their knowledge-sharing experience in conducting the Learning Study project and they looked forward to sharing their findings with their colleagues. They were intellectually engaged with what brought them into the profession, while finding "new passions through work in a community of practice" (Niesz 2007, p. 609).

Wenger (1998) argues that learning is the negotiation of meaning through participation. Participation in communities is the context in which the teachers learn to assign meaning to their teaching lives over time, because the time taken for the project enables an accumulated knowledge-sharing experience. Practice is shaped by negotiating meaning among the members. In the Learning Study project, teachers brought ideas and assumptions to contest what they viewed and tried to pull colleagues towards their own ideas. Thus Learning Study provided legitimacy for their ideas and advocacy (Cheng 2009). When they come together to discuss and think about how to improve the lesson, they also become connected to the research lesson. This is the sort of negotiation of meaning that makes a CoP a promising space for knowledge sharing. Teachers contribute their own expertise to a research lesson; they learn collaboratively with each other and they have equal status in knowledge sharing.

The model of community of practice is based on the idea that one cannot separate knowledge from practice (Nonaka and Takeuchi 1995). A CoP shares knowledge in living ways rather than in the form of a database or documentation. Even if information is captured in a manual, the knowledge is frequently highly contextual and cannot be collected. If the goal of professional development is based on a growth and practice standpoint, and assisting teachers to develop the competence that enables them to improve their practice, then the interaction function of the community of practice is essential.

4.5 CoP Facilitation

A CoP consists of dynamic social structures that require cultivation so that they can emerge and grow (Wenger et al. 2002). A CoP emerging from bottom-up initiatives does not mean that organisations cannot do anything to influence their development. CoPs are increasingly initiated by a sponsor at senior management level, rather than emerging spontaneously (Fontaine 2001). Despite the fact that a CoP does not usually require heavy institutional infrastructures, the school could design

a community environment, foster the formalisation of the community, and plan activities to help grow and sustain a CoP. Although the concept of a CoP is different from that of a team or group (Wenger et al. 2002), the existence of a common goal as a driving force to bond the members together at the initial stage of the development would be very similar, and thus strategies for building a team or group that focus on developing a common goal may also be adopted to launch a CoP. A study by Griffith et al. (1998) confirmed that strategies focused on the content or the process in the context of information systems management could facilitate group discussion.

Facilitation can be defined as "making things easier by using a range of skills and methods to bring the best out in people as they work to achieve results in interactive events" (Townsend and Donovan 1999, p. 2). The facilitator role entails a wide variety of behaviours, including leadership behaviours (Schuman 2005). An effective facilitation strategy is critical to the development and sustainability of a CoP. Facilitation strategies may focus on the process or content for knowledge sharing (Griffith et al. 1998). Process facilitation provides structure and general support to CoP members during their knowledge sharing, while content facilitation focuses on the content of the sharing, analysing the data, and displaying relevant issues. Content and process facilitation for knowledge sharing are not exclusive but rather inform each other to achieve a multiplier effect (Eden 1990; Miranda and Bostrom 1999; Zúñiga et al. 2002). Griffith et al.'s (1998) strategies of content and process facilitation provide a framework to schools to initiate the development of a CoP. Empirical results indicate that the process and content theory of facilitation have significant positive effects on both the knowledge-sharing process and the outcome of collaborative learning (Leidner and Fuller 1997; Khalifa and Kwok 1999). A CoP is a platform for collaborative learning (Holland 2005; Cheng 2009), thus content and process facilitation could be adopted as strategies to launch a CoP for effective learning.

Content facilitation focuses on the needs of the CoP members, particularly for those activities that could provoke members' reflection and induce collaboration. Content facilitation guides the content of the negotiation and dialogues in line with the knowledge domain of the joint enterprise. It could be adopted as a strategy to frame the discussion content of a CoP to align with the knowledge domain for creating the joint enterprise. Content facilitation draws the boundary of a CoP by focusing on the knowledge domain of the joint enterprise. Content strategy aims to create a shared domain and to define the learning activities inside the CoP boundary by providing resource. Although a CoP operates fairly autonomously, it can benefit from outside experts (Wenger 1998; Wenger et al. 2002). Therefore, inviting external experts of the field via building partnership with the organisation is essential to the development of a CoP. Effective learning activities for teachers should involve collaborative practices (Shulman 2004). Collaborative learning provides a platform for knowledge sharing, while practice provides the opportunity for them to internalise the knowledge acquired from the platform into their tacit knowledge through learning by doing. Collaborative practice is extremely important for creating a CoP, as social learning and practice are the core ideas of CoPs.

Activities that provoke reflective learning are considered as the most important professional development approach (Shulman 2004). Such activities also facilitate CoP members' reflective inquiry and mutual engagement. In this study, the content strategy for launching a CoP is conceptualised as the facilitation activities that provoke teacher reflection and fostering their collaboration with the supports from the external experts in the field. Content facilitation enhances the communication and interaction of CoP members so as to strengthen their mutual engagement and build up their shared repertoire to create a knowledge resource.

Process facilitation provides a monitoring and evaluating mechanism to regulate the content knowledge sharing in alignment with the joint enterprise. A CoP needs regular care and feeding from the facilitators to promote better results (Vestal 2006). It requires a regulation mechanism to plan, to implement and to evaluate whether the content is aligned with the school development. Therefore, to launch a CoP in an organisation, it is important to ensure that CoP discussions are aligned with organisation needs (Vestal 2006). Process facilitation serves this purpose by providing a mechanism to regulate the activities of the CoP during its members' interactions. It aims to align the content of the learning activities with the learning task of the joint enterprise and to leverage knowledge to build a shared repertoire to improve practices. In this study, the process strategy for launching a CoP is conceptualised as the facilitation activities that provide a regulatory mechanism to plan, to implement and to evaluate whether the content is aligned with the shared domain of the joint enterprise.

4.6 A Study of CoP Facilitation Strategies

Cheng and Lee (2014) conducted a study to explore strategies for developing communities of practice to improve teaching in school organisations. These strategies provide guiding principles to CoP facilitators to develop the CoP and to understand their roles and the complexity of their responsibilities to support the activities in the CoP. Content strategy is confirmed as the predictor of all the CoP elements, while process strategy is the predictor of joint enterprise and shared repertoire only. Strategies for developing a CoP in schools involve designing reflective and collaborative learning content, as well as monitoring, regulating and streamlining the learning process.

The relationship between process and content is a dialectical one: neither facilitation can be considered in isolation if the learning process is to be fully understood. The balance between the two is a key duality in cultivating communities of practice. In providing training workshops for teacher learning, a sole focus on process facilitation may have the result that participants find it difficult to improve their practice and develop new conceptual understanding. In contrast, too much focus on content facilitation for leveraging knowledge may create separation and suppress creativity and lower the status of the participants, who are likely to formally comply without taking any ownership. A successful facilitation strategy is

therefore to balance process and content by aligning the regulating mechanism with the learning task of the CoP. The alignment requires the capability of the facilitators to coordinate the perspectives and actions of the participants for directing their energies to the common discussion domain. The facilitators are also required to broaden styles and discourses in ways that allow participants to invest their energy in them (Wenger 1998).

4.7 Incorporating After-Action Review in CoP Activities

Learning and knowledge transfer could be enhanced by incorporating a reviewing process that promotes teachers' reflection in CoP activities. Learning, reflection and knowledge creation are intertwined. Learning involves reflection to create knowledge through combining new and old information. The Learning study as mentioned in Cheng's (2009) study involved a structured review or de-brief process analysing what happened in the lesson, how students responded, why learning happened or not, and how the lesson could be delivered better by the teachers. These reviewing processes help teachers to capture knowledge. The reviewing process is commonly known as the after-action review (AAR).

AAR is a knowledge management tool to capture and learn from successful or unsuccessful experience through systematic review and discussion of a recently completed task. AAR is a training approach that has been used by the US Army for all US military services and by many other non-US organisations for many years (Morrison and Meliza 1999). It then evolved as a KM tool in business organisations to review what could be learnt and what should be avoided in carrying out repeated tasks. AAR is thus a collective reflection process used by a team to capture the lessons learned from past successes and failures of a project, activity, event or task for improving future performance. Therefore AAR is a team learning activity which could strengthen organisational learning capacity. Villado and Arthur (2013) conducted an empirical study to examine the effectiveness of AARs. They find that AARs are effective at enhancing training outcomes. AAR could result in a higher team performance, team efficacy, openness of communication and cohesion.

An AAR is usually conducted immediately after the activity to avoid brain-drain of the participants. A facilitator should be appointed to run the AAR, to cultivate an atmosphere of openness so as to facilitate the knowledge sharing among the team. The facilitator is not asked to answer members' questions, but to help the team to reflect on what they have learnt and to leverage knowledge for future action. Openness and commitment to learning is the ideal climate for conducting an AAR, with everyone participating in an atmosphere free from the concept of seniority or rank. It certainly should not be treated as personal performance evaluation, otherwise the participants' defence mechanisms would be triggered. During the AAR, participants review what was intended, what actually happened, why it happened and what was learned.

4.8 ORID Group Facilitation Techniques

ORID is a focused discussion method for the four consecutive stages discussion logically passes through: objective discussion, reflective discussion, interpretive discussion and decisional discussion. O stands for objective: the facts that the group knows. R stands for reflective: how people feel about the topic being evaluated and what they like and dislike. I stands for interpretive: what are the issues or challenges. D stands for decisional: what is our decision or response. It is a very useful group facilitation technique helping group members explore common experiences through sequentially developed questions (Nelson 2001). Facilitators can use ORID to conduct an AAR as it provides a framework for asking questions. They should start by dividing the event into discrete activities, each of which should have had an identifiable objective and plan of action. The discussion begins with asking the first question: what was supposed to happen? This question helps the group establish facts about a particular situation, experience or event for having an objective discussion. Then, the facilitator should lead the group to reflect on discussing how they felt about the situation, experience or event by asking what actually happened, so that the group understand and agree facts about what happened. After that, the facilitator should lead the group to interpret the facts by enabling the group to address questions such as: why were there differences between what was intended and what actually happened? The learning begins at this stage by comparing the lesson plan with the enacted lesson and what actually happened in the classroom. Finally, the facilitators help the group to make a decision by asking: what did you learn and what will you do?

Content and process facilitation strategies could be adopted at the same time to cultivate the three core elements: joint enterprise, mutual engagement and shared repertoire of a CoP in a school organisation; while AAR and ORID facilitation could be applied as KM tools to promote reflection and leverage best practices. Schools can sponsor CoPs by setting a clear knowledge-sharing focus and assign facilitators to facilitate knowledge sharing among teachers.

4.9 Chapter Summary

A community of practice (CoP) is a group of people having a joint enterprise to improve their professional practice. They engage mutually in CoP activities and aim to create a repository for knowledge sharing. A CoP can be applied as a knowledge management tool for leverage knowledge. A CoP cannot be self-created, but requires cultivation and facilitation. Promoting an organisational learning culture would help school leaders to cultivate CoPs in their schools. They may apply the ORID model to conduct an after-action review (AAR) for leveraging knowledge for improvement. Facilitators should balance the direction of content facilitation and process facilitation in the discussion in the CoP for leveraging expected knowledge.

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Chapter 5
Nurturing Teachers' Personal Knowledge Management Competencies

Abstract This chapter addresses the issue of developing teacher competencies to take up the responsibilities of KM practitioners and to carry out KM activities. It critically reviews the literature on personal knowledge management and describes the key skill sets required to carry out KM tasks. The school-based professional development activities for developing teachers' PKM competencies are then outlined.

5.1 Why is PKM Important?

Recent education reforms in Hong Kong highlight the development of student learning-to-learn skills for acquiring knowledge through various channels (Education Commission 2000). To achieve this aim, teachers should learn how to teach their students learning-to-learn skills, and are also expected to equip themselves with this competency for learning pedagogical knowledge. As mentioned in Chap. 1, the recent education reforms in Hong Kong (Education Commission 2000) addressed this lifelong education issue by proposing a learning-to-learn slogan in the policy document. Learning to learn is the basic skill for lifelong learning in a knowledge society (Hoskins and Fredriksson 2008). Learners should be well equipped with this skill to acquire new knowledge for effective learning. The policy suggests that teachers should develop student self-regulated competency for acquiring knowledge through various methods. To develop students with knowledge acquisition skills, teachers should also be equipped with the competency for knowledge acquisition. Teacher development is viewed as a lifelong learning process as teachers strive to learn how to teach students to learn how to learn (Cochran-Smith and Lytle 1999). Enhancing learners with learning competency for lifelong learning has become a core issue in teaching and teacher education. Developing learners with personal knowledge management competency is not simply a lifelong education issue, it is also an important teacher education issue in terms of sustaining competitive human capital in the knowledge economy.

Frand and Hixon (1999) proposed PKM for undergraduate students as a means of contextualising a more integrated learning experience as well as an alternative

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to the traditional narrow focus of a declared major. Learners with higher PKM competencies could have more alternative strategies to internalise information systematically into their tacit knowledge from different complex contexts. Enhancing teacher PKM competency is an effective way to support the conversion of information into pedagogical knowledge. Research shows that there is a predictive relationship between PKM competency and learning effectiveness (Cheng 2011; Wright 2005; Tsui 2002; Grundspenkis 2007), in which learners can apply PKM competency to support their learning. School leaders and teachers as knowledge workers can apply PKM to improve their planning capacities. The significance of exploring PKM may contribute to human cognitive capabilities (Sheridan 2008).

5.2 What is PKM?

The increase in the amounts and formats of information available do not automatically make learners more informed or knowledgeable if a learner cannot manage and meld the accumulated information through their daily experiences and construct knowledge in a systematic fashion. This competency is referred to by most (Frand and Hixon 1999; Dorsey 2000; Wright 2005) as personal knowledge management (PKM). Recent literature links learning-to-learn competencies and technologies with the domain of PKM (Dorsey 2000). PKM can be conceptualised as an intertwined macro-competency. Wright (2005) developed a PKM model that links distinctive types of problem-solving activities with specific cognitive and metacognitive, information, social and learning competencies to develop knowledge workers' PKM competency. As a knowledge management competency, PKM enables knowledge workers to apply a set of learning skills that are essential to lifelong learning for information processing, knowledge application and decision making. As a cognitive and metacognitive competency, it enables knowledge workers to apply complex thinking skills to solve problems. As an information competency, it enables knowledge workers to link technology tools with a set of information skills, thus providing an intentionality that moves the focus from the technology more directly to the information. As a social competency, its underlying principles include enabling knowledge workers to understand others' ideas, develop and follow through on shared practices, build win–win relationships and resolve conflicts. PKM integrates human cognitive and metacognitive competencies (Sheridan 2008), social competency (Wright 2005; Pettenati and Cigognini 2009) and informational competency (Tsui 2002).

Frand and Hixon (1999) define PKM as a conceptual framework to organise and integrate important information such that it becomes part of an individual's personal knowledge base. They outlined five PKM techniques as searching, categorising, naming things, evaluating and integrating skills. Avery et al.'s (2001) then broadened the Frand and Hixon PKM framework well beyond its formulation into seven information skills which, when exercised together, are integral to effective knowledge work. These seven PKM skills are retrieving, evaluating,

organising, analysing, presenting and securing information, and collaboration for creating knowledge.

The operational definitions of Avery et al.'s (2001) PKM skills are as follows:

1. *Retrieving skill* is the ability of learners to retrieve information from relational databases, electronic library databases, websites, threaded discussion groups, recorded chats, and moderated and unmoderated lists.
2. *Evaluating skill* is the ability to make judgements on both the quality and relevance of information to be retrieved, organised and analysed.
3. *Organising skill* is the ability to make the information one's own by applying ordering and connecting principles that relate new information to old information.
4. *Collaborating skill* is the ability to understand others' ideas, develop and follow through on shared practices, build win–win relationships, and resolve conflicts among these underlying principles.
5. *Analysing skill* is the ability to extract meaning from data and convert information into knowledge.
6. *Presenting skill* is the ability to familiarise oneself with the work of communications specialists, graphic designers and editors.
7. *Securing skill* is the ability to develop and implement practices that help to ensure the confidentiality, integrity and actual existence of information.

Dorsey (2000) emphasises the importance of injecting PKM into the undergraduate curriculum in order to bridge the gap between general education and other subject disciplines. PKM can serve as a framework for integrating general education and major subjects and as an approach to technology integration initiatives throughout the curriculum.

5.3 PKM in Teacher Education

Personal knowledge management is related to learner effective learning (Frand and Hixon 1999). It refers to a collection of processes that an individual learner needs to accomplish in order to collect, categorise, store, search and retrieve knowledge in one's daily activities (Grundspenkis 2007). Its focus is on how individual learners apply knowledge processes to support their day-to-day learning activities (Wright 2005). Utilising PKM for acquiring knowledge refers to a collection of information management processes that an individual learner needs to carry out in order to gather, classify, store, search and retrieve information in their daily activities (Tsui 2002; Grundspenkis 2007). In teacher education, knowledge acquisition focuses on the process of how teachers apply PKM to support their day-to-day teaching and learning activities.

Recently, a few empirical teacher PKM studies have been conducted in the school setting to verify its impact on improving education. In Hong Kong, Cheng (2011) has conducted a survey to explore the relationship between PKM and

knowledge acquisition of pre-service teachers. A four-factor PKM model, which consists of retrieving, organising, analysing and collaboration skills, was empirically constructed. Pre-service teacher PKM competency was identified to be a predictor for learning effectiveness. The result shows that PKM is a means for enhancing pre-service teachers' professional competency in learning instructional design, classroom management and assessment skills. Incorporation of PKM skills in the teacher education curriculum is recommended to teacher education institutions to enhance pre-service teacher PKM competency.

In Taiwan, Yeh et al. (2012) identified eleven core competencies of knowledge management for elementary school teachers that can contribute to the sustainable development of school education. These competencies include identifying problems, knowledge adoption, activities recording, knowledge application on work planning, research data application, transforming knowledge into concrete actions, interpreting results and judging knowledge value. In order to gain the competitive advantages in human resource development, they suggested that these core competencies should be exploited effectively.

In China, Zhao (2009) conducted a survey on teachers' PKM competency and found that Chinese teachers were not good at making use of Web 2.0 technology to manage knowledge and communicate with other teachers. Zhao presented a framework of Web 2.0 including Blog, WiKi, RSS, Tag, SNS, Social Bookmark, Diido and Podcasting to support teachers exercising their PKM. The study also claimed that Web 2.0 provides a series of effective tools and platforms to develop teachers' PKM competencies.

In Malaysia, Abdullah and Talib (2012) conducted a study to examine the possibility of enhancing teaching and management performance based on PKM techniques. They found that PKM skills were related to individual-level knowledge acquisition, storage, dissemination and application, as well as collective-level teaching cooperation and knowledge sharing. However, teachers' pedagogical knowledge was not well managed because their PKM skills were affected by time-wasting.

In Singapore, Chai et al. (2011) proposed a Technological Pedagogical Content Knowledge (TPACK) framework which has seven constructs to describe teachers' technology integration expertise. They found that TPACK constructs had a significant impact on pre-service teachers' TPACK perceptions. However, only technological pedagogical knowledge and technological content knowledge were found to be significant predictors of TPACK in their study. "The TPACK constructs address a theoretical void in the area of educational technology and have been widely adopted by colleges of education for the planning of teacher technology integration courses" (Koh and Chai 2011, p. 735). The finding of the study provides insights to educators on how to connect the pedagogical knowledge, content knowledge and pedagogical content knowledge learnt in methods courses to their ICT courses.

These empirical studies of the PKM model provide frameworks for teacher educators to articulate how pre-service teachers exercise their PKM competencies to organise retrieved information, and internalise them into their pedagogical

knowledge via analysis or collaboration. The studies also explore the knowledge gap between the expected and actual PKM competency level of the teachers. Once teachers know how to control this knowledge management process, they can integrate information into their personal knowledge, hence creating a foundation for effective knowledge sharing.

5.4 How to Develop PKM?

Wright (2007) developed a PKM Planning Guide for developing knowledge worker PKM competency. The guide is based on his research findings that four interrelated PKM competencies are activated in order to plan PKM training. These four competencies are: cognitive and metacognitive, information, social and learning. The training process encourages participants to reflect on their knowledge activities and focus on areas for improvement. Wright's training model integrates problem-based learning (Armstrong 1991) and action research (Kemmis 1988) for developing participants' retrieving, organising and analysing skills, which are all identified to be the core PKM skills in this study. Wright's training approach can be adopted for training teachers' PKM competencies by assigning collaborative tasks to them. Teachers appreciate collaborative learning (Hauge and Wittek 2003) and their collaborative skills can thus be enhanced. Moreover, applying statistical software for data mining and collaboration tools for communication are compulsory skills for managing knowledge in a knowledge society. Teacher education institutions should integrate these tools and software with the collaborative action research into the teacher education curriculum. This can be of significant assistance to teachers in retrieving, organising, analysing and collaborating information across all disciplines.

A set of learning outcomes for planning the PKM curriculum can be articulated from the PKM elements (Cheng 2011). For example, teachers should be able to access databases and websites for information retrieval; operate electronic tools for information integration; use spreadsheet and statistical software for data and information analysis; use collaborative PKM tools for collaboration to support both synchronous and asynchronous communication for the purpose of learning; and construct knowledge that is based on an appropriate understanding of the nature of data, sound inference, and an understanding of potentially meaningful relationships within a data set. Koh and Chai (2011) claimed that "a conscious modelling of the pedagogical uses of technology and content representations with technology should be emphasized to strengthen the contributions of these elements to TPACK" in the ICT courses (p. 744). The course should be integrated with "the use of tutor modelling, vicarious observation, self-paced exploration, critique of ICT integrated lessons, and hands-on ICT integration design experiences to develop these aspects of pre-service teachers' TPACK" (p. 744). To develop teachers on the basis of the above derived learning outcomes, competency training including the interrelated skills of cognitive and metacognitive, information, social and learning should be provided (Wright 2005).

5.5 PKM Tools

Tsui (2002) takes a technology-centric view of PKM and looks at the challenges and problems associated with the use of PKM tools. He considers PKM as a set of information skills and describes several categories of tools for developing PKM skills. These PKM tools are search/index tools, meta-search tools, information capture and sharing tools, associative link tools and concept/mind mapping tools, email management, voice recognition, collaboration and synchronisation, and learning tools. Garner (2010) proposed a Software-as-a-Service (SaaS) tool which is a way of the future for software applications. It has recently developed rapidly and this paper discusses how such technology can support the personal knowledge management (PKM) of students. Garner (2010) proposes using wikis and Google Docs to support and develop PKM skills. A wiki is a web application whose content is collaboratively added to, updated and organised by its users (Mitchell 2009), and which can be utilised in knowledge management within education to support analysis and collaboration around information. Google Docs is a platform where word processing, spreadsheeting, and presentation software are made available. Such software is often free, and also enables sharing and collaboration between users. Learners can also acquire relevant new knowledge by internalising information from a wiki.

5.6 E-Learning Activities

Besides efficient use of PKM tools, e-learning activities also involve sharing and intelligent practices that guide the use of tools. E-learning is a means of learning that uses wireless mobile communications network technology and wireless mobile communication systems, individual digital assistants, etc. to access information and resources. E-learning activities should be delivered by the action research approach. Action research is a form of self-reflective enquiry undertaken by participants in educational situations in order to improve the rationality and justice of their own educational practices, their understanding of these practices and the situations in which the practices are carried out (Kemmis 1988). Studies involving teachers in collaborative action research into their own practices can be traced back to Elliott's research work (1976). As part of the action research process, teachers are expected to learn cooperatively and become reflective practitioners (Schon 1983) by practising theories postulated from others. Research shows that incorporating action research approaches into initial teacher education programmes could educate reflective teachers to deal with the complexity of practice, but that adequate resources and support are required for the programme implementation (Gore and Zeichner 1991; Cochran-Smith 2004; Mills 2007).

Pettenati and Cigognini (2009) devised a conceptual model of e-learning activities to develop adult learner PKM skills. They grouped PKM skills under three intertwined macro-competence categories: creation, organisation and sharing.

These activities involve using internet tools for teaching PKM skills. The training is built around learning purposes and activity tasks, and requires learners to respond to, comment on and evaluate others' learning. This training model involves the development of cognitive, metacognitive and information skills. In order to develop learners with effective knowledge construction, reflection and metacognition in the learning context, Pettenati et al. (2007) framed the PKM training model with instructional design methodologies and personal learning contexts. They provided a social networked context with a sample educational scenario to "illustrate an example of the ways in which formal and informal learning may lead to holistic and complete development of PKM skills for the connected learner" (p. 61). The model can be applied in the educational contexts of the undergraduate programme. They claimed that social networking tools and methods provide a tremendous opportunity and context to lead the learner into a learning and knowledge landscape in which PKM skills and competencies are both the enabling condition and final outcome of the social network-based learning experience.

5.7 Collaborative Action Research

Zuber-Skerritt (2005) proposed a model of action research and action learning to help knowledge workers access, communicate and manage personal knowledge. This soft approach may help develop people's PKM competency. Pre-service teachers appreciate collaborative action learning and value opportunities for deliberation and reflection on experience (Eisner 2002) as long as they feel confident speaking about their experiences of knowledge acquisition. Cheng (2009) adopted a CoP framework to help a group of five in-service teachers create pedagogical content knowledge for mathematics teaching. He applied an action research approach entitled Learning Study to cultivate and facilitate a community of practice for studying the knowledge sharing and creation process. He discovered that the collaborative action research approach can develop teachers' learning competency for knowledge creation. However, in light of the present rapid advancement in mobile computing, it is important also to consider how teachers' knowledge can be shared and used by teachers' CoPs via electronic mobile devices.

5.8 Personal Learning Environment

The concept of a personal learning environment (PLE) is driven by the development of lifelong learners. Van Harmelen (2006) defined a PLE as "a single user's e-learning system that provides access to a variety of learning resources, and that may provide access to learners and teachers who use other PLEs and/or virtual learning environment" (p. 1). In the PLE the learners can select, individualise and customise the learning resources and services according to their needs and interests.

A PLE helps learners set their own learning goals, manage their learning, both content and process, and communicate with others in the learning process (Van Harmelen 2008). It usually involves the integration of a number of Web 2.0 technologies such as blogs, wikis, RSS feeds, Twitter and Facebook around the independent learner. Individual learners can connect to both information and to communities with their own preferred PKM tools. A PLE can promote authentic learning by integrating the training on PKM tools, collective action research and e-learning activities into the learning process by challenging individuals to reflect on the PKM tools and learning resources that help them to achieve effective learning.

To support the sustainable development of teachers as professionals in the knowledge society, teacher education institutions have to integrate PKM tools, e-learning activities and collaborative action research and personal learning environment into the teacher education curriculum. This could be of significant assistance to teachers in retrieving, organising, analysing and collaborating around information across all disciplines. If PKM skills are taught, acquired and utilised in each discipline across the curriculum, teachers can organise and integrate information to provide strategies for transforming what might be random pieces of information into something that can be systematically applied and that expands their personal knowledge. Nurturing teachers with PKM competencies can help sustain a competitive human capital in the knowledge economy.

Teachers are expected to be knowledgeable and up-to-date in subject knowledge, pedagogical knowledge and educational knowledge, all of which require an intensive ongoing learning process. If their PKM skills are further developed, known and utilised in each discipline across the teacher education curriculum, they would come to understand how important holistic information skills and critical thinking skills are in processing, interpreting and synthesising information and in producing and contributing knowledge in any content area. If teacher education institutions are earnest in equipping teachers with learning-to-learn skills for acquiring knowledge, they should inject PKM elements into the teacher education curriculum to develop teachers' PKM competency.

5.9 Summary

PKM can be conceptualised as an intertwined macro-competency that links distinctive types of problem-solving activities with specific cognitive and metacognitive, information, social and learning competencies. PKM is related with learner effective learning and therefore it should be developed in teacher education. PKM competency could be developed through e-learning activities, collaborative action research, metacognitive training in face-to-face tutorials or a personal learning environment on the worldwide web.

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Chapter 6
Institutionalising a School Knowledge Management System

Abstract This chapter illustrates the role and application of information technologies for supporting people interaction in virtual communities to manage knowledge by providing an overview of knowledge management systems and tools. The specifications for designing a school KM system are discussed and the KM tools and methods installed in the KM system such as taxonomy, knowledge portal and data mining are presented.

6.1 What is a KM System?

A Knowledge Management system is a platform that can be used as information technology to support knowledge processes with a repository in which KM application systems are built (Maier and Hädrich 2006). A KM system can be defined as an IT system which consists of a set of detailed methods, procedures and routines created to carry out knowledge and knowledge management activities to store and retrieve knowledge, improve collaboration, locate knowledge sources, mine repositories for hidden knowledge, capture and use knowledge, or in some other way enhance the KM process for solving knowledge-related problems. A KM system aims to support knowledge processes such as knowledge creation, organisation, storage, retrieval, transfer, refinement and packaging, use, reuse, revision and feedback, and ultimately to support knowledge work to solve one or more business problems (Mattison 1999) in an organisation (Davenport et al. 1996; Alavi and Leidner 1999). It extends the function of computer-based communication and information systems to support the knowledge processes, so as to enhance knowledge-intensive tasks and projects (Jennex and Olfmann 2003).

A KM system involves not only a technological-oriented information system, but also requires effective integration and alignment of social, cultural and managerial elements to successfully manage and leverage knowledge as a source of competitive advantage (Alavi and Leidner 1999; Varma and Heintzeler 2012). However, a KM system should be seen from a socio-technical perspective rather

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than from a technical-rational view, because IT initiatives are person-oriented organisational instruments targeted at improving the productivity of knowledge workers (Maier 2004). In this sense, a school KM system is not confined to a physical IT system but also involves processes and mechanisms for managing knowledge, because its effectiveness is dependent on the coordination of social relations and technology (Pan and Scarborough 1999; Bhatt 2001).

6.2 Why is a KM System Important?

A KM system is recognised as one of the key enablers to eliminate distance and time barriers and improve accessibility to relevant information in the minimum amount of time. It provides a strong support for group communication to connect people and promote remote collaboration, and serves as a powerful enabler for KM in virtual communities that may contribute to organisational learning. It helps assimilate sources of knowledge and, with the help of a shared context, increases the breadth of knowledge sharing between persons rather than storing knowledge itself (Alavi and Leidner 2001). A KM system not only supports interaction amongst people and manages the knowledge created from the interaction, but also provides repositories that contain lessons learned, directories and networks designed to facilitate communication between members. With a school-based taxonomy, the KM system supports the proper categorisation and retrieval of content, and consistency in naming documents from the knowledge repositories. In addition, it helps users to manage data, information and knowledge, to conduct data mining and to reuse knowledge from their knowledge repository for effective decision making. It can also provide information to identify people with adequate competencies and solutions for problems through group discussions and email groups.

6.3 Studies of KM Systems in the Education Sector

KM systems can be applied in the education sector to support teaching and class management. Lou et al. (2006) have conducted a research study in the application of a KM system for mechanical engineering teachers at vocational high schools in Taiwan. They found that teachers' attitude towards using the KM system significantly improved and they gained a better understanding of the concept of knowledge management. Chou (2005) conducted a case study to examine the application of knowledge management systems (KMS) in Yung Ta Institute of Technology and Commerce, a private college in Taiwan, which was facing administrative challenges and cutting-edge competition. The KM implementation process involved building a KM vision, appointment of KM leaders to facilitate knowledge sharing, and formulation of a KM road map and KM strategies. Chou proposed that

leaders had to adopt a multi-perspective KM system in the search for excellence to deal with cutting edge competition, and management techniques such as KM and related strategies should be applied to enhance quality and performance.

Knowledge management helps an organisation to create collective information and experience that is available to staff. Munir and Rohendi (2012) developed a prototype KM system for organising, documenting and storing the knowledge at the Indonesia University of Education. They selected Share points, software that is able to collect, store and publish all digital data available together with an online accessed function, to develop the prototype of the KM system in their University. They found that leadership supports and university policies that rewarded academic staff for knowledge sharing were motivators for academic staff to use the KM system.

6.4 Designing a KM System

A KM system should be integrated and tailored to meet the needs of specific communities, because knowledge does not exist in technical elements but rather exists in human beings who are able to act upon the knowledge (Jelavic 2011). Not all KM initiatives involve the implementation of IT, for example cultivating a CoP of lesson study or Learning Study (see Chap. 4) for leveraging pedagogical knowledge for effective curriculum innovation. However, many KM initiatives rely on IT as an important enabler. For example, knowledge codification and storing, and data mining for decision making, require IT support. With the IT-based approach, systems designed to support knowledge in organisations may not appear totally different from standard information systems, but will be built in such a way as to enable users to facilitate the assimilation of information into knowledge.

The nature of tacit and explicit knowledge and the development of personalisation and codification strategies for knowledge management were discussed in Chap. 2. The personalisation strategy emphasises human factors in designing and implementing KM in schools while the codification strategy emphasises the use of IT-based tools. Developing and implementing a KM system should also be aligned with these two approaches. The essential elements in the human-centred KM system are the culture, people, experience, skills, communication and people interaction; while the focus of the information-centred approach is on the identification, application and alignment of IT-based tools and technologies to support knowledge management activities.

6.4.1 IT Elements in KM Systems

The role of information technologies in knowledge management systems is to provide capabilities for searching, accessing, gathering, codifying, storing, retrieving and distributing information and connecting people to the sources of knowledge

so that individuals can expand their personal knowledge and apply this to the school's requirements. Several IT elements and concepts should be considered for building a KM system to support knowledge retrieval, sharing and storing. For effective knowledge retrieval, taxonomy concepts can be applied to help in classification. Taxonomy works with search engines to improve the effectiveness and efficiency in locating and retrieving documents. Therefore, a KM system should have a search engine that locates relevant materials in the database or repository. The search engine would support various kinds of searches including keyword, menu-based and attribute-value pair searches. The meta-data and tags created in the taxonomy system can also help search engines to refine and converge the search to produce faster and more accurate outcomes. When explicit knowledge and information are being codified in a taxonomy set, a document management system (DMS) should be incorporated to provide control over versions and access for all the documents generated and stored in the KM system. The process for managing knowledge flow is also critical to effective application of the KM system, the workflow of interrelated jobs and the coordination of these jobs for processing and approval before proceeding to the next one. Collaboration tools are a necessary part of cultivating a virtual community that must be embedded in the KM system.

6.4.2 Layers in KM Systems

School KM systems should be used at multiple levels which involve specific KM platforms that are shared among stakeholders so that they can contribute to the existing information repository by adding their own content. Tiwana (2002) proposed a multi-layer KM system architecture that contains seven layers (see Fig. 6.1). The lower layer contains the repositories, which themselves contain raw data stored for access by applications. Data can be quantitative data, discussion threads (texts), email messages, documents, spreadsheets, etc. The second level is the middleware and legacy integration layer that transmits data between legacy applications and applications on other platforms. The third level is the transport layer which is responsible for transporting data and information between applications in other layers. The fourth level is the application layer which hosts collaboration tools that support knowledge integration and sharing. The fifth level is the collaborative intelligence and filtering layer which contains many of the applications for codifications and information retrieval (e.g. search engine, intelligent agents, taxonomy software, indexing and meta-tagging software). The sixth level is the access and authentication layer which defines the security and authentication/authorisation measures to manage access for the individual or groups of users. The top level is the interface layer which defines the client software and the hard-ware devices that enable users to access the system.

Interface layer	Defines the client software and the hardware devices that enable users to access the system	Integration via the web
Access and authentication layer	Defines the security and authentication/authorisation measures which manage and govern access	
Collaborative intelligence and filtering layer	Contains many of the applications that support codifications and information retrieval	
Application layer	Hosts collaboration tools that support knowledge integration and sharing	
Transport layer	Responsible for the transportation of data and information between applications in other layers	
Middleware and legacy integration layer	Integrates software that transmits data between legacy applications and applications on other platforms	
Repositories layer	Serves as operational stores that contain raw data stored for access by applications.	

Fig. 6.1 Tiwana (2002) KM system architecture

6.5 Building Taxonomy

In its simplest form, taxonomy is a system of classification used to categorise documents and other information found in the repository. It is used by the organisation to support a mechanism for navigating and gaining access to the intellectual capital of the organisation. The functions of taxonomy are to serve as portal navigation aids, authority for tagging documents, support for search engines and knowledge maps (Gilchrist and Kibby 2000). Taxonomy is a structure that provides a way of classifying things into a series of hierarchical groups to make them easier to locate. The structure of the taxonomy defines the relationship among categories or nodes of information and a way of representing the available information.

Thambia and O'Toole (2013) conducted a study to examine the relevance of a corporate-based taxonomy of knowledge management to secondary schooling. They wanted to identify the principles of KM developed from the corporate world that would translate effectively to the secondary school. They used Michael Earl's corporate-based taxonomy and found that many of the categories were not only relevant to secondary schools, but were already in use. Building taxonomy helps schools to make fast and accurate decisions based on the huge amount of information obtained from other persons, the web, documents, and other sources of unstructured and structured information. The fact is that users receive a huge amount of information every day but most of it is left somewhere unused or even forgotten.

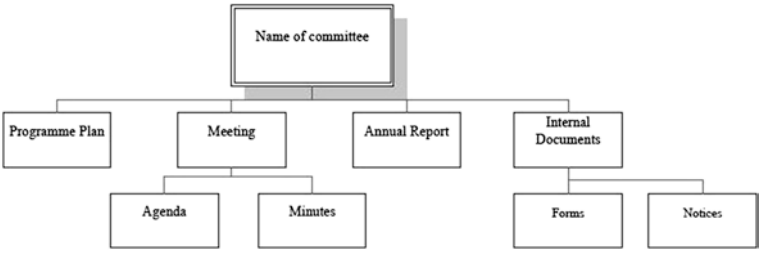

Fig. 6.2 Taxonomy of a committee in a secondary school

To develop a school taxonomy, a list of standard terms called a "controlled vocabulary" is developed. This describes the list of terms used to categorise the content. The next step is to determine the relationships among the terms. These relationships may include cross-references from nonstandard terms to standard terms, from narrower terms to broader terms, and from one term to a related term. Definitions and notes for explaining the relationship are usually included with the terms. This part of the taxonomy is often called the thesaurus. The controlled vocabulary and the thesaurus constitute the taxonomy structure (Dow et al. 2008). After constructing the structure of the taxonomy, the next step would be connecting the terms with the resources to be stored and retrieved, such as school notices, parent letters, meeting agendas and minutes, annual plans and reports, government policy documents, reference books, academic articles, teaching materials and photos, etc. Typically this happens in the taxonomy application, along with sorting and formatting the terms. A pilot study should be conducted to check how well the taxonomy meets the real needs of the user before full implementation. It is more important to meet the real needs of users than to produce an ideal textbook taxonomy. Users will need to be briefed in the development and application of a taxonomy. Content owners and users have to be educated about the benefits of a taxonomy in order to introduce its concepts effectively. Figure 6.2 shows an example of a taxonomy of a secondary school. Three hierarchical levels of taxonomy are designed for document searching and retrieval.

6.6 Knowledge Portal

A portal is a network service that brings together content from diverse distributed resources using technologies such as cross-searching, harvesting and alerting, and collating this into an integrated form for presentation to the user (Alavi and Leidner 2001; Bansal and Bawa 2005). Creating a knowledge portal can be an effective way to institutionalise KM. A knowledge portal is the entry point for storing new knowledge and finding existing intellectual assets (Tryon 2012).

A portal can also be considered as a customised transactional web environment, designed purposefully to enable an individual end user to personalise the content and the look of the web site (Lakos 2004). A portal aims to aggregate, integrate, personalise and present information to the user according to their role and preferences (Dolphin et al. 2002), and to present its users with all the information necessary to carry out their jobs (Winkler 2003). A portal enables the users and school management to gain access to a large volume of information—or even knowledge—through the school portal web. Users have access to content, including text, pictures and short videos stored on the repositories or databases. Portal technologies support important backend operations that provide the flexibility, scalability and security required for any robust web-based environment. "Advanced portals include capabilities such as single sign-on, authentication and authorization services, directory services, content management, collaboration, mobile device support, search and taxonomy services, accessibility support, and internationalization" (Natarajan 2004, p. 1). Figure 6.3 displays the portal of a school KM system which supports data mining for student academic performance, attendance, punctuality, homework submission and misbehaviour, as well as providing repositories for school procedural manuals, students' photos, teacher memos and notices, and school documents, and supporting a room reservation function.

Al-Halhouli and Owaied (2013) presented the design and implementation of a portal for secondary schools in Jordan. The portal represents a typical educational platform of a KM system in a way which allows students, parents, teachers and the school director to communicate with each other in a fast and direct way. The portal was installed with a mobile-based software ASP.Net 2008 and SQL Server Management Studio which allows the user a large amount of freedom to access the KM system.

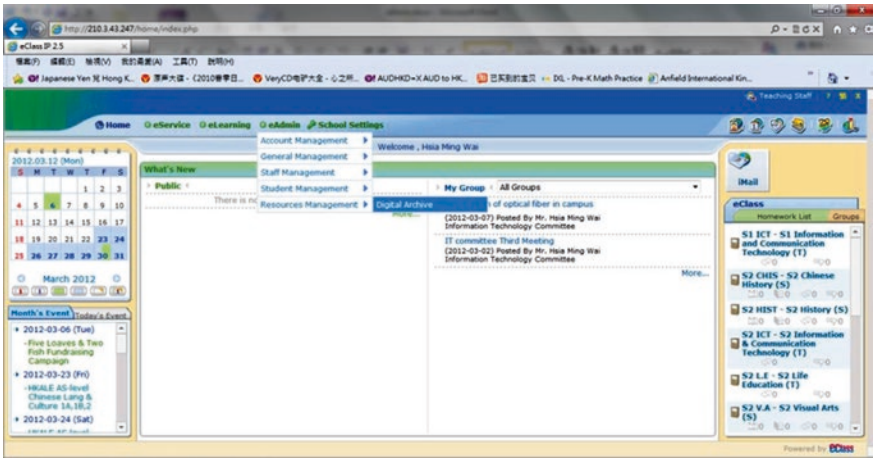

Fig. 6.3 An example of a school knowledge portal

In order to ensure success in operating a portal, it is essential to consider users' behaviour and IT competency, content, operational issues and launching strategy in the design of a portal before the layout of the portal is made. School context and policy environment should also be taken into account when planning and designing a portal. A school portal should be a private portal with restricted access limited to authorised users, that is, the teachers and administrative staff of the school. The portal itself should serve as a communication platform among the users. As the possession of portable handsets or devices with web access are now commonplace, it is also essential to plan an education portal which is simplified and mobile.

The main purpose of a portal is to provide information that is personalised for each user. Thus, the concept of personalisation in the development and design of an education portal should be considered. Users can also be divided into at least two groups: (1) common or public users, who look for and enjoy reading the news and information about the school on the portal only; and (2) members, who would like to take part in some of the activities, such as teaching and learning, on the platform. What users want to acquire through the portal is information. As such, simple and uncluttered designs are crucial. By utilising graphics, pictures and more sophisticated navigation systems, the portal would appeal to younger users. The aspects of security, data or information retrieval, communication, knowledge mapping, searching, content publication, and personal content must always be considered.

6.7 Data Mining

Data mining is a data analysis approach (Jantan et al. 2011) which has been given a great deal of attention in the information industry (Jashapara 2011). In the knowledge management process, data-mining techniques can be used to extract and discover valuable and meaningful knowledge from a large amount of data and to produce valuable information for decision making as well as policy making (Natek and Zwilling 2013). One key aspect of accountability in education is school self-evaluation which requires schools to achieve the four performance domains (management and organisation, teaching and learning, student support and school ethos, and student performance) to a specified standard. In order to evaluate the performances, schools must have assessment and statistical tools to conduct data mining to determine whether the standards are being met or how to meet them. Predictive models of student performance can be developed by data mining to determine what factors affect achievement on the tests and what interventions are required for those who are likely to fail. Lamont (2007) suggests that schools should collect student performance data throughout the year, with baseline data obtained at the beginning of each school year, interim data during the year, and achievement measures at the end of the year. Statistical software product and assessment tools, for example MS Excel and SPSS, are essential to efficient data

analysis after large amounts of data are collected in order to streamline its assessment process.

Data is a collection of facts and quantitative measures which exist outside of any context from which people can draw conclusions. By itself, data has relatively little value. Student test scores are data which has no meaning at all without interpretation with the corresponding rubric and grade descriptors. Data mining helps teachers generate information from the data set. Information by itself is merely an order of signs that can be interpreted as a message. Information as a possibility is not equal to knowledge. For example, mean and standard deviation of student test scores in each test item only provide information on how well students perform in that item and how large the individual difference is, but this information can provide insight to the teacher to reflect on ways to improve students' performance and their learning differences. Knowledge is being created by the new insight. The teachers may discuss with their peers and reflect to seek ways of enhancing student learning. New insights may be gained from the communities of practice, and the teacher may create pedagogical knowledge to fine-tune his or her pedagogical skills, for example questioning techniques or presentation skills, or feedback and formulate an action plan for improvement that is based on the information provided and the sense-making process in the CoP.

Student data that is available to teachers is usually limited and falls into the category of a small dataset. However, small datasets still carry enough student-specific characteristics in the sense of hidden knowledge which can be successfully associated with student success rates (Lamont 2007). Despite the fact that data-mining algorithms work best on large datasets so that most data-mining techniques work best with very large samples, Natek and Zwilling's (2013) study showed that data-mining techniques are still applicable to smaller samples. They found that the available desktop data-mining tools were mature in terms of their usability and ease of use, and provided usable results without extensive investment. Teachers using available data-mining tools can predict the success rate of students enrolled in a course. As schools usually find that they do not have all the data in the KM system that they need to carry out the desired correlations and other statistical tests, these tools can be installed in a KM system and associated with a school portal that allows users to input data. Data-mining tools allow schools to modify their data collection strategy over time. For example, if access to the internet is allowed, an online survey or data input can be conducted to capture that data and information any time and anywhere.

6.8 Promoting a KM System

It is very important that schools explore tacit knowledge, not only in teachers' minds, but also explore the knowledge hidden in data and transform it into explicit knowledge for school improvement. The practice of conversion of tacit knowledge into explicit knowledge is still a major concern that should be addressed in the

future. There is a preference for face-to-face interaction and learning as opposed to online discussions that can be provided by KM systems. Schools should choose a codification strategy to manage their knowledge and invest in IT in order to store codified knowledge (Grover and Davenport 2001) and to reuse it to offer fast solutions. Infrastructure, reluctance to share, and KM strategies are inhibitors for using KM systems. Other barriers include a bureaucratic structure and hierarchies, cultural stability, staff resistance, and the overlapping of initiatives. Top management commitment and support, organisational learning culture, KM tools, technology and incentives are critical success factors for the KM system (Mathew et al. 2012). KM system development should be emergent as knowledge is an intangible resource created in the human mind (Davenport et al. 1998) and only the organisational learning culture can encourage people to use the KM system to share their knowledge.

6.9 Summary

A Knowledge Management system is an IT-based system which consists of a set of detailed methods, procedures and routines created for managing knowledge in organisations for supporting creation, capture, storage and dissemination of information. To encourage the usability of the KM system, its design should consider both the human-centred and information-centred approach. A KM system can be applied to the education sector to provide repositories that contain lessons learned, directories and networks and a platform to facilitate communication between members for supporting their communication, decision making and knowledge transfer. A knowledge portal should be designed for the KM system as the interface to provide information that is personalised for each user to improve the efficiency of school management and administration.

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Chapter 7
A Knowledge Management Model for School Development

Abstract This chapter introduces a normative knowledge management model to support strategic planning by bridging the knowledge gaps for school development. School strategic planning can help school leaders to tackle the impacts and change generated from the schools' external environment. It articulates the relationship between knowledge management and strategic planning and addresses the implementation issues for applying knowledge management in schools.

7.1 Strategic Planning

Strategic planning helps schools to survive in a turbulent policy environment by coping with the changes generated by government policies and market forces as mentioned in Chap. 1. It plays an important role in providing a blueprint for school leaders and teachers to address curriculum reform and lifelong learning policy. Strategic planning can also facilitate the sustainable development of schools by scanning the organisational environment and reviewing internal strengths and weaknesses to prioritise action planning. Without effective planning, schools' targets cannot be achieved and the quality of education cannot be improved. This can lead to a high risk of failure for education reforms and, in turn, a waste of government resources. An important research agenda is how to strengthen staff PKM competency for planning and facilitate knowledge sharing within the school to improve strategic planning.

Effective strategic planning can be streamlined by incorporating knowledge management strategies so as to leverage knowledge resources for gaining competitive advantage. Knowledge management is a management strategy that makes use of information and knowledge to enhance organisational performance, management and operation. It aims to support organisations in creating a capable structure which retains, creates and applies knowledge not only for problem solving, but also for sustainable organisational development. Applying knowledge management in schools may help them to improve their planning capabilities.

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Strategic planning is an overarching process that includes strategic thinking, planning, implementation, review (Lumby 2002), monitoring and adjusting to the realities of the external environment (Peterson 1999). This process includes scanning or assessment of the internal and external environmental components of the school organisation, analysing the information and data collected, and formulating a plan to tackle the impact generated by the external environment (Allison and Kaye 2005; Fidler 1998). Through this process, school leaders and teachers can articulate institutional goals and priorities. School strategic planning helps school leaders to coordinate and reorganise different decisions within schools, and deal with an increasingly turbulent environment and the challenges faced by the school (Weindling 1997). Through this planning process, school leaders and participants can articulate institutional goals and priorities. School leaders can analyse the external environment and internal school capacity for prioritising and planning school improvements through strategic planning (James and Phillips 1995; Everard and Morris 1996). Fidler et al. (1996) note that, during the process of strategic planning, schools can realise the impact of the external environment through environmental monitoring and apply the outcomes to planning. By conducting an environmental analysis, schools can better understand their external environment and formulate a corresponding strategic plan to cope with changes. Institutionalising effective strategic planning not only assists school leaders to understand the situations of the internal and external organisational environment of their school, but also supports the coordination of different management tasks for improving the quality of teaching and achieving school objectives (Hodgson and Chuck 2003; Taylor et al. 2008; Ewy 2009).

An effective strategic plan should be comprehensive, wide-ranging and combine various school activities which would then be compiled into a document (Cheng 2011), ensuring that the actions in the plan are well-coordinated. The objectives of the plan should be aligned with the school goals, the actions in the plan should be well-implemented and the outcomes should be assessed and monitored (Fernandez 2011). Strategic planning is related to the school's vision. It envisions the future positioning and creates a plan to achieve the school vision. The criteria for success for each school activity should be aligned with its objectives. Effective strategic planning formulation depends on the collective wisdom of staff and the knowledge-sharing culture. Staff can contribute more to school development if they are familiar with the school situation through involvement in planning (Cheng 2011). The participation in planning is more important than the outcome of planning, not only because it creates a knowledge-sharing culture, but because it also promotes ownership of the plan. Involvement of teachers in the planning process can facilitate knowledge sharing for effective strategic planning.

As Ewy (2009, p. 3) contends, "involvement of competent teachers in the planning process is a key factor in effective strategic planning." Common reasons for the failure of strategic planning are inadequate staff participation in planning and whether access to reliable data and information is available. A possible solution would be to enhance teacher PKM competency and to institutionalise the KM system for data mining and knowledge sharing. Collecting reliable data and information and staff competency in data analysis are essential for effective strategic planning.

As such, reliable data and information for strategic planning can be mined from a KM system (see Chap. 6). KM aims to support organisations in creating a mechanism that measures, stores and uses knowledge. It increases staff problem-solving capabilities and the organisation's ability to make improvements (Sallis and Jones 2002). KM can be conceptualised at both the organisational level and the individual level. KM at the school's organisational level can be seen as an approach that enables teachers within schools to develop a set of policies and practices or processes to collect information and share what they know, leading to action that improves teaching and learning outcomes. Personal knowledge management is individual competency in managing information and knowledge for problem solving and decision making. Both KM and PKM may play roles in supporting strategic planning. As strategic planning is a management process to manage change for school sustainable development, implementing KM to support strategic planning becomes very important.

7.2 KM Enhances Strategic Planning

Cheng (2013) conducted an evaluative study to examine the predictive effect of the critical success factors (CSFs) for KM on effective strategic planning capacity and on improving school performance. A cross-sectional predictive quantitative survey was carried out to collect data from teachers of 10 primary schools and 10 secondary schools who participated in a Quality Education Fund KM project. The subjects of the study were the teachers of the 20 project schools. Each of the participating schools established a KM Committee (KMC) to facilitate school development in daily practices and had conducted KM audits for strategic planning. In each school, the principal (or someone delegated by the principal) and a group of three senior teachers (as KM managers) were members of the KMC. The KM managers were responsible for conducting KM audits and facilitating knowledge sharing to formulate school strategic plans. Professional training programmes and workshops were provided to KM managers and teachers. Each participating school practised at least one to two focused areas from four different performance domains, namely, management and organisation, teaching and learning, student support and school ethos, and student performance (see Fig. 7.1).

Results showed that teachers tended to agree that applying KM in schools can improve strategic planning capacity, management, their teaching competencies, student support and assessment for learning. Knowledge management vision, sharing culture and IT support were identified as predictive factors for strategic planning capacity. The teachers tended to be satisfied with the curriculum design, materials, instruction and activity arrangements of the KM workshop. They tended to agree that applying KM can enhance the school's management efficacy, is useful for analysing data of students' academic performance and performance in other areas and for the school's development as a whole. However, the teachers tended to only slightly agree that KM implementation can help develop their professional skills and optimise student support services.

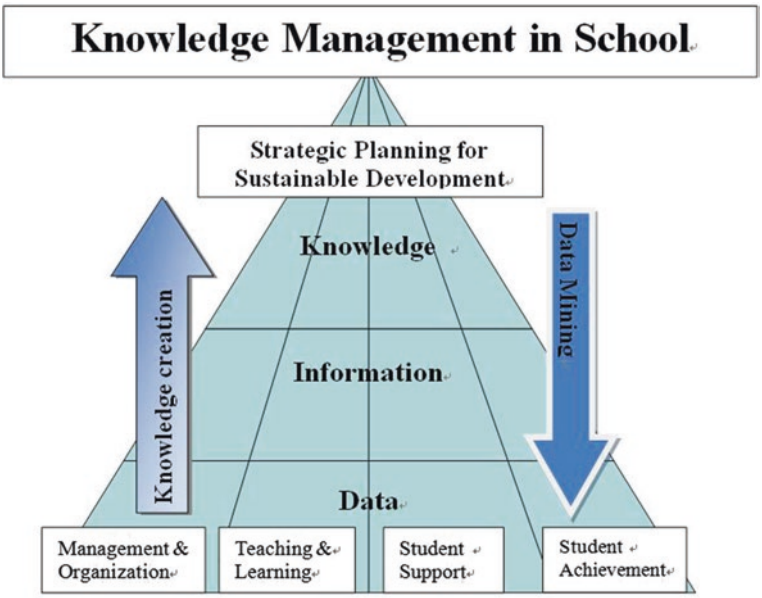

Fig. 7.1 Conceptual diagram for applying KM in schools (Cheng 2013, p. 7)

Four factors were extracted using factor analysis: knowledge-sharing culture, strategic planning, IT support and knowledge management vision. The regression model confirms that KM vision, knowledge-sharing culture and IT support were predictors for enhancing the capacity of strategic planning. The findings of this study support the claims that in order to improve school strategic planning capacity, schools should build a KM vision, cultivate a knowledge-sharing culture and seek resources to develop IT infrastructure.

7.3 How Can KM Contribute to Strategic Planning?

School planning capacity can be enhanced by sharing the KM vision with teachers, cultivating a knowledge-sharing culture by building trust with each other and institutionalising a KM system. KM vision refers to the degree to which the school can become one that creates knowledge and develops teaching and learning by using knowledge management. School management supports the promotion of the idea of knowledge management and shares the vision of knowledge-based development with stakeholders. The sharing culture refers to the degree to which the school is successful in establishing the culture of knowledge sharing and is able to lead colleagues to share their teaching experiences with others. The schools' management can be seen to share their teaching experiences and knowledge regularly, and is capable of leading colleagues to apply knowledge management. They have the leadership

ability to create knowledge sharing and encourage and support teachers to share their knowledge. IT support refers to the degree to which the school's information technology facilities support knowledge sharing. Schools involved have already established collaborative technology to allow knowledge sharing to be conducted through the internet and provide support for teachers to build a virtual learning community.

During the process of knowledge audit and strategic planning, the principal and KM managers of the project schools would consult teachers, ask them for improvement suggestions and develop the plan for teacher collaboration. KM managers would encourage staff to form communities of practice in formulating strategic plans. These CoPs would enhance teachers' understanding of school development and reduce the discrepancy between ideas and action during implementation. This would establish a clear and feasible common goal, and would enable staff to gain a deeper understanding of school values and vision. A culture of trust and collegiality can then be developed. The principal and KM managers allow staff to present their viewpoints through discussion of plans for promoting knowledge sharing among members with an eye to better decision making. Participation by school staff in planning can encourage teachers to conduct regular self-evaluation (Cheng 2008). School organisations may have the best technology and other resources which support KM implementation; however, if teachers are not willing to share their knowledge, that puts the whole KM project at risk. The first step to having a successful KM project is to create a culture of mutual trust, which enables knowledge sharing and which results in organisational learning. Teachers, talents, their skills and knowledge are the ultimate foundations of organisational performance. Eventually, school effectiveness would be achieved by managing the KM system strategically.

The process of formulating KM strategy involves creating a vision and mission, scanning the organisational environment through SWOT and PEST analysis, setting objectives, formulating alternative strategies and choosing particular strategies to pursue the organisation's goals (Ahmad and Idris 2008). Strategies' formulation usually commences with setting the school vision with all the teachers. A bottom-up approach could create a shared vision that bonds teachers together to work in the same direction. However, very few initiatives in an organisation can be successful without the support of the top management. It is the role of the leadership to promote learning and knowledge diffusion amongst the organisation's members as well as to promote the shared vision. When the leadership is committed and supportive, it instills confidence in the employees to be confident in practising something which is completely new to them. Moreover, the shared vision provides a foundation and knowledge-sharing platform to teachers to brainstorm the strategies of the development plans. Therefore, it is not surprising that building a KM vision is related to the school's strategic planning capacity.

The use of information and communication technologies supports the process of formulation of school strategic planning. Effective strategic management, especially under conditions of competition, changing education policy and environmental factors, relies upon data and information. The use of information technologies can enable ready access to data and information and thereby enhance strategic

decision making and strategy implementation. For example, data and information in the four core domains in school education (see Fig. 7.1) can be extracted and transformed into knowledge for strategic planning through data mining. IT infrastructure enables the smooth functioning of various KM processes. KM tools such as data mining help to analyse large quantities of data in the school database and discover hidden knowledge patterns: "KM technology, when given the right source feeds, can deliver relevant and timely knowledge" (Warier 2009, p. 63). The findings provide insight to researchers and KM managers to highlight the importance of information technologies for strategic planning: "These technologies are strongly related to long-term enterprise growth and prosperity, competitive advantages" (Kovacheva 2008, p. 55) and innovation development. They are based on knowledge and help organisations overcome the competition in the knowledge markets.

7.4 How Can KM Improve School Performance?

Knowledge management in school education can be seen as a management system or approach that enables teachers within the school organisation to develop a set of practices or knowledge strategies to collect information and share what they know. This can lead to actions that improve school management, teaching and learning outcomes and student development services (see Sect. 6.1). Applying KM in school settings improves school management, leverages innovative teaching knowledge for enhancing student learning and improves services (see Sect. 6.2). This is mostly done through institutionalisation of a KM system to speed up the problem-solving process through creating or using knowledge to make better decisions and develop innovative ideas for strategic planning. Taxonomy can provide a systematic filing system for effective knowledge retrieval. Ready-made materials can be more easily retrieved from the KM system. Schools should therefore strengthen their knowledge management capacity in order to leverage pedagogical knowledge and maintain a competitive advantage.

The Quality Assurance Division, Education and Manpower Bureau group school performance into four domains, namely: management and organisation, teaching and learning, ethos and support, and students' academic performance (see Fig. 7.1). Cheng's (2013) study showed that applying KM in education would improve school performance. In the management and organisation domain, KM can contribute to knowledge dissemination and to the organisational communication system (King and Newmann 2001). It therefore provides schools with adequate communication channels for teachers to discuss school issues with management. Teachers can reflect on and review feedback from others and develop further strategies for improving management and teaching effectiveness. School policies can be adjusted in light of teacher feedback for maximising student learning. With the building of a knowledge repository for student affairs services, KM provides a one-stop service to teachers and students to achieve information on student study advancement and career guidance, and teachers can be better equipped to provide student guidance and counselling services. KM also helps to capture

and retain experienced teachers' knowledge within the school and strengthen the novice teacher's knowledge through knowledge transfer in administrative work and teaching. Thus, this retains the knowledge within the school organisation. As for the teaching and learning domain, KM supports innovative teaching and effective learning. Through conducting data mining in student test scores, teachers can identify students' strengths and weaknesses for effective instructional design. A few communities of practice on lesson study can be cultivated by the KM system for capturing, sharing, storing and creating pedagogical knowledge and pedagogical content knowledge. As a result, teachers' professional development can be enhanced (Cheng 2009). In the school culture domain, KM not only provides a means for teachers to discuss different ideas about teaching and posting resources for student learning, but also retains the expertise of experienced teachers, increases their effectiveness in terms of teaching and learning performance, supports the development of the knowledge community in the school, and fosters the culture of learning (Leung 2010). KM can strengthen the knowledge-sharing culture and build collegiality into the school organisation.

7.5 Towards a Normative Model for KM Initiative and Implementation

This book may provide an increased appreciation for a broader view of applying KM in school education in Chaps. 1 and 2, developing an organisational learning culture in Chap. 3, cultivating CoPs in schools in Chap. 4, enhancing teachers' PKM competencies in Chap. 5, institutionalising a KM system in Chap. 6 and implementing the KM initiative for strategic planning in this chapter. All these elements constitute a knowledge base for the KM initiative and critical building blocks for KM implementation. Many knowledge problems occur because schools neglect one or more of these building blocks and thus interrupt the KM implementation. Therefore a normative model that guides the design of KM initiatives and sustainable strategies for KM implementation is proposed in this section. The model recommends school leaders to consider knowledge leadership, KM vision, a knowledge-sharing culture, KM in the school structure, and KM strategies as critical success factors in initiating KM implementation. All of these elements need to operate in a mutually supportive way for the knowledge to be leveraged such that the likelihood of effective implementation of KM in schools would be greatly increased.

7.5.1 Knowledge Leadership

Leadership style has a very considerable effect on the attitudes and behaviours of staff towards innovation. Even where schools have clear, uniform KM policies, the way these are enacted by school leaders differs considerably and such differences are significant. School leaders can be vital in making policies meaningful

or, conversely, virtually meaningless. Their underlying attitude towards innovation should be positive, celebratory, encouraging and radical (Storey and Salaman 2004). They should also have ideas for, and experiences of, innovation; as well as knowledge of theories of innovation. For effective institutionalisation of a KM system and implementation of KM processes in schools, the support of the principal and engagement of middle management are essential. Therefore, legitimising KM in the school structure by setting up a KM committee in the school structure and strengthening the leadership role of KM managers to the middle management is critical. The school organisational structure should be as flat as possible to devolve knowledge, power and decision making of teachers closer to students. A flat organisational structure draws upon the core competence of each teacher to enable knowledge transfer.

7.5.2 Building KM Vision

School leaders must have a personal vision regarding how KM practices can sustain school development before working with teachers to develop a shared vision for the entire school (Owens 2004). The essence of building a KM vision among teachers is to create an ongoing process that aims to inculcate a sense of commitment in the whole school, and a desire to apply KM. The KM vision must not be created solely by school leaders or imposed on teachers in a top-down manner. Rather, the vision must be created by means of a comprehensive interaction among the teachers in the school and through challenging and ongoing dialogue. The teachers as frontline knowledge workers should also be informed of KM practices and how KM can be of benefit to their teaching and improve student learning. For effective KM implementation in the school, it is vital to make sure that each teacher "shares a common understanding of KM's basic concepts" (Tryon 2012, p. 77). This can be done by documenting the reasons why the school is pursuing a KM implementation and helping teachers understand the difference between, and significance of both, explicit and tacit knowledge. A successful KM implementation may require significant behavioural change. Resistance to "sharing individual knowledge or reusing existing knowledge" is one of the most critical concerns accompanying KM implementation (Tryon 2012, p. 77).

7.5.3 Knowledge-Sharing Culture

School culture is important in shaping the way in which and the extent to which a school is able to utilise knowledge and deliver innovation with regard to teaching and learning (see Sect. 3.1). The practices of Senge's (1990) five disciplines of organisational learning and Kotter's model for cultural change may help school leaders to cultivate a collective learning culture. School leaders should promote

trust in their schools by first fostering trust between themselves and their teachers. A culture of trust and a platform for knowledge sharing must be cultivated and built. Effective knowledge sharing requires mutual trust among people (Politis 2003; Panteli and Sockalingam 2005). Teachers require the existence of trust in order to respond openly and share their knowledge (Gruenfeld et al. 1996). When there is a higher level of trust, people are more likely to share knowledge (Zand 1972; Andrews and Delahay 2000) and more willing to absorb knowledge (Mayer et al. 1995).

7.5.4 A Normative Model for Guiding KM Strategies

A normative model is necessary to guide the implementation of a sustainable strategy for KM. School leaders are called to answer two fundamental questions on what to manage and how to manage before KM implementation. The first question is what domains of knowledge will be required to support the school development. The second question is how to manage such domains of knowledge so that school leaders and teachers know how to support the school development. Knowledge management is part of the process of the strategic management that makes use of knowledge as a resource to facilitate organisational development. The knowledge to be leveraged and the KM strategies to be formulated should be aligned with the aims of the development plans.

To answer the first question, school leaders should identify the knowledge domains that are critical to the school development plans. For example, if the school planned on developing students' self-regulated abilities and/or enhancing student achievement by conducting assessment for learning, how to develop a self-regulated learner (see Sect. 1.2.2) and how to conduct data analysis (see Chap. 6) would be the domains of knowledge to be managed. A knowledge audit to identify the knowledge of metacognitive teaching and data mining in their schools would help school leaders to decide the details of the KM implementation plan such as KM strategies and tools adopted and the evaluation methods to bridge the knowledge gaps. They should create and maintain a strategic link between the aims of the school plan and domain of knowledge to be managed.

The development of KM implementation strategies to promote innovation and create knowledge is critical. The choice of knowledge strategy (see Sect. 2.6) depends on the specific organisational context (Blackler 1995). In schools, knowledge is usually shared through person-to-person contact based on dialogue through social networks, including occupational groups and teams, and less on the use of information technology. Teacher communication and knowledge sharing are usually carried out person-to-person rather than by codifying the teaching knowledge into documents and sharing them with colleagues through the school intranet. However, teachers do not consider that they can create subject knowledge or pedagogical content knowledge through these interpersonal knowledge-sharing strategies. The process for creation of pedagogical content knowledge at the individual

teacher level not only requires the teachers to retrieve and share knowledge, but also to internalise the knowledge through teaching practice and action learning (Kolb 1984). Similarly, knowledge creation at the organisational level requires the implementation of the knowledge strategies through organisational action learning (Argyris 1993). If schools adopt interpersonal knowledge-sharing strategies, but the teachers have no platforms or resources to conduct action research individually and collaboratively for knowledge internalisation at personal and organisational levels, pedagogical content knowledge cannot be created. Therefore, school leaders should balance the codification strategies and personalisation strategies. This leads to the second question of *how* to manage the knowledge.

In answer to the second question, and to balance the codification strategies and personalisation strategies, school leaders may refer to knowledge conversion activities suggested by Nonaka and Takeuchi's SECI model (see Sect. 2.4). The model indicated four modes of activities that intertwine and transform knowledge: socialisation, externalisation, combination and internalisation. Wu et al. (2013) have conducted a case study of the SECI model on the knowledge transfer and creation process of an educational organisation. They find that knowledge flow can be obtained through the members' mutual interaction and sharing. Further, educational training, conference and workshop systems, and formal or informal social interactions can have a positive influence on knowledge transfer between tutors. The SECI model provides a range of knowledge activities to school leaders for managing knowledge transfer in schools.

Socialisation is the process of transforming individual tacit knowledge into group tacit knowledge. This process represents informal learning that takes place beyond the activities planned, for example teachers' exchange of observations and reflections on the teaching process, exchange of experience and informal experience sharing, and the open-house activities of schools. Therefore, to encourage teachers to share their knowledge and experiences in teaching is the critical success factor for designing socialisation activities. The activities involved in the socialisation process include formal training activities emphasising interactive learning among teachers such as regular study, learning activities, conferences and workshops.

Externalisation is the process of codification of conceptualised or tacit knowledge to explicit knowledge. The activities of knowledge externalisation include presenting the learning experience in a meeting and writing a teaching guide or reports. It is only when the knowledge has been shared and analysed by teachers that such organised highly repetitive knowledge can then be transformed into written materials. School leaders should create a knowledge retention policy to store the extracted explicated knowledge.

Combination is a process to systemise and integrate developed conceptions into the school knowledge system. This process aims to capitalise on the existing knowledge resource for enriching the knowledge of the school KM system. The knowledge activities involved in the combination process include seminars, workshops, secondments and collaborative working on special problem-solving tasks. Through activities for the process of knowledge combination, explicit knowledge

is codified to handbooks or instructional manuals. These documents and manuals are then distributed to all the teachers as the guidelines for the development or modification of teaching materials.

Internalisation is the process of transforming explicit knowledge or concepts into substantial personal experience and practices. This can be a process for teacher learning which takes place in their professional practices and creates tacit knowledge through learning by doing. In this process, teachers have an in-depth learning and understanding of external explicit knowledge and, with the integration of their personal practice experience, they will internalise the knowledge they have learned into the individual mind (Wu et al. 2013).

School leaders should evaluate and measure the impact of the above KM activities for ensuring the alignment of KM implementation with the school development plan and the knowledge transfers for bridging existing knowledge gaps for school development. This evaluation would be continuous and supplement the after-action review to capture the knowledge to improve the above activities (see Sect. 4.7). The successful criteria and approach for collecting data and information to evaluate the effectiveness of the KM should be determined before the KM implementation.

7.6 Summary

The many changes in education and the rapid expansion of knowledge have dramatically influenced how schools perform and the flexibility of teaching. In order to bridge the existing knowledge gaps of nurturing self-regulated learners and conducting effective self-evaluation for sustainable development, schools can strengthen their strategic planning capacity by institutionalising a normative knowledge management model. This can be done through utilising information and knowledge to support the continuing development of professional practice within a global learning environment. School leaders should play their knowledge leadership roles to nurture an organisational learning culture by cultivating different CoPs to support school management, teaching and learning, and school guidance activities. They should institutionalise a KM system and provide learning opportunities for teachers to develop their PKM competencies. They should formulate KM strategies that align with the school strategic plan. The normative KM model emphasises the mapping of knowledge domains with the aims of the school plan and the alignment of KM strategies and the school development strategies. This normative KM model needs to be put into practice to bridge the knowledge gaps and to address problems occurring in school development. The model provides a tangible starting point for a KM initiative and implementation.

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