# Introduction to Research Methods

(Preparatory module for Addis Ababa University graduate programs)

compiled by

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# Preface

From the dawn of human history, people have been engaged in exploring their surrounding; and in more recent history this exploration has extended to the cosmos. It is an innate human nature to be curious, to want to know or learn something new. When something catches the eyes of a young child, he or she examines the thing, studies it, observes it, and touches it so as to learn about the phenomenon. From passive observations and active interactions a child gradually learns about his/her world. In other words, the child is applying some kind of procedure or approach in his/her day-to-day living to discover new knowledge about the world and express the knowledge gained. The methods or approaches used, however, are not systematic or structured.

As adults, when you experience something new, you go beyond your five senses and raise different questions about the phenomenon you encountered. And then you start to explore about it so as to get convincing answers to your questions. You use various ways of learning about the new phenomenon. The way of knowing about the phenomenon may not be the same for all people. And the answers you may get about the questions you raised are not absolute, since there is no absolute truth.

As prospective graduate students, you are now embarking on a scientific journey. By the time you finish your post-graduate training you would have acquired sufficient know-how, and critical and analytical thinking to be able to frame your questions in a scientific context, as well as devise ways to systematically obtain answers to your questions. In short, you will conduct scientific research.

As a scientist you will be expected to adapt to standards and norms about what constitutes research, how research is conduct, and how research output is communicated. The main thrust of this preparatory module is to lay the foundation for the more rigorous training and research you will encounter upon joining your postgraduate program.

The wealth of scientific information that is now available to you is the cumulative effort of many that preceded you in your area of study. The entire scientific endeavor is based on implicit trust. You are the beneficiaries of many years of scientific output that was done rigorously and honestly. Can you imagine what could happen if everyone “cooked” their data to fit their hypothesis? That is why this preparatory module also covers the ethics of scientific inquiry and reporting.

From where you stand now, you may perceive research as some lofty enterprise that only a gray bearded, bespectacled know-it-all can dare undertake. By the end of this preparatory module, it is hoped that scientific research is de-mystified and made accessible. Moreover, we hope that the entire exercise will sharpen your understanding of scientific research methods, and sufficiently increase your confidence to explore new frontiers of science.

# Note to the Student

As an incoming graduate student, there is an expectation on the part of the Addis Ababa University's Office of Graduate Studies and Research that you, as a prospective graduate student, have all the necessary educational background that prepared you for graduate studies. However, this may not always be the case. Therefore, the Office of Graduate Studies and Research deems it necessary to provide certain intensive preparatory trainings to ensure that all incoming graduate students have strong English language skills, an understanding of basic research methods and a solid grasp of basic computational and quantitative skills.

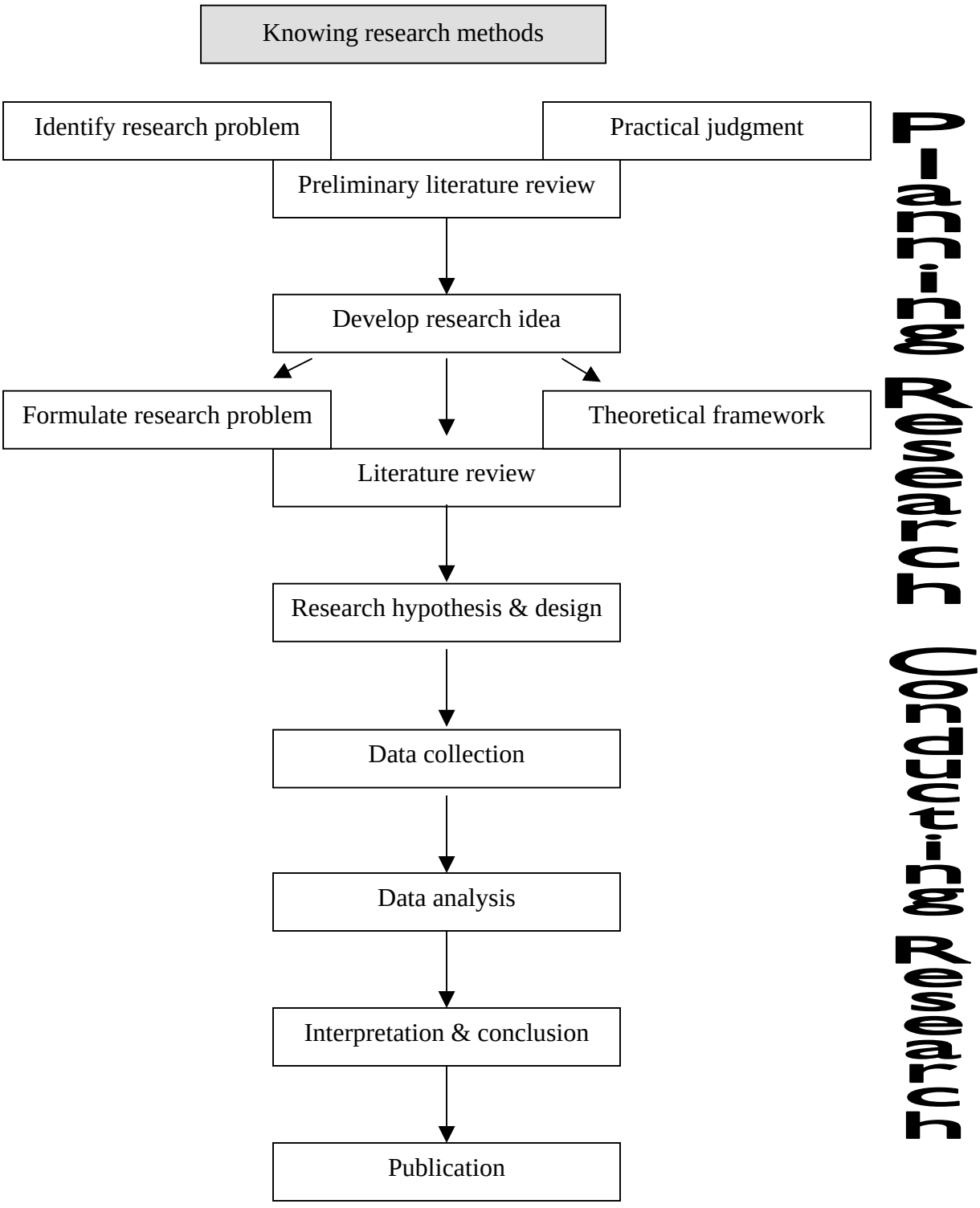
This 'Research Methods' module is one component of the intensive preparatory training sanctioned by the AAU. The module is designing with the aim of imparting the basic concepts, principles and processes of research methods. The compilers of this introductory 'Research Methods' module are aware that the entire content may not be fully suited to all fields of specialization nor to the educational background of all students. However, the compilers have made an effort to make this module generic enough that all prospective graduate students will take away some concepts that will be useful to them.

The module is organized in three broad categories: *viz*, knowing what research is, planning research and conducting research. The six units are sequenced in a way that closely follows the process from inception to conclusion of a research project as depicted in the flow chart below. A more in-depth coverage of the data analysis component will be dealt with in the 'Quantitative and Computational' sister module. The interpretation and conclusion, obviously, will be up to you to derive from the results of your data analysis.

This module will also present you with an opportunity to familiarize yourself with the intensive modular approach now being implemented by the Office of Graduate Studies and Research of the AAU. The instructors' role in the delivery of the module content is limited to imparting basic ideas and concepts, answering or clarifying questions, and facilitating discussion forums. A substantial portion of the course delivery depends on your self-learning. To gain maximum benefit from this module you must:

- read ahead
- attend all lectures
- actively participate in the classroom
- do all exercises and assignments
- actively interact in discussion forums
- start writing the mini-proposal early
- revise and study for the final assessment exam

**A simple schematic representation of the research process**



# Table of Content

UNIT

• 1 •

# The Concept of Research

## Key Concepts

| | |
|---|---|
| **Common sense** | **Science** |
| **Deductive reasoning** | **Epistemology** |
| **Inquiry** | **Empirical** |

## Objectives

After completing this unit you should be able to:

- Distinguish the difference between the two sources or approaches to knowledge (commonsense vs. science/ everyday observations vs. planned observations);
- Distinguish between science and commonsense;
- Differentiate between the various ways of knowing;
- Give example of each way of knowing;
- Define the concept of research;
- Explain the purpose of research;
- Describe the difference between research methodologies and research methods;
- Explain the assumptions that underlie research methodologies;
- Describe the epistemological issues that underlie scientific inquiry; and
- Discuss the philosophy of research.

## Mode of Delivery and Assessment

Brainstorming session, group discussions, and lecture will be the major modes of delivery. Students will be assessed for this unit through group assignments and individual tests.

## Lesson 1: Sources of Knowledge

This lesson deals with the two major approaches of knowing the world: everyday experience and science. It answers questions like what is the difference between common sense knowledge and science? Are they alike? What are the various forms of knowing?

### 1.1 Everyday Experience as Sources of Knowledge

"Why is the grass green and the sky blue?"

As we live in this world and interact with our surrounding we may be confronted with new ideas that may have important impact on our lives. We get access to this new information through our senses --- the most immediate way of knowing something. This is what we call sensory knowledge. Reflecting on your own experiences, do you think your senses provide a perfect means of observation?

- *Are eye witnesses to a crime as reliable as some people think?*
- *Are the stars in the night sky actually twinkling?*
- *Does the sun really move across the sky?*

We may also use the opinion of others as sources of knowledge. We might have experienced a stimulus with our senses but we want to check on the accuracy and authenticity of these sensations. We often ask:

- *Does this food taste delicious to you?*
- *Did you hear someone cry for help?*

Being open minded is not about accepting new ideas that fit neatly into our existing knowledge. It is the willingness and readiness to question our most ardent beliefs in the face of new evidence.

### *Exercise*

*Do you rely only on your senses and trust the data you collected, because it has been said, "seeing is believing"? How reliable are your senses?*

*Do you think that a majority opinion defines what is true?*

There are also other ways of knowing from our everyday experiences. These are presented below.

1.1.1 The Method of Tenacity

The term tenacity refers to the acceptance of a belief based on the idea that "***we have always known it to be this way"***. In other words, it represents the automatic acceptance of the prevailing

traditional beliefs and customs in which we have been socialized. We accept those beliefs and customs as true without exploring them and then behave with it. Even when we come across evidences that contradict our beliefs, we still tend to cling to our traditional belief.

As a way of learning about the surrounding world the method of tenacity has two problems:

1. The information may gain wide acceptance through its familiarity alone.
2. Tenacity offers no means for correcting erroneous ideas.

Your point of view is correct, as long as it agrees with that of your boss.

### *Exercise*

*Is darker colored injera more nutritious?*

*Give two examples of the general beliefs that you have accepted without evaluating them. For instance, in some cultures Female Genital Cutting (FGC) is an accepted practice.*

1.1.2 The Method of Authority

If we enter into a new culture, we may experience so many things for which we are not familiar. If we are naïve to most of the practices what we do, is we ask someone in that culture who is supposed to have the knowledge – an authority figure. We are likely to ask others whom we think have a wealth of experience and knowledge about the cultural practices of the community. We may, then, accept a new idea or information stated by this authority figure.

In many cases, referring to an authority, especially in areas about which we know nothing, is useful and beneficial. We often rely on the judgment and expertise when we consult, for example, electrician, civil engineer or chemist.

Experts, like all of us, can be mistaken

Remember that authority can be incorrect and at times can lead people in the wrong directions. Hence, it is important to examine the basis of the authority's claims. We have to raise questions like, are these claims based on opinion, tradition, or direct experience? How valid are the sources of this information?

### *Exercise*

*In our day-to-day living we accept what we have been told by an authority figure, for example, a physician may tell us that smoking affects our health. Can you list examples that can be explained in terms of the method of authority?*

*Is everything published in a newspaper or book always true and accurate?*

*Is there a problem if we unquestioningly accept the knowledge and expertise of others?*

A priori propositions "agree with reason" and not necessarily with experience.

### 1.1.3 The *a Priori* Method

The idea that underlies the *a priori* method is that first we develop general knowledge, opinion, or belief about the world through the aforementioned methods or personal observation of things around us and then we draw new and specific conclusion from this general knowledge. As a result it is also known as a **deductive reasoning**. Our intellect allows us to use sensory data to develop a new kind of knowledge.

If we take the FGC example once again, a person living in a culture where the practice of female genital cutting is common and well accepted may draw specific knowledge that the practice is against the rights of females because it is the removal of a body part without asking the consent of the victims.

Reason and logic are the basic tools of an *a prior* method and often take the form of a logical syllogism such as ***All men are tall; Alemu is a man; therefore, Alemu is tall***. Hence, logical conclusions may not necessarily lead to correct conclusions.

We all use reason everyday as we try to solve problems and understand relationships. As useful as it is to be reasonable, however, reason alone will not always produce the appropriate knowledge.

The most uncommon thing in the world is common sense.

### *Exercise*

*Is there an a priori method without problems?*

*Draw your own syllogistic conclusion: Ethiopia has the best long-distance runners in the world. Mossisa is an Ethiopian, therefore … Does this conclusion always hold true?*

### 1.1.4 Common Sense

This method of knowing offers an improvement over acceptance based on tenacity, authority, or reason because it appeals to direct experience. Common sense is based on our own past experiences

and our perceptions of the world. It originates from our day-to-day practical experiences and in turn guides our daily interaction with our surrounding.

Theory is the ultimate aim of science.

Note that our experiences and perceptions of the world may be quite limited. The concepts that we have about the world may be seriously misleading. Although common sense may help us deal with the routine aspects of daily life, it may also form a wall and prevent us from understanding new ideas.

### *Exercise*

*Since common sense is related to our practical experience, can you say that this method of knowing is devoid of shortcomings?*

*What is the difference between common sense and science?*

*Where would it be more appropriate to apply common sense: knowing what will happen to the price of teff when the rainy season fails, or knowing how bacteria will respond to a new type of drug?*

Science only deals with testable ideas.

## 1.2 The Scientific Method as a Source of Knowledge

Science is a body of systematized knowledge. In scientific method ideas are evaluated and corrected through dispassionately observing by means of our bodily senses or measuring devices - in this case science can be seen as a systematic and controlled extension of common sense - and using reason to compare various theoretical conceptualization based on experience – which represents a direct application of the principles of logic. This blend of direct sensory experience (or measurement) and reason gives science a self-corrective nature.

One of the characteristics of science is a reliance on information that is verifiable through experience. That is, it must be possible for different people in different places and at different times using the same method to obtain comparable results.

Science and common sense differ in terms of:

- the use of conceptual schemes and theoretical structures
- the notion of control
- the explanations of different observed phenomena

The difference between common sense and science revolves around the concepts **systematic** and **controlled**. Scientists systematically build theoretical structure, test them for internal consistency, and

subject aspects of them to empirical test.

The scientific method of knowing is the scientific research, and its goal is the discovery of regularities of nature and their representation in theories from which predictions can be made.

The steps in the scientific method guide researchers in planning, conducting, and interpreting research studies. Scientific research follows logical steps, which include:

- defining the problem
- making tentative explanations
- gathering information
- testing the validity of the hypothesis
- making conclusions as to whether the hypothesis can be accepted or rejected

Scientific methods:

- find general rules,
- collect objective evidences,
- make testable statements,
- adopt a skeptical attitude about all claims,
- are creative,
- are public, and
- are productive.

It should be noted that, apart from its importance in knowing the world, the scientific method of knowing has some limitations.

- The scientific method cannot answer all questions
- Application of the scientific method can never capture the full richness of the individual and the environment
- The measurement devices always have some degree of error.

Research is an attempt to search for truth.

### *Exercise*

*What is the difference between common sense and science?*
*What are the steps that people should follow in scientific methods of knowing?*
*What are the strengths of scientific method?*
*What are the limitations of scientific method of knowing?*
*Can you subject a faith-based knowledge to a scientific method?*

*"I soon learned that it did not require a great brain to do original research. One must be highly motivated, exercise good judgment, have intelligence, imagination, determination, and a little luck. One of the most important qualities in doing research, I found, was to ask the right questions at the right time".*

*Julius Axelrod*

# Lesson 2: Definition and Purposes of Research

In this lesson the concept of research is defined and the purposes, approaches and goals of research are described. Distinction has also been made between terms like methods and methodologies.

## 2.1 Scientific Research Defined

People have long strived to come to grips with their environment and to understand the nature of the phenomena it presents to their senses. One of the means by which they set out to achieve these ends is research. Research is an often-misused term; its usage in everyday language is very different from the strict scientific meaning. In the field of science, it is important to move away from the looser meaning and use it only in its proper context. Scientific research adheres to a set of strict protocols and long established structures.

Research is defined as human activity based on intellectual application in the investigation of matter. In other words, research is the systematic process of collecting and analyzing information to increase our understanding of the phenomenon under study. It is the function of the researcher to contribute to the understanding of the phenomenon and to communicate that understanding to others. It may be said that the general aims of research are to observe and describe, to predict, to determine causes and explain.

## 2.2 Scientific Research Explained

The strict definition of scientific research is performing a methodical study in order to prove a hypothesis or answer a specific question. Finding a definitive answer is the central goal of any experimental process.

Research must be systematic and follow a series of steps and a rigid standard protocol. These rules are broadly similar but may vary slightly between the different fields of science. Scientific research must be organized and undergo planning, including performing literature reviews of past research and evaluating what questions need to be answered.

Any type of 'real' research requires some kind of interpretation and an opinion from the researcher. This opinion is the underlying principle, or question, that establishes the nature and type of experiment.

The scientific definition of research generally states that a variable must be manipulated; although case studies are purely observational science and do not always comply with this norm.

For a successful career in science, you must understand the methodology behind any research and be aware of the correct protocols. Science has developed these guidelines over many years as the benchmark for measuring the validity of the results obtained. Failure to follow the guidelines will prevent your findings from being accepted and taken seriously. These protocols can vary slightly between scientific disciplines, but all follow the same basic structure.

For any study, there must be a clear procedure so that the experiment can be replicated and the results verified. Again, there is a bit of a gray area for observation-based research, as is found in anthropology, behavioral biology and social science, but they still fit most of the other criteria.

Most scientific research looks at an area and breaks it down into easily testable pieces, *i.e*. breaking down a large and seemingly insurmountable problem into manageable chunks. The incremental experimentation of the individual pieces will allow the larger questions to be approached and answered.

In conclusion all scientific research has a goal and ultimate aim, repeated and refined experimentation gradually reaching an answer. These results are a way of gradually uncovering truths and finding out about the processes that drive the universe around us. Only by having a rigid structure to experimentation, can results be verified as acceptable contributions to science. Some other areas, such as history and economics, also perform true research, but tend to have their own structures in place for generating solid results. They also contribute to human knowledge but with different processes and systems.

As explained above, scientific research is a systematic attempt to obtain answers to meaningful questions about phenomena or events through the application of scientific procedures. It is impartial, objective, empirical and logical analysis and recording of controlled observations that may lead to the development of generalizations, principles or theories, resulting into some extent in prediction and control of events that may be causes or consequences of specific phenomena. The analysis of the above given definition of research will identify the salient features that distinguish it from casual observations. Research is:

- **Systematic** - so ordered, planned and disciplined;

- **Controlled** - the researcher can have confidence in his/her research outcomes;
- **Empirical** - putting beliefs, ideas, or assumptions to a test; and
- **Critical** - many truths are tentative and are subject to change as a result of subsequent research.

### *Exercise*

*What do the terms systematic and controlled represent in scientific research?*

## 2.3 Characteristics of Scientific Research

As mentioned above research has been considered as an impartial, objective, empirical and logical analysis and recording of controlled observations that may lead to the development of generalizations, principles or theories, resulting, to some extent, in prediction and control of events that may be causes or consequences of specific phenomena. We can summarize the main characteristics of research as follows. Research:

- is directed toward the solution of a problem;
- is based upon observable experience or empirical evidence;
- demands accurate observation and description;
- involves gathering new data from primary or first-hand sources or using existing data for a new purpose;
- is characterized by carefully designed procedures, always applying rigorous analysis. However, it is sometimes somewhat random and unsystematic;
- requires expertise;
- is characterized by patient and unhurried activity;
- is carefully recorded and reported;
- sometimes requires courage;
- emphasizes the development of generalizations, principles, or theories that will be helpful in predicting future occurrences; and
- strives to be objective and logical, applying every possible test to validate the procedures employed, the data collected, and the conclusion reached.

## 2.4 Goals of Scientific Research

The purpose of scientific research is problem solving. The problem could be of an immediate and practical value or they could be of theoretical nature. That is, research focuses on answering various

questions and acquiring new knowledge. It is the primary tool used in virtually all areas of science to expand the frontiers of knowledge. In addition, by conducting research, researchers attempt to reduce the complexity of problems, discover the relationship between seemingly unrelated events, and ultimately improve the way we live.

On the whole, across all types of science, research is frequently used for describing a thing or event, discovering the relationship between phenomena, or making predictions about future events. In short, research can be used for the purposes of description, explanation, prediction, and control all of which make important and valuable contributions in solving practical problems and also in the expansion of what we know and discovery of new knowledge.

Seeking solutions to practical or theoretical problems involves doing the following important tasks.

- Describing phenomena
- Explaining phenomena
- Predicting phenomena
- Controlling phenomena
- Comparing phenomena

### 2.4.1 Description

Description represents efforts exerted to give pictorial account of the phenomenon being studied. It is actually the first step in research since it provides the basis for further exploration about the phenomenon under consideration.

**E.g.** If a researcher collects data about women's participation in politics and reports their level of participation based on the data collected, then we can say that females' participation in politics has been described.

**E.g.** A researcher may also describe that water in the solid state is less dense than in its liquid state.

In description, the researcher attempts to find answers to the questions "what," "who," and "where?"

### 2.4.2 Explanation

In explanation, the researcher is interested in exploring the reasons or the causes of the occurrence of certain behavior or event. It involves understanding the cause – and – effect relationship between phenomena. Attempts have been made to answer the

question “why?”

**E.g.** Why do females fail to actively participate in politics? Here the researcher attempts to answer the causes of low level of participation females in politics. Is there causal link between gender and level of participation in politics?

**E.g.** Why does ice have lower density than water?

Having found possible causes for a particular happening or state of affairs, the researcher has to build generalizations that will explain a wider body of knowledge in the area.

2.4.3 Prediction

In research, generalization is made not only to explain the past but also to predict what will happen in the future. A widely based conceptual framework or theory will be used to make prediction about the variable of interest.

**E.g.**, Females’ empowerment improves their level of participation in politics.

2.4.4 Control

Researchers are also interested in influencing or changing a particular event or condition for different purposes. Therefore, the description, explanation, and or prediction of events which result from any research undertaking are not casual or without aim. It is to explore and allow possibilities of control – to intervene and subsequently observe an expected result.

Epistemology is how we come to know.

**E.g.**, If educational level and male dominance are identified as the causes of low participation of females in politics and if the researcher predicted that an intervention program that raises females’ educational level and changes males’ attitude increases females’ level of participation in politics, the researcher will introduce the intervention package to bring about the desired change.

2.4.5 Comparison

The researcher may also be interested in comparing two or more groups on a certain behavior. The purpose here is to explore whether two or more groups are similar or different with respect to the occurrence of certain event. Comparison may take different forms. Instead of comparing groups on one behavior, the researcher

may instead compare different behaviors in one group simply to determine which behavior is more likely to occur in this same group of individuals.

**E.g.**, Is there gender difference in terms of level of participation in politics?

### 2.6 The Difference between Research Method and Research Methodology

Although the terms methods and methodologies are often used synonymously, it is helpful for you to understand that the terms convey/carry different meanings.

A method is a particular research technique or way to gather evidence about a phenomenon. Therefore, methods are the specific research tools we use in research projects to gain fuller understanding of phenomena. That is, the range of approaches used in research to gather data which are to be used as a basis for inference and interpretation, for explanation and prediction.

**E.g.**, surveys, interviews, participant observations

Methodology describes "the theory of how inquiry should proceed" that "involves analysis of the principles and procedures in a particular field of inquiry." It involves the researchers' assumptions about the nature of reality and the nature of knowing and knowledge. In other words, methodology represents "a theory and analysis of how research does or should proceed." Methodology encompasses our entire approach to research. Our assumptions about what we believe knowledge is are embedded in methodological discussions and therefore have consequences for how we design and implement research studies.

Epistemology is how we come to know.

## Lesson 3: Philosophy of Research

All research is based on assumptions about how the world is perceived and how we can best come to understand it. Of course, nobody really knows how we can best understand the world, and philosophers have been arguing about that very question for long. In this lesson attempt has been exerted to look at how most researchers approach the question of how we know about the world around us. Thus, you will learn the major philosophical schools of thought.

## 3.1 Epistemological Issues in Research

Epistemology is a branch of philosophy that studies the nature of knowledge and the process by which knowledge is acquired and validated. Some epistemologists have a particular interest in the nature of inquiry and knowledge in the natural sciences and others in social sciences. These philosophers tried to seek answers to questions as:

- Are the objects that the researchers study real?
- How is research knowledge different from other forms of knowledge, and does it have any special authority?
- What is a theory, and how can it be validated?
- What does it mean to find "laws" that enable us to predict individual and group behavior?
- Is inquiry in the social sciences fundamentally different from inquiry in the natural sciences?

As philosophers have investigated that nature of scientific inquiry over a period of many centuries, they have different schools of thought. There are different schools of thought that describe the nature of reality but we will focus on the major ones.

As described earlier, epistemology is a philosophy of knowledge and methodology is also concerned with how we come to know, but is much more practical in nature. Epistemology and methodology are intimately related: the former involves the ***philosophy*** of how we come to know the world and the latter involves the ***practice***.

### *Exercise*

*What is epistemology?*
*Is there difference between epistemology as a philosophy of knowledge and methodology?*

## 3.2 Positivism and Post-Positivism

When people are asked about science, they think individuals who work with facts in the laboratory. A scientist is someone who is brilliant who thinks, spins complex theories, and spends his/her time in ivory towers aloof from the world and its problems. Such kinds of stereotypes about science come from a period where science was dominated by a particular philosophy - **positivism**.

**Positivism** is a position that holds that the goal of knowledge is simply to describe the phenomena that we experience. Positivists believe that the purpose of science is simply to stick to what we can observe and measure. Knowledge of anything beyond that is

impossible. According to this philosophical thought the key approach of the scientific method is the experiment, the attempt to discern natural laws through direct manipulation and observation. The following are three tenets of positivism:

- Scientific attention should be restricted to observable facts; ‘‘inferred constructs,’’ such as beliefs or motives, have no place in science,
- The methods of the physical sciences (e.g., quantification, separation into independent and dependent variables, and formulation of general laws) should also be applied to the social sciences, and
- Science is objective and value free.

On the other hand, **post-positivism** rejects the central tenets of positivism. A post-positivist might begin by recognizing that the way scientists think and work and the way we think in our everyday life are not distinctly different. Scientific reasoning and common sense reasoning are essentially the same process. The difference between the two is not in kind but it is in terms of degree – as has been mentioned earlier science is the extension of commonsense knowledge.

Most post-positivists are **constructivists** who believe that we each construct our view of the world based on our perceptions of it. Because perception and observation is fallible, our constructions must be imperfect. It is difficult to believe that individual scientists would perfectly see the reality as it is. Scientists, like any other human being, are inherently biased by their cultural experiences, worldviews, and so on. We are all biased and all of our observations are affected (theory- laden). So what is objectivity?

Positivists and post-positivists differ in the way they look at objectivity. Positivists believed that objectivity is a characteristic that resided in the individual scientist. Scientists are responsible for putting aside their biases and beliefs and seeing the world as it 'really' is. Post-positivists reject the idea that any individual can see the world perfectly as it really is. Our best hope for achieving objectivity is to triangulate across multiple fallible perspectives. Thus, objectivity is not the characteristic of an individual; it is inherently a social phenomenon.

Although positivism conceived a social and cultural life as objective, quantitative, or empirical, and governed by “laws,” it was increasingly argued that social life was in many ways subjective and socially constituted. It has been argued by post-positivism that positivistic science was inappropriately applied to social and cultural life. This

required a research methodology that could capture the actual nature of social and cultural life.

### *Exercise*

*What is the main theme of positivism?*
*In your opinion, which tenet best describes modern scientific research?*

## Unit Summary

- *There are two broad sources of knowledge: Everyday experience as a source of knowledge and scientific method as a source of knowledge.*
- *Everyday sources of knowledge include the method of tenacity, authority, a priori method and common sense.*
- *The scientific method as a source of knowledge represents scientific research.*
- *The goal of research is problem solving. The problem could be of an immediate and practical value or they could be of theoretical nature.*
- *The specific purposes of scientific research include description, explanation, prediction, control and comparison.*
- *Scientific research relies on the application of the scientific method, a harnessing of curiosity.*
- *Research provides scientific information and theories for the explanation of the nature and the properties of the world around us.*
- *Research is systematic, controlled, empirical and critical investigation of natural, behavioral and social phenomena.*
- *There is difference between research method and research methodology the former represents a particular research technique used to gather data about the phenomenon being studied and the later describes the theory of how inquiry should proceed.*
- *Scientific research has epistemological and philosophical roots.*
- *Positivism and post-positivism are the two philosophical perspectives discussed in this unit.*

Research is the systematic process of collecting and analyzing information to increase our understanding of the phenomenon under study.

## Assignment

1. List the everyday sources of knowledge and give examples for each of these sources of knowledge.

_____

2. What are the limitations of using everyday experience as sources of knowledge?

_____
_____

3. How do lay people and scientists differ in the way they use theories?

_____
_____

4. Some researchers argue that positivism is less successful in its application to the study of human behavior? Why?

_____
_____

5. Why is the scientific method superior to any other sources of knowledge?

_____
_____

6. Research methods can be considered as simply technical exercises. Argue against or for by citing evidences..

_____
_____

7. Describe the limitations of scientific method by giving at least one example.

_____
_____

8. What is objectivity for positivism and post-positivism?

_____
_____

## References


1. Belay Tefera (2007). Research Methods in Behavioral Sciences: Modular Text for Psychology Students.

2. de Marrais, K & Lapan, S.D. (eds.) (2004). *Foundations for Research: Methods of Inquiry in Education & the Social Sciences.* Mahwah: Lawrence Erlbaum Associates.
3. Gay, L.R.; Mills, G.E.; & Airasian, P. (2009). *Educational Research: Competencies for Analysis and Applications* (9th ed.). New Jersey: Pearson.
4. Marczyk, G.; DeMatteo, D.; and Festinger, D. (2005). *Essentials of Research Design and Methodology*. New Jersey: John Wiley & Sons, Inc.
5. Mitchell, M.L. & Jolley, J.M. (2004). *Research Design* (5th ed.). Wadsworth: Thomson.
6. Ray, W. J. (2003). *Methods Toward a Science of Behavior and Experience* (7th ed.). Wadsworth: Thomson.

UNIT

• 2 •

# Types of Research

**Key Concepts**

| | |
|---|---|
| **Curiosity/motivation** | **Exploration** |
| **Descriptive** | **Qualitative** |
| **Explanatory** | **Quantitative** |

**Objectives**

After completing this unit you will be able to:

- Classify research into different types based on different criteria;
- Describe the difference between basic research and applied research;
- Identify the link between basic and applied research;
- Identify the situations where basic or applied research can be conducted
- List the aims of basic and applied research;
- Discriminate among descriptive, explanatory and exploratory research;
- Identify the different types of descriptive and explanatory research;
- Discuss when to use descriptive or explanatory or exploratory research;
- Explain the uses of each of the three types of research;
- Define qualitative and quantitative research; and
- Distinguish between qualitative and quantitative research.

## Mode of Delivery and Assessment

Group discussions to debate types of research, and lecture will be the major modes of delivery. Students will be assessed for this unit through written test and group assignment based on group discussion.

## Lesson 1: Classification of Research

In this lesson an attempt has been to introduce the classification of research. There are different ways of classifying research. It is really difficult to propose a single classification method that fits different disciplines and is acceptable by all. For example, some classify research as theoretical and applied research, descriptive and explanatory research, quantitative and qualitative research, conceptual and empirical research, and other types of research. Others classify research in a different way. It should also be noted that there is no clear dividing line between one method and the other. There are always overlaps in a sense that one method some how includes the other. Some researchers rather prefer to treat each type of research separately instead of looking at a method as a subset of a broad category.

In this module we use the following ways of classifying research only for the purpose of illustrating how research is classified. Research can be classified in terms of:

- goal of research,
- specific objectives of research,
- approaches of research,
- designs,
- the type of data used in research, and
- fields of study.

### 1.1 Classification of Research based on the Goal of Research

As you will recall, it has been mentioned in Unit One that the goal of research is problem solving. The nature of the problem that the research attempts to solve could be theoretical or practical – building a theory or solving immediate practical problems. These two types of problems that the research tries to solve leads to two broad classifications of research:

- basic research, and
- applied research.

### 1.2 Classification of Research based on the Specific Objectives of Research

From your knowledge of Unit One, research also addresses specific purposes. Your interest could be describing a phenomenon of

interest or explaining causal link between two variables. Or you may be interested in comparing two or more groups on the basis of a particular phenomenon. Research, therefore, can be classified differently when the issues at hand are specific objectives of research. Hence, according to the specific objectives research can be classified as:

- descriptive,
- explanatory, or
- exploratory research.

### 1.3 Classification of Research based on Approaches of Research

Research can be classified as qualitative research and quantitative research when the issue at hand is the approaches to be employed in conducting research. As mentioned above, this structure is mainly for educational purpose. Otherwise, some even argue that these approaches lie on a continuum ranging from unstructured qualitative approach to a structured quantitative approach.

### 1.4 Classification of Research based on Designs

Another way of classifying research is by design. Once the researcher has determined the specific question to be answered and has operationalized the variables and research question into a clear, measurable hypothesis, the next task is to consider a suitable research design. Although there are endless ways of classifying research designs, they usually fall into one of three general categories:

- experimental,
- quasi-experimental, and
- non-experimental.

### 1.5 Classification or Research by Type of Data

Depending of the type of data generated and used research can be classified as Primary research (also called field research) and Secondary research (also known as desk research). Primary research involves the collection of data that does not already exist whereas secondary research involves the summary, collation and/or synthesis of existing data rather than generating primary data, where data are collected from, for example, research subjects or

experiments.

### 1.6 Classification of Research by Fields of Study

Research can also be classified based on fields of study. Therefore, there are:

- natural science research,
- social science research,
- educational research,
- behavioral science research,
- health science research, *etc*.

### *Exercise*

*What is the difference between natural science research and social science research?*
*Describe the difference between descriptive and explanatory research?*
*How do you choose a particular type of research?*

## Lesson 2: Basic and Applied Research

The purpose of research can be a complicated issue and varies across different scientific fields and disciplines. At the most basic level, science can be split, loosely, into two types, 'pure research' and 'applied research'.

Both of these types follow the same structures and protocols for propagating and testing hypotheses and predictions, but vary slightly in their ultimate purpose. An excellent example for illustrating the difference is by using pure and applied mathematics.

Pure mathematics is concerned with understanding underlying abstract principles and describing them with elegant theories. Applied mathematics, by contrast, uses these equations to explain real life phenomena, such as mechanics, ecology and gravity.

In this Lesson you will get the opportunity to understand the difference between basic and applied research and the situations under which basic and applied research can be conducted. And in this section, the nature of basic or pure research will be discussed. You will learn the features basic research. Moreover, the nature of applied or operational research will be discussed. You will learn the basic features applied research.

## 2.1 Pure/Basic Scientific Research

Some science, often referred to as 'pure science', is about explaining the world around us and trying to understand how the universe operates. It is about finding out what is already there without any greater purpose of research than the explanation itself. It is a direct descendent of philosophy, where philosophers and scientists try to understand the underlying principles of existence.

Basic research lays down the foundation for the applied research that follows

Basic research (also called **fundamental** or **pure research**) has as its primary objective the advancement of knowledge and the theoretical understanding of the relations among variables. It is basically concerned with the formulation of a theory or a contribution to the existing body of knowledge. That is, basic research is designed to add to an organized body of scientific knowledge and does not necessarily produce results of immediate practical value.

The major **aims** of basic research include:

- Obtaining and using empirical data to formulate, expand, or evaluate theory; and
- Discovery of knowledge solely for the sake of knowledge.

Hence, basic research may take any of the following forms:

- **Discovery**: where a totally new idea or explanation emerges from empirical research which may revolutionize thinking on that particular topic.
- **Invention** : where a new technique or method is created.
- **Reflection** : where an existing theory, technique or group of ideas is re-examined possibly in a different organizational or social context.

The driving force in basic research is a researcher's **curiosity** or **interest** in a scientific question. The motivation behind is to **expand human knowledge**, not to create or invent something that has practical significance.

Whilst offering no direct benefits, pure research often has indirect benefits, which can contribute greatly to the advancement of humanity. For example, pure research into the structure of the atom has led to x-rays, nuclear power and silicon chips.

In general, **basic research**:

- Represents a rigorous and structured type of analysis;
- Employs careful sampling procedures in order to extend the findings beyond the group or situation; and

- Has little concern for the application of the findings or social usefulness of the findings.

## 2.2 Applied Scientific Research

Basic research lays down the foundation for the applied research that follows

Applied research is designed to solve **practical problems** of the modern world, rather than to acquire knowledge for knowledge's sake. One might say that the goal of the applied scientist is to **improve the human condition.** It is undertaken to solve immediate practical problem and the goal of adding to the scientific knowledge is secondary. Some scientists feel that the time has come for a shift in emphasis away from purely basic research and toward applied science. This trend, they feel, is necessitated by the problems resulting from globalization, migration, overpopulation, pollution, and the overuse of the earth's natural resources.

Applied scientists might look for answers to specific questions that help humanity, for example medical research or environmental studies. Such research generally takes a specific question and tries to find a definitive and comprehensive answer.

The purpose of applied research is about testing theories, often generated by pure science, and applying them to real situations, addressing more than just abstract principles. Applied scientific research can be about finding out the answer to a specific problem, such as ‘Is global warming avoidable?’ or ‘Does a new type of medicine really help the patients?’

The primary purpose for applied research is discovering, interpreting, and the development of methods and systems for solving practical problems on a wide variety of real life situations of our world and the universe.

Applied research:

- Is conducted in relation to actual problems and under the conditions in which they are found in practice;
- Employs methodology that is not as rigorous as that of basic research;
- Yields findings that can be evaluated in terms of local applicability and not in terms of universal validity.

## 2.3 Distinction between Basic and Applied Research

Traditionally, basic and applied research were seen as activities of a different nature, carried out by different institutions and financed from

different sources. It is, however, difficult to draw a clear boundary between these two types of research. Researchers believe that basic and applied types of research should not be thought of as two mutually exclusive categories, into one or the other of which all instances of research can be placed unambiguously. Even thinking of basic and applied as representing ends of a continuum is an oversimplification because research often yields results that have both theoretical and practical implications.

It may be appropriate to view the distinction as better considered a matter of emphasis than as representing a true dichotomy. Some researchers prefer to focus on one type of research or the other, addressing natural curiosity or concerns about specific problems faced by humans. Others may flit back and forth, or find themselves starting a research which could be considered basic which turns applied, or vice versa. Although for applied researchers the focus of research for which the practical motivation is relatively strong, we believe that much of their work include both theoretical and practical concerns and the same applies true for researchers who conduct basic research.

### *Exercise*

*Is there commercial value involved in the discoveries that result from basic research?*
*Is basic research important for progress to take place?*
*When do we use basic research?*
*Is applied research different from action research?*
*Is applied research the order of the day? If yes why?*
*When do we use applied research?*
*How do basic and applied researches differ?*
*Which is more important?*
*When is each type of research useful? Can you give examples?*

## Lesson 3: Descriptive, Explanatory and Exploratory Research

As mentioned above research can be classified as descriptive and explanatory depending on the specific purpose that the research tries to address. **Descriptive research** sets out to describe and to interpret **what is**. It looks at individuals, groups, institutions, methods and materials in order to describe, compare, contrast, classify, analyze and interpret the entities and the events that constitute the various fields of inquiry. It aims to describe the state of affairs as it

exists.

On the other hand, **explanatory research**, aims at establishing the cause and effect relationship between variables. The researcher uses the facts or information already available to analyze and make a critical evaluation of the data/information. **Exploratory research** is less formal, sometimes even unstructured and focuses on gaining background information and helps to better understand and clarify a problem. It can be used to develop hypotheses and to develop questions to be answered.

## 3.1 Descriptive Research

As said earlier, the goal of descriptive research is to describe some aspect of a phenomenon, i.e., the status of a given phenomenon. It can help understand a topic and lead to causal analysis. Descriptive research, therefore, involves a variety of research methods to achieve its goal. The methods that come under descriptive research are:

- Surveys
- Correlation studies
- Observation studies
- Case studies

The details of the methods are given in the subsequent units.

### 3.1.1. Surveys

Surveys gather data at a particular point in time with the intention of describing the nature of existing conditions, or identifying standards against which existing conditions can be compared, or determining the relationships that exist between specific events. They may vary in their levels of complexity and in terms of their scope. Typically survey method is used to scan a wide field of issues, populations, programs etc. in order to measure or describe any generalized features. It is useful in that it usually:

- gathers data on a one-shot basis and hence is economical and efficient;
- represents a wide target population
- generates numerical data;
- provides descriptive, inferential and explanatory information;
- manipulates key factors and variables to derive frequencies; and

- presents material which is uncluttered by specific contextual factors.

Surveys can be distinguished as cross-sectional and longitudinal. Longitudinal surveys can further be classified as trend studies, cohort studies and panel studies.

### *Exercise*

*In what situation is survey more appropriate?*
*Distinguish among the different types of surveys.*

#### 3.1.2 Correlational Studies

Correlational studies trace relationships among two or more variables in order to gain greater situational insight. We may wish to know, for example, whether there is relationship between sex and choice of field of study; whether criminal behavior is related to social class background; or whether an association exists between the number of years spent in full-time education and subsequent annual income. In this case we conduct correlational study- where researchers measure a number of variables for each participant, with the aim of studying the associations among these variables. The purpose of correlational studies is not to establish cause-effect relationship among variables but to determine whether the variables under study have some kind of association or not. Variables being studied may have positive or negative relationship or they may not have relationship at all.

### *Exercise*

*Give examples of variables that are positively or negatively related, or are unrelated.*

#### 3.1.3 Observation Studies

There are many instances where we may be interested in a behavior that occurs in its natural environment. In such situation we conduct observation studies. What is observation study? Observation studies, as their name implies, involve observing and recording of behavior or trait or attribute as it occurs in its natural settings.

In general, observation study has the following important features:

- The first and most fundamental principle is that of noninterference.
- Second, observation study involves the observation and detection of invariants, or behavior patterns or other phenomena that exist in the real world.
- Third, observation study is particularly useful when we know little or nothing about a certain subject.
- Finally, observation study is basically descriptive. Although it can provide a somewhat detailed description of a phenomenon, it cannot tell us why the phenomenon occurred.

### *Exercise*

*Give examples of variables that can be studied most effectively with observation studies.*

#### 3.1.4 Case Studies

Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. They are largely descriptive examinations, usually of a small number of sites (small towns, hospitals, schools). Case studies can provide very engaging, rich explorations of a project or application as it develops in a real-world setting.

### *Exercise*

*When do you decide to use case study than surveys or correlational study?*
*What are the problems associated to case study?*

## 3.2 Explanatory Research

When we encounter an issue that is already known and have a description of it, we might begin to wonder why things are the way they are. The desire to know "why," to explain, is the purpose of explanatory research. It is a continuation of descriptive research and builds on exploratory and descriptive research and goes on to identify the reasons for something that occurs. The researcher goes beyond merely describing the characteristics, to analyze and explain why or how something is happening. Thus, explanatory or analytical research aims to understand phenomena by discovering and

measuring causal relations among them. That is, explanatory research looks for causes and reasons. For example, it is one thing to describe the crime rate in a country, to examine trends over time or to compare the rates in different countries. It is quite a different thing to develop explanations about why the crime rate is as high as it is why some types of crime are increasing or why the rate is higher in some countries than in others.

### *Exercise*

*The way in which researchers develop research designs is fundamentally affected by whether the research question is descriptive or explanatory. Discuss.*

Explanatory research builds on both exploratory and descriptive researches. It involves:

- Explaining things not just reporting. Why? Elaborating and enriching a theory's explanation.
- Determining which of several explanations is best.
- Determining the accuracy of the theory; test a theory's predictions or principle.
- Providing evidence to support or refute an explanation or prediction.
- Testing a theory's predictions or principles.

Answering the **why** questions involves developing causal explanations. Causal explanations argue that phenomenon Y is affected by factor X. In this example, the cause or the reason is Y which is technically termed as independent variable and the effect or the behavior is X which is also known as dependent variable. Some causal explanations will be simple while others will be more complex.

There are two types of explanatory research:

- Experimental research
- Ex post facto research

#### 3.2.1 Experimental Research

In its simplest form, experimental research involves comparing two groups on one outcome measure to test some hypothesis regarding causation. The key element in true experimental research is scientific control and the ability to rule out alternative explanations.

An experimenter interferes with the natural course of events, in order

to construct a situation in which competing theories can be tested. It is the best method when the purpose of research is to determine causal influences between variables. In experimental research, the researcher intentionally manipulates one variable to measure its effect on the other.

### 3.2.2 Ex Post Facto Research

*Ex post facto* research is a method of teasing out possible antecedents of events that have happened and cannot, therefore, be engineered or manipulated by the investigator. *Ex post facto* in research means **after the fact** or **retrospectively** and refers to those studies which investigate possible cause-and-effect relationships by observing an existing condition or state of affairs and searching back in time for plausible causal factors.

If a researcher is interested in investigating the reasons why fatal traffic accident is increasing in Ethiopia, he/she can not do it by randomly assigning research participants into experimental and control group. There is no way in which a researcher can study the actual accidents because they have happened . What a researcher can do, however, is to attempt to reconstruct the causal link by studying the statistics, examining the accident spots, and taking note of the statements given by victims and witnesses. This means that a researcher is studying the independent variable or variables in retrospect for their possible relationship to, and effects on, the dependent variable or variables.

### *Exercise*

*What are the characteristics of ex post facto research?*
*Why do we use ex post facto research?*
*What is the difference between experimental research and ex post facto research?*

## 3.3 Exploratory research

Exploratory research is conducted when there are few or no earlier studies to which references can be made for information. It provides insights into and comprehension of an issue or situation for more rigorous investigation later. Exploratory research is a type of research conducted because a problem has not been clearly defined. Its purpose is to gain background information and better understand and clarify a problem. Exploratory research helps to:

- determine the best research design,
- develop hypotheses,

- develop questions to be answered,
- understand how to measure a variable,
- determine data collection method, and
- determine selection of subjects.

It can be said that exploratory research is generally a precursor to a more formal study. It helps save time, and resources. If a researcher is starting a new project, she/he probably should start with exploration. Exploratory research often relies on secondary research such as reviewing available literature and/or data, or qualitative approaches such as informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies.

The results of exploratory research are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation. Although the results of qualitative research can give some indication as to the "why", "how" and "when" something occurs, it cannot tell us "how often" or "how many."

***Exercise***

*What are the methods used in exploratory research?*
*The aim of exploratory research is to look for patterns, ideas or hypotheses rather than testing or confirming a hypothesis. Why?*

## Lesson 4: Qualitative and Quantitative Research

There is no consensus about how to conceptualize the actual undertaking of research. However, as you might recall from Lesson 2.1, we mentioned that there is a tendency to divide research into qualitative and quantitative when approach to research has been considered as the criterion of classification. Quantitative and qualitative methods raise a number of fundamental epistemological issues and visions of what science is. Each method derives from contrasting academic and philosophical traditions. Quantitative methods are identified with the so-called ‘‘hard science’’ disciplines, whereas qualitative methods, with the social sciences.

## 4.1 Qualitative Research

Qualitative research involves studies that do not attempt to quantify their results through statistical summary or analysis. Qualitative research seeks to describe various aspects about behavior and other factors studied in the social sciences and humanities. In qualitative research data are often in the form of descriptions, not numbers. But sometimes results of qualitative research are subjected to relatively less rigorous quantitative treatment. Often the goal of qualitative research is to look for meaning. That is, stress is laid on the socially constructed nature of reality, the intimate relationship between the research and researched and situational constraints that shape the enquiry.

Qualitative research is characterized by adherence to diverse array of orientations and strategies for maximizing the validity of trustworthiness of study procedures and results. It is thus a type of empirical enquiry that entails purposive sampling for gathering data. It typically involves in-depth interviews, group discussions, artifact studies, projective techniques, and observations without formal measurement. A case study, which is an in-depth examination of one person, is a form of qualitative research. Qualitative research is much more time consuming, but provides more richness to the data. In epistemological terms, qualitative research is identified with phenomenological and interpretative research.

### *Exercise*

*What is qualification in qualitative research?*
*What are the advantages and disadvantages of qualitative research?*

## 4.2 Quantitative Research

Quantitative research is the systematic and scientific investigation of quantitative properties and phenomena and their relationships. The objective of quantitative research is to develop and employ mathematical models, theories and hypotheses pertaining to natural phenomena. The process of measurement is central to quantitative research because it provides the fundamental connection between empirical observation and mathematical expression of an attribute.

It usually starts with a theory or a general statement proposing a general relationship between variables. With this approach it is likely that the researchers will take an objective position and their approach will be to treat phenomena as hard and real. As a result

proponents of such studies claim that quantitative research is undertaken in a value free framework. Quantitative researchers favor methods such as surveys and experiments, and will attempt to test hypotheses or statements with a view to infer from the particular to the general. This approach typically concentrates on measuring or counting and involves collecting and analyzing numerical data and applying statistical tests.

### *Exercise*

*In what sense is quantitative research different from qualitative research?*
*What are the advantages and disadvantages of quantitative research?*
*What does quantification mean?*

### 4.3 Characteristics of Qualitative and Quantitative Research

The main characteristics of qualitative and quantitative research are summarized in the following table.

| Characteristics | Qualitative Research | Quantitative Research |
|---|---|---|
| • Typical Data Collection Methods | Participant observation, semi-structured interviews, introspection. | Laboratory observations, questionnaire, schedule or structured interviews. |
| • Formulation of Questions and Answers | Open loosely specified questions and possible answers. Questions and answers are exchanged in two way communication between researcher and research participant. | Closed questions and answer categories to be prepared in advance. |
| • Selection of Respondents | Information maximization guides the selection of respondent. Every respondent may be unique (key person). | Representativeness as proportion of population **N**. Sample selection, sample size according to assumptions about distribution in population **N**. Respondents should be directly comparable. |
| • Timing of Analysis | Parallel with data collection | After data collection |
| • Application of Standard Methods of Analysis | Are rarely used. Methods of analysis are formulated during the data collection process. | Standard statistical methods are frequently used |
| • Typical forms of Analysis | Critical analysis and interpretation of source materials. Selection, systematizing and summarizing interview transcripts and observations. | Cross tabulations, correlation analysis and tests of significance on numerical data |
| • The Role of Theories in the Analysis | Existing theories are typically used only as point of departure for the analysis. Theories are further developed by forming new concepts and relations. The contents of the new concepts are studied and illustrated. Practical application of theory is illustrated by cases. | A-priori deducted theories are operationalised and tested on data. The process of analysis is basically deductive. |

### 4.4 Differences between Qualitative and Quantitative Research

The above summary also provides us with important features where qualitative and quantitative researches differ. In addition we may summarize the differences between the two approaches as follows:

1. They differ in terms of the nature of reality. Quantitative researchers believe that there are human characteristics and processes that constitute a form of reality in that they occur under a wide variety of conditions and thus can be generalized to some degree. On the other hand, qualitative researchers believe that there are no human characteristics and processes from which generalizations can emerge. Instead, each subject or phenomenon is different and can only be studied holistically.

2. They also differ in terms of the relationship of the researcher to the research participants. In quantitative research, the researcher can function independently of the participants of the research to a major degree, although some interaction is probably inevitable. Whereas in qualitative research the researcher and the research participant interact to influence one another and are inseparably interconnected. In addition, in qualitative research the research participants play a role in interpreting the outcomes of the study.

3. Qualitative research often does not know what it is looking for whereas quantitative research does - designs and measurements decisions are made prior to conducting the research. In qualitative research the design of the research emerges as the research progresses. That is, in qualitative inquiry the investigator starts with a very tentative design and develops the design as the inquiry progresses.

4. Qualitative researchers are often immersed in the data and look at it more subjectively whereas quantitative research demands objectivity.

5. Qualitative research typically employs small samples than quantitative research.

6. The ultimate goal of research in quantitative research is to develop a body of knowledge in the form of generalization that will hold at least to some degree over time and in contexts similar to those in which the generalizations were developed. In Qualitative research the aim of inquiry is to develop a body of knowledge that is unique to the individual being studied, and that can be used to develop hypotheses about the individual.

7. Qualitative research describes meaning or discovery whereas quantitative establishes relationship or causation. That is, in quantitative research, given sufficient research with valid measures, every action or effect can be explained by a cause or combination of causes that precede the effect in time. In qualitative research all elements in the situation are in a state of mutual simultaneous interaction so it is impossible to distinguish causes from effects.

8. Quantitative inquiry should be made as value-free as possible through the use of sound research design and objective data collection procedures. Qualitative research, on the other hand, is value-bound because inquiries are inevitably influenced by the values of the researcher, the choice of theory, the methodology employed, and the values inherent in the context of the inquiry.

9. Qualitative research uses unstructured data collection whereas quantitative research uses structured data collection methods. In qualitative research, humans are the primary data-gathering instrument. Non-human instruments – measurement instruments are the data gathering tools in quantitative research.

### *Exercise*

*Qualitative and quantitative approaches differ in terms of the objectives of research. Discuss.*

*Which of the two approaches emphasizes the use of intuitive insights in conducting research?*

## Unit Summary

- There are different ways of classifying research. As illustration, in this module research is classified based on goal of research, specific objectives of research, approaches of research, designs, the type of data used in research, and fields of study.
- In terms of goals, research is divided into basic and applied research.
- In terms of specific objectives, research is divided into descriptive, explanatory, and exploratory research.
- In terms of approach, research is divided into qualitative and quantitative research.
- In terms of design, research is divided into experimental, quasi-experimental, and non experimental research.
- In terms of the type of data to be generated, research can be classified as primary and secondary research.
- In terms of fields of study, research can be classified as natural science, social science, health science, engineering, behavioral science, etc. research.
- The aim of basic research is the advancement of knowledge and involves rigorous and structured type of analysis.
- Applied scientific research can be about finding out the answer to a specific problem.
- Descriptive research sets out to describe and to interpret what is.
- Explanatory research, aims at establishing the cause and effect relationship between variables.
- Exploratory research focuses on gaining background information and helps to better understand and clarify a problem.
- The methods that come under descriptive research are: surveys, correlation studies, observation studies, and case studies.
- There are two types of explanatory research: experimental research and *ex post facto* research
- Qualitative and quantitative approaches differ in terms of the nature of reality, relationship of the researcher to the research participants, the possibility of generalizations, the possibility of causal linkage, and in terms of the role of values in research.

## References


1. Belay Tefera (2007). Research Methods in Behavioral Sciences: Modular Text for Psychology Students.
2. de Marrais, K & Lapan, S.D. (eds.) (2004). *Foundations for Research: Methods of Inquiry in Education & the Social Sciences.* Mahwah: Lawrence Erlbaum Associates.
3. Gay, L.R.; Mills, G.E.; & Airasian, P. (2009). *Educational Research: Competencies for Analysis and Applications* (9th ed.). New Jersey: Pearson.
4. Marczyk, G.; DeMatteo, D.; and Festinger, D. (2005). *Essentials of Research Design and Methodology*. New Jersey: John Wiley & Sons, Inc.
5. Mitchell, M.L. & Jolley, J.M. (2004). *Research Design* (5th ed.). Wadsworth: Thomson.
6. Ray, W. J. (2003). *Methods Toward a Science of Behavior and Experience* (7th ed.). Wadsworth: Thomson.


## Assignment

1. Which of the two types of research (basic or applied) will be the focus of your graduate research?

_____
_____

2. Is there commercial value involved in the discoveries that result from basic research?

_____
_____

3. Is basic research important for progress to take place?

_____
_____

4. When do we use basic research?

_____
_____

5. Is applied research different from action research?

_____
_____
_

6. When do we use applied research?

_____
_____

7. How do basic and applied researches differ? Is one type of research more important than the other?

_____
_____

8. When is each type of research useful? Can you give examples?

_____
_____

9. Why is qualitative research inductive in its nature?

_____
_____

10. Which of the two approaches involves flexible methods of data collection?

_____
_____

# UNIT • 3 •

# Process in Research Proposal Development

## Key Concepts

| | |
|---|---|
| **Research proposal** | **Research problem** |
| **Research questions** | **Research objectives** |
| **Literature review** | **Research design** |
| **Sample size determination** | **Sampling methods** |
| **Probability sampling** | **Non-probability sampling** |

## Objectives

The objective of this unit is to demonstrate the various steps involved in the development of a research proposal. After completing this unit you should be able to:

- Know the contents of a research proposal
- Describe how to identify a research topic
- Identify a research problem and formulate a research question/hypothesis
- Set the objectives/aims
- Develop a research design and methods
- Prepare a review of the literature related to the topic
- Cite references
- Prepare work plan
- Identify resources required and prepare a budget
- Produce a complete research proposal

## Mode of Delivery and Assessment

- The training method applied is based on learning by doing. Students will themselves develop a mini-research proposal. Thus, the course should not be perceived as having a teacher-student orientation. It should rather provide a forum for sharing information where everyone can contribute the

benefits of his or her own experience and knowledge. This sharing will add greatly to the richness and relevance of the research methods module. There will be lectures, exercises, individual assignments and group discussions.

- Students will work individually or in small groups and design mini-research proposals, step by step, on a problem (research question) they have selected. As each new step is introduced, new concepts and research procedures will be presented. The participants will immediately apply these in the proposals they are developing.

## Lesson 1: What is the Research Proposal?

1.1 Introduction

Before an attempt is made to start with a research project, a research proposal should be compiled. For the beginner researcher, this is usually among the most difficult parts. It is, however, the most important aspect of the research project and should be considered carefully by the researcher. This does not only require subject knowledge, but also insight into the problem that is going to be investigated, so as to give logic and structure to the research envisaged. This unit of the research methodology module is a guide to write a research proposal. Use the guidelines as a point of departure for discussions with your advisor/instructor. They may serve as a straw-man against which to build your understanding of both your study and of proposal writing.

Students are advised to read the module beforehand so that they can benefit, as much as possible, from the presentations and group work. It may be extremely useful for the students to (re)read the module after the presentation and group work as well.

1.2 Identifying a research topic

Defining the problem is the first step and one of the most difficult in research undertaking. There is a tendency for the beginner in research to ask questions that are usually diffuse or vague. Each topic that is proposed for research has to be judged according to certain guidelines or criteria. There may be several ideas to choose from. Before deciding on a research topic, each proposed topic must be compared with all other options. The guidelines or criteria discussed on the following can help in this process:

Criteria for selecting a research topic:

- Relevance/Significance
- Avoidance of duplication
- Urgency of data needed (timeliness)
- Feasibility of study
- Applicability of results
- Interest to the researcher
- Ethical acceptability

1.3 What is a research proposal?

After proper and complete planning of a research, the plan should be written down. The research proposal is the detailed plan of study. The term "research proposal" indicates that a specific course of action will be followed. It is a document which sets out your ideas in an easily accessible way. The intent of the written research proposal is to present a focused and scholarly presentation of a research problem and plan. The early presentation of a research plan in the post graduate training of students is intended to promote critical and analytical thinking, focused research effort, and extensive interaction with their thesis advisor throughout the research. The objective in writing a proposal is to describe what you will do, why it should be done, how you will do it and what you expect will result. Being clear about these things from the beginning will help you complete your research in a timely fashion. A vague, weak or fuzzy proposal can lead to a long, painful, and often unsuccessful research writing exercise. A clean, well thought-out, proposal forms the backbone for the research itself. A good research proposal hinges on a good idea. Getting a good idea hinges on familiarity with the topic. This assumes a longer preparatory period of reading, observation, discussion, and incubation. Read everything that you can in your area of interest. Figure out what are the important and missing parts of our understanding. Figure out how to build/discover those pieces. Live and breath the topic. Talk about it with anyone who is interested. Then just write the important parts as the proposal.

The written proposal:

- forces the students to clarify their thoughts and to think about all aspects of the study;
- is a necessary guide if a team is working on the research;
- is essential if the study involves research on human subjects or on experimental animals, in order to get the institution’s ethical approval;

- is an essential component submitted for funding.

From the process of the development of the research proposal, students benefit from the advise of their supervisor(s), experts and colleagues in referring to their plan. But once a proposal for a study has been developed and approved, and the study has started and progressed, it should be adhered to strictly and should not be changed. Violations of the proposal can discredit the whole study.

A well-thought out and well-written proposal can be judged according to three main criteria.

- Is it adequate to answer the research question(s), and achieve the study objective?
- Is it feasible in the particular set-up for the study?
- Does it provide enough detail that can allow another investigator to do the study and arrive at comparable results?

**Issues to remember:** *Know your area of expertise: what are your strengths and what are your weaknesses? Play to your strengths, not to your weaknesses. Do not assume that, because you do not understand an area, no one understands it or that there has been no previous research conducted in the area. If you want to get into a new area of research, learn something about the area before you write a proposal. Research previous work. Be a scholar. Before you start work on your research proposal, find out whether you're required to produce the proposal in a specific format. Most graduate programs at Addis Ababa University have a general outline and a guide as to how many pages to produce.*

***Exercise***

*Why do you need to write a good research proposal?*

*Who do you think will want to read your research proposal?*

## Lesson 2: Components of a Research Proposal

The basic components of a research proposal are the same in many fields. However, how they are phrased and staged may vary by discipline. The following components can be regarded as steps in the writing of the research proposal. They are important and should be followed for the actual composition of the proposal. The organization of the contents of a proposal may vary somewhat with the nature of the activity proposed. Generally, the basic components

of a proposal are described in this unit in the order in which they most logically appear in a proposal. However, when it comes to related research, the inquirer may find it useful, even necessary, to incorporate some parts of the discussion into other sections of the proposal.

**Issues to remember:** *It is important to remember the components will not always appear in all postgraduate programs at AAU, as separate sections, or in the order listed here. Once you've learned the basic rules for research proposal, you can apply them to any research discipline.*

Components of a research proposal:

1. Title page
2. Summary/Abstract
3. Introduction/Background
4. Statement of the problem
5. Literature review
6. Hypotheses /Questions
7. Conceptual framework
8. Objective/Aim of the study
9. Research methods, materials and procedures
    - Study area
    - Study design
    - Study subjects
    - Eligibility Criteria (if any)
    - Sample size
    - Sampling methods
    - Method of data collection
    - Description of variables
    - Data quality assurance
    - Operational definitions
    - Plan of data analysis
10. Work plan
11. Budget
12. References
13. Appendices/Annexes

The abstract is a mini version of the proposal

## 2.1 Title page

A title ought to be well studied, and to give, so far as its limits permit, a definite and concise indication of what is to come. The title of your research proposal should state your topic exactly in the smallest

possible number of words. Put your name, the name of your department/faculty/college, the name of your advisor(s) and date of delivery under the title.

All words in the title should be chosen with great care, and association with one another must be carefully managed. The title page identifies the proposal and provides the endorsement of appropriate body (advisor). A good title is defined as the fewest possible words that adequately describe the contents of the study. Title is a label: it is not a sentence. Titles should almost never contain abbreviations. The title page has no page number and it is not counted in any page numbering.

### *Exercise*

*What do you think of the following the research topics? Discuss on their merits and provide your own alternative titles.*

*How does the human brain work when faced with stress?*

*The workings of the human brain in times of stress.*

*Stress and the human brain.*

*Effect of stress on short-term memory*

*Abebe's memory function during semester final exams*

2.2 Summary/Abstract

The abstract is a one page brief summary of the thesis proposal. It needs to show a reasonably informed reader why a particular topic is important to address and how you will do it. To that end, it needs to show how your work fits into what is already known about the topic and what new contribution your work will make. Specify the question that your research will answer, establish why it is a significant question; show how you are going to answer the question. Do not put information in the abstract that is not in the main text of your research proposal. Do not put references, figures, or tables in the abstract.

First impressions are strong impressions: make your title an attention grabber.

**Issues to remember**: *The abstract is a concise summary of the material presented in the proposal. Though it appears at the front of the proposal, it is written last. A well-prepared summary enables the reader to*

- *Identify the basic content of a document quickly and accurately,*
- *Determine its relevance to their interests, and*
- *Decide whether they need to read the document in its entirely*

### *Exercise*

*Do you think it would be appropriate to include your methods in the abstract?*

*Summarizing a wide topic is more difficult than it sounds. By way of illustration, make single sentence statements on the following topics:*

*The role of water in living organisms.*

*Differences between males and females.*

*The political history of Ethiopia.*

*Status of child health care in Ethiopia.*

*Environmental impact of urban living.*

## 2.3 Introduction/background

The introduction is the part of the proposal that provides readers with the background information for the research proposal. Its purpose is to establish a framework for the research, so that readers can understand how it is related to other research. Be sure to include a hook at the beginning of the introduction. This is a statement of something sufficiently interesting to motivate your reader to read the rest of the proposal, it is an important/interesting scientific problem that your study either solves or addresses. The introduction should cite those who had the idea or ideas first, and should also cite those who have done the most recent and relevant work. You should then go on to explain why more work is necessary (your work, of course.)

The introduction also should address the following points:

- Sufficient background information to allow the reader to

understand the context and significance of the question you are trying to address.

- Proper acknowledgement of the previous work on which you are building.
- Sufficient references such that a reader could, by going to the library, achieve a sophisticated understanding of the context and significance of the question.
- The introduction should be focused on the research question(s).
- All cited work should be directly relevant to the goals of the research.
- Explain the scope of your work, what will and will not be included.
- A verbal "road map" or verbal "table of contents" guiding the reader to what lies ahead.
- Is it obvious where introductory material ("old stuff") ends and your planned contribution ("new stuff") begins?

**Issues to remember:** *In summary, the introduction/background section should contain a rationale for your research. Why are you undertaking the project? Why is the research needed? This rationale should be placed within the context of existing research or within your own experience and/or observation. You need to demonstrate that you know what you're talking about and that you have knowledge of the literature surrounding this topic. If you're unable to find any other research that deals specifically with your proposed project, you need to say so, illustrating how your proposed research will fill this gap. If there is other work that has covered this area, you need to show how your work will build on and add to the existing knowledge. Basically, you have to convince people that you know what you're talking about and that the research is important.*

### *Exercise*

*Is it appropriate to include in the introduction theories, hypothesis and findings that go against your stated hypothesis?*

*Is it appropriate to include research works in progress that offer an alternative hypothesis?*

## 2.4 Statement of the problem

Most research proposals, whether designed for master's theses or doctoral dissertations, may be considered as responses to a

Statement of the problem encapsulates the question you are trying to answer.

problem. A problem might be defined as the issue that exists in the literature, theory, or practice that leads to a need for the study. The prospective researcher should think on what caused the need to do the research (problem identification). The question that he/she should ask him/herself is: Are there questions about this problem to which answers have not been found up to the present? The research problem should be stated in such a way that it would lead to analytical thinking on the part of the researcher with the aim of possibly concluding solutions to the stated problem. The problem statement describes the context for the study and it also identifies the general analysis approach. It is important in a proposal that the problem stand out—that the reader can easily recognize it. Effective problem statements answer the question *"**Why does this research need to be conducted**."* If a researcher is unable to answer this question clearly and succinctly, and without resorting to hyper-speak, then the statement of the problem will come off as ambiguous and diffuse. The most frequent dilemma among graduate students is their seemingly aimless search for a problem significant enough to pursue and discrete enough to handle. A well-articulated statement of the problem establishes the foundation for everything to follow in the proposal and will render less problematic most of the conceptual, rhetorical and methodological obstacles typically encountered during the process of proposal development. This means that, in subsequent sections of the proposal, there should be no surprises, such as categories, questions, variables or data sources that come out of nowhere: if it can't be found in the problem statement section, at least at the implicit level, then it either does not belong in the study or the problem statement needs to be re-written.

### *Exercise*

*Formulate a problem statement in your specific area of research interest*

*Evaluate the research questions provided below and answer the following questions:*

*- Do the questions offer significant area of research?*

*- Are they testable (i.e. can you obtain answers to these questions?)*

*- Are they too broad/narrow?*

*- Propose alternatives that refine the questions.*

*"Does frequent use of mobile phones increase the risk*

*of brain cancer?"*

*"Which of the following cultivars (varieties) of sorghum produces the highest yield in semi-arid regions of*

*Ethiopia?"*

*"Does capital punishment serve as a deterrent to*

*violent criminals?*

## 2.5 Literature review

To conduct research regarding a topic, by implication, means that the researcher has obtained sound knowledge with regard to the research topic. It is therefore imperative that the researcher, at the time of the submission of the research proposal, clearly indicates what theoretical knowledge he possesses about the prospective research.

### What is a literature review?

The literature review asks how similar and related questions have been answered before.

Literature review is *not* a compilation of every work written about a topic. It is *not* simply a list of sources reviewed separately for their own merit. A literature review is a description of the literature relevant to a particular field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypotheses, what questions are being asked, and what methods and methodologies are appropriate and useful. As such, it is not in itself primary research, but rather it reports on other findings.

A literature review uses as its database reports of primary or original scholarship, and does not report new primary scholarship itself. The primary reports used in the literature may be verbal, but in the vast majority of cases reports are written documents. The types of scholarship may be empirical, theoretical, critical/analytic, or methodological in nature. Second a literature review seeks to describe, summarize, evaluate, clarify and/or integrate the content of primary reports.

### The stages of a literature review

Define the problem

It is important to define the problem or area which you wish to address. Having a purpose for your literature review will narrow the

scope of what you need to look out for when you read.

Carry out a search for relevant materials

Relevant materials will probably comprise a range of media:

- books (monographs, text books, reference books);
- articles from journals, whether print or electronic (but make sure electronic journals have been subject to the peer review process);
- newspaper articles;
- historical records;
- commercial reports and statistical information;
- government reports and statistical information;
- theses and dissertations;
- other types of information which may be relevant to your particular discipline.

Initial appraisal from raw bibliographical data:

- What are the authors' credentials? are they experts in the field? are they affiliated with a reputable organization?
- What is the date of publication, is it sufficiently current or will knowledge have moved on?
- If a book, is it the latest edition?
- Is the publisher a reputable, scholarly publisher?
- If it is a journal, is it a scholarly journal peer reviewed?

Appraisal based on content analysis:

- Is the writer addressing a scholarly audience?
- Do the authors review the relevant literature?
- Do the authors write from an objective viewpoint, and are their views based on facts rather than opinions?
- If the author uses research, is the design sound?
- Is it primary or secondary material?
- Do the authors have a particular theoretical viewpoint?
- What is the relationship of this work to other material you have read on the same topic, does it substantiate it or add a different perspective?
- Is the author's argument logically organized and clear to follow?
- If the author is writing from a practice-based perspective, what are the implications for practice?

<u>How to organize a literature review</u>

There are a number of ways of organizing a literature review. Here is

one suggestion:

A. **Introduction:** define the topic, together with your reason for selecting the topic. You could also point out overall trends, gaps, particular themes that emerge, *etc*.

B. **Body:** this is where you discuss your sources. Here are some ways in which you could organize your discussion:
   - ***chronologically***: for example, if writers' views have tended to change over time. There is little point in doing the review by order of publication unless this shows a clear trend;
   - ***thematically***: take particular themes in the literature;
   - ***methodologically***: here, the focus is on the methods of the researcher, for example, qualitative versus quantitative approaches.

C. **Conclusion:** summarize the major contributions, evaluating the current position, and pointing out flaws in methodology, gaps in the research, contradictions, and areas for further study.

**Issues to remember:** *A literature review must do the following things:*
- *be organized around and related directly to the research question you are developing*
- *synthesize results into a summary of what is and is not known*
- *identify areas of controversy in the literature*
- *formulate questions that need further research*

Ask yourself the following type of questions:
- What is the **s**pecific research question that my literature review helps to define?
- What type of literature review am I conducting? Am I looking at issues of theory? methodology? policy? quantitative research? qualitative research ?
- What is the scope of my literature review? What types of publications am I using? What discipline am I working in?
- How good was my information seeking? Has my search been wide enough to ensure I've found all the relevant material? Has it been narrow enough to exclude irrelevant material? Is the number of sources I've used appropriate for the length of my paper?
- Have I critically analyzed the literature I use? Do I follow through a set of concepts and questions, comparing items to

each other in the ways they deal with them? Instead of just listing and summarizing items, do I assess them, discussing strengths and weaknesses?
- Have I cited and discussed studies contrary to my perspective?
- Will the reader find my literature review relevant, appropriate, and useful?

### *Exercise*

*Is wikipedia an authoritative scholarly source of information?*

*You are studying the impact of flooding on loss of livestock in a region of Ethiopia. Would the Ethiopian Herald newspaper be a reliable source of information for such a study?*

2.6 Questions and/or Hypotheses

Hypotheses and questions are linked to the speculative proposition of the problem statement, can be inferred from the overall conceptual framework of a study, and are of critical importance to data analysis and interpretation. In research studies, the term hypotheses implies a derivation, within a hypothetic-deductive theoretical system, of a particular assertion or prediction. The hypothesis is subject to test, i.e., to confirmation or rejection on empirical grounds. The term question implies an interrogative statement that can be answered by data, which is logically related to the same conceptual framework, but which does not necessarily stem from that framework through logical deduction.

*Questions* are most often used in qualitative inquiry, although their use in quantitative inquiry is becoming more prominent. *Hypotheses* are relevant to theoretical research and are typically used only in quantitative inquiry. A research question poses a relationship between two or more variables but phrases the relationship as a question; a hypothesis represents a declarative statement of the relations between two or more variables. Deciding whether to use questions or hypotheses depends on factors such as the purpose of the study, the nature of the design and methodology of the research. Make a clear and careful distinction between the dependent and independent variables and be certain they are clear to the reader. Hypotheses are thus tentative statements that should either be acknowledged or rejected by means of research.
Because hypotheses give structure and direction to research, the following aspects should be kept in mind when formulating a hypothesis:

- Hypotheses can only be formulated after the researcher has gained enough knowledge regarding the nature, extent and intensity of the problem.
- Hypotheses should figure throughout the research process in order to give structure to the research.
- Hypotheses are tentative statements/solutions or explanations of the formulated problem. Care should be taken not to over-simplify and generalize the formulation of hypotheses.
- The research problem does not have to consist of one hypothesis only. The type of problem area investigated, the scope of the research field are the determinate factors on how many hypotheses will be included in the research proposal.

**Issues to remember:** *A research hypothesis is usually stated in an explanatory form, because it indicates the expected reference of the difference between two variables. In other words it verifies the reference that the researcher expects by means of incorporating selected research procedures. The research hypothesis may be stated in a directional or non-directional form. A directional hypothesis statement indicates the expected direction of results, while a non directional one indicates no difference or no relationship.*

***Exercise***

*Formulate hypotheses for the questions at the end of 3.2.4*

## 2.7 Conceptual framework

Every research activity is conceptualized and will be carried out within some contextual framework. This contextual framework is in part conceptual, in part valuational, and in part practical (or operational), and all of these factors must typically be considered.

A conceptual framework is described as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation. When clearly articulated, a conceptual framework has potential usefulness as a tool to scaffold research and, therefore, to assist a researcher to make meaning of subsequent findings. Such a framework should be intended as a starting point for reflection about the research and its context. The framework is a research tool intended to assist a researcher to develop awareness and understanding of the situation under scrutiny and to communicate this.

### *Exercise*

*What are some examples of constraining contextual factors?*

2.8 Objective/aim of the study

The objectives of a research delineate the ends or aim which the inquirer seeks to bring about as a result of completing the research undertaken. An objective may be thought of as either a solution to a problem or a step along the way toward achieving a solution; an end state to be achieved in relation to the problem. The objectives of a research project summarise what is to be achieved by the study. Objectives should be closely related to the statement of the problem. After statement of the primary objective, secondary objectives may be mentioned.

Objectives should be

- simple (not complex),
- specific (not vague),
- stated in advance (not after the research is done), and
- stated using "action verbs" that are specific enough to be measured.

Commonly, research objectives are classified into **general objectives and specific objectives.** The general and specific objectives are logically connected to each other and the specific objectives are commonly considered as smaller portions of the general objectives. It is important to ascertain that the general objective is closely related to the statement of the problem.

- ***General objective***
  - What exactly will be studied?
  - General statements specifying the desired outcomes of the proposed project
- ***Specific objectives***
  - Specific statements summarizing the proposed activities and including description of the outcomes and their assessment in **measurable terms**
  - It identifies in greater detail the specific aims of the research project, often breaking down what is to be accomplished into smaller logical components
  - Specific objectives should systematically address the various aspects of the problem as defined under 'Statement of the Problem' and the key factors that are

assumed to influence or cause the problem. They should specify **what** you will do in your study, **where** and **for what purpose**

Why should research objectives be developed?

The formulation of objectives will help you to:

- **Focus** the study (narrowing it down to essentials);
- **Avoid** the collection of data which are not strictly necessary for understanding and solving the problem you have identified; and
- **Organize** the study in clearly defined parts or phases.

Properly formulated objectives will facilitate the development of your research methodology and will help to orient the collection, analysis, interpretation and utilization of data.

**Issues to remember:** *Keep in mind that when a proposal is evaluated, the anticipated results will be compared to the objectives. If the objectives have not been spelled out clearly, the proposal cannot be evaluated.*

*Take care that the objectives of your study:*

- *Cover the different aspects of the problem and its contributing factors in a **coherent** way and in a **logical sequence**;*
- *Are **clearly phrased** in **operational terms,** specifying exactly what you are going to do, where, and for what purpose;*
- *Are feasible;*
- *Are **realistic** considering local conditions;*
- *Are phrased to clearly meet the purpose of the study; and*
- *Use **action verbs** that are specific enough to be evaluated.*

## 2.9 Methods, material and procedures

Methods/procedures show how you will achieve the objectives, answer the questions.

The methods or procedures section is really **the heart** of the research proposal. You must decide exactly how you are going to achieve your stated objectives: *i.e.*, what new data you need in order to shed light on the problem you have selected and how you are going to collect and process this data. The activities should be described with as much detail as possible, and the continuity between them should be apparent. Indicate the methodological steps you will take to answer every question, to test every hypothesis illustrated in the Questions/Hypotheses section or address the objectives you set.

What belongs in the "methods" section of a research proposal?

- Information to allow the reader to assess the believability of your approach.
- Information needed by another researcher to replicate your experiment.
- Description of your materials, procedure, theory.
- Calculations, technique, procedure, equipment, and calibration plots.
- Limitations, assumptions, and range of validity.
- Description of your analytical methods, including reference to any specialized statistical software.

The proposal should describe in detail the general research plan. (may not necessarily be true for all types of research)

- Description of study area
- Description of study design
- Description of study participants
- Eligibility criteria ( if any)
- Determination of sample size (if any)
- Description of selection process (sampling method)
- Methods of data collection
- Description of the expected outcome and explanatory variables… (if any)
- How data quality is ensured
- Operational definition
- Presentation of the data analysis methods

**Issues to remember**: *Be aware of possible sources of error to which your design exposes you. You will not produce a perfect, error free design (no one can). However, you should anticipate possible sources of error and attempt to overcome them or take them into account in your analysis.*

Important components of the materials and methods section are described in detail below.

2.9.1 Study design

The study type may dictate certain research designs. More commonly, the study objectives can be achieved through a number of alternative designs. Students have to select the most appropriate and most feasible design.

The type of research design chosen depends on:

- the type of problem;
- the knowledge already available about the problem; and
- the resources available for the study.

Generally, there are two main categories of research design: observational study, and experimental or intervention study. In the observational study, the researchers stand apart from events taking place in the study. They simple observe and record. In the experimental or intervention study, the researches introduce an intervention and observe the events which take place in the study.

Observational studies

An observational study may be exploratory, descriptive or analytical. An exploratory study is a small-scale study of relatively short duration, which is carried out when little is known about a situation or a problem. If the problem and its contributing factors are not well defined, it is always advisable to do an exploratory study before embarking on a large-scale descriptive or analytic study. *S*mall-scale studies may be called exploratory case studies if they lead to plausible assumptions about the causes of the problem and explanatory case studies if they provide sufficient explanations to take action. A descriptive study is an observational study that simply describes the distribution of a characteristic. An analytical study (correlation in some disciplines) is an observational study that describes associations and analyses them for possible cause and effect. An observational study may be cross-sectional or longitudinal. In cross-sectional study, measurements are made on a single occasion. In a longitudinal study, measurements are made over a period of time. A longitudinal observational study may be retrospective or prospective. In a retrospective study, the researchers study present and past events. In a longitudinal prospective study, the researchers follow subjects for future events.

Experimental or intervention studies

In the experimental or intervention study, the investigators test the effect of an intervention on the events taking place in the study. An experimental or intervention study may be controlled or non-controlled. A controlled experimental study may be randomized or non-randomized. Randomized controlled trials are intervention studies characterized by the prospective assignment of subjects, through a random method, into an experimental group and a control

group. Controlled trails without randomization are intervention studies in which allocation to either experimental or control groups is not based on randomization, making assignment subject to possible biases influence study results.

### 2.9.2 Sampling

Sampling for quantitative studies

Sampling is the process of selecting a number of study units from a defined study population. Often research focuses on a large population that, for practical reasons, it is only possible to include some of its members in the investigation. You then have to draw a sample from the total population. In such cases you must consider the following questions:

- What is the study population you are interested in from which we want to draw a sample?
- How many subjects do you need in your sample?
- How will these subjects be selected?

The study population has to be clearly defined. Otherwise you cannot do the sampling. Apart from persons, a study population may consist of villages, institutions, plants, animals, records, *etc*. Each study population consists of study units. The way you define your study population and your study unit depends on the problem you want to investigate and on the objectives of the study.

The key reason for being concerned with sampling is that of *validity*—the extent to which the interpretations of the results of the study follow from the study itself and the extent to which results may be generalized to other situations with other people or situation. Sampling is critical to *external validity*—the extent to which findings of a study can be generalized to people or situations other than those observed in the study. To generalize validly the findings from a sample to some defined population requires that the sample has been drawn from that population according to one of several *probability* sampling plans. By a *probability sample* it is meant that the probability of inclusion in the sample of any element in the population must be given *a priori*. All probability samples involve the idea of *random sampling* at some stage. Probability sampling requires that a listing of all study units exists or can be compiled. This listing is called the **sampling frame**. Of course, at times, it is impossible to obtain a complete list of the population.

A sample is a representative of the population under study.

Another reason for being concerned with sampling is that of *internal validity*—the extent to which the outcomes of a study result from the variables that were manipulated, measured, or selected rather than from other variables not systematically treated. Without probability sampling, error estimates cannot be constructed. Perhaps the key word in sampling is *representative*. If researchers want to draw conclusions which are valid for the whole study population, which requires a quantitative study design, they should take care to draw a sample in such a way that it is **representative** of that population. A representative sample has all the important characteristics of the population from which it is drawn.

**Examples of probability sampling**

Simple random sampling

The guiding principle behind this technique is that each element must have an equal and nonzero chance of being selected. This can be achieved by applying a table of random numbers or a computer generated random numbers to a numbered sampling frame. Another approach involves drawing numbers from a container. The product of this technique is a sample determined entirely by chance. It should be noted, however, that chance is "lumpy", meaning that random selection does not always produce a sample that is representative of the population. Imagine, for example, a sampling frame comprising 10,000 people. Furthermore, consider that altitude is a critical variable, and that the composition of the sampling frame is as follows: 1,500 are from high altitude ; 7,500 are from medium altitude white, and 1,000 are from low altitude. You are going to select a sample of 500 people from this sampling frame using a simple random sampling technique. Unfortunately, the simple random selection process may or may not yield a sample that has equivalent altitudinal proportions as the sampling frame. Due to chance, disproportionate numbers of each altitudinal category may be selected.

Systematic sampling

The systematic random sampling technique begins with selecting one element at random in the sampling frame as the starting point; however, from this point onward, the rest of the sample is selected systematically by applying a predetermined interval. For example, in this sampling technique, after the initial element is selected at random, every "$k^{th}$" element will be selected ($k^{th}$ refers to the size of the interval—the ratio of the population to sample size) and becomes eligible for inclusion in the study. The "$k^{th}$ " element is selected

through the end of the sampling frame and then from the beginning until a complete cycle is made back to the starting point (that is, the place where the initial random selection was made). If there is a cyclic repetition in the sampling frame, systematic sampling is not recommended.

Stratified sampling

Stratified random sampling begins with the identification of some variable, which may be related indirectly to the research question and could act as a confounder (such as geography, age, income, ethnicity, or gender). This variable is then used to divide the sampling frame into mutually exclusive *strata* or subgroups. Once the sampling frame is arranged by strata, the sample is selected from each stratum using simple random sampling or systematic sampling techniques. It is important that the sample selected within each stratum reflects proportionately the population proportions; thus, you can employ *proportionate stratified sampling.*

Cluster sampling

It may be difficult or impossible to take a simple random sample of the units of the study population at random, because a complete sampling frame does not exist. Logistical difficulties may also discourage random sampling techniques (e.g., interviewing people who are scattered over a large area may be too time-consuming). However, when a list of groupings of study units is available (e.g., villages or schools) or can be easily compiled, a number of these groupings can be randomly selected. Then all study units in the selected clusters will be included in the study.

Multistage sampling

Multistage cluster sampling is used when an appropriate sampling frame does not exist or cannot be obtained. Multistage cluster sampling uses a collection of preexisting units or clusters to “stand in” for a sampling frame. The first stage in the process is selecting a sample of clusters at random from the list of all known clusters. The second stage consists of selecting a random sample from each cluster. Because of this multistage process, the likelihood of sampling bias increases. This creates a lack of sampling precision known as a design effect. It is recommended to consider the design effect during sample size determination.

Purposeful sampling strategies for qualitative studies

Qualitative research methods are typically used when focusing on a limited number of informants, whom you select *strategically* so that their in-depth information will give optimal insight into an issue about which little is known. This is called *purposeful sampling.* There are several possible strategies from which a researcher can choose. Often different strategies are combined, depending on the topic under study, the type of information wanted and the resources of the investigator(s).

2.9.3. Sample Size

Sample size in quantitative studies

Having decided **how** to select the sample, you have to determine the **sample size**. The research proposal should provide information and justification about sample size. It is not necessarily true that the bigger the sample, the better the study. Beyond a certain point, an increase in sample size will not improve the study. In fact, it may do the opposite; if the quality of the measurement or data collection is adversely affected by the large size of the study. After a certain sample size, in general, it is much better to increase the **accuracy and richness** of data collection (for example by improving the training of interviewers, by pre-testing of the data collection tools or by calibrating measurement devices). than to increase sample size. Also, it is better to make extra effort to get a **representative** sample rather than to get a very large sample.

The level of precision needed for the estimates will impact the sample size. Generally, the actual sample size of a study is a compromise between the level of precision to be achieved, the research budget and any other operational constraints, such as time (see 3.2.7). In order to achieve a certain level of precision, the sample size will depend, among other things, on the following factors:

- The variability of the characteristics being observed: If every person in a population had the same salary, then a sample of one person would be all you would need to estimate the average salary of the population. If the salaries are very different, then you would need a bigger sample in order to produce a reliable estimate.
- The population size: To a certain extent, the bigger the population, the bigger the sample needed. But once you reach a certain level, an increase in population no longer

You have to make a trade-off between generating a large enough sample size to make a valid generalization to the population and the many constraints that appear with increasing sample size.

affects the sample size. For instance, the necessary sample size to achieve a certain level of precision will be about the same for a population of one million as for a population twice that size.

- The sampling and estimation methods: Not all sampling and estimation methods have the same level of efficiency. You will need a bigger sample if your method is not the most efficient. But because of operational constraints and the unavailability of an adequate frame, you cannot always use the most efficient technique.

When the study is designed to find a difference or an association, you may not find a difference or an association. In this case, we still want to calculate statistical probability that we may have missed a difference or an association that exists in the population, but was not found in the sample. This so-called statistical power of the study depends also on the size of the sample. The larger the sample size, the higher the power of the study. For calculating sample size before the study begins, the researchers have to make a decision on the level of statistical power they are willing to accept for the study. Traditionally, most studies set a power of 80%.

The effect size in a study refers to the actual size of the difference observed between groups or the strength of relationships between variables. The likelihood that a study will be able to detect an association between the variables depends on the magnitude of the association you decide to look for. Large sample sizes are needed to detect small differences. The choice of effect size is difficult and arbitrary, but it must be set beforehand and must make a meaningful difference. In designing a study, the researcher chooses the size of effect that is considered important.

Sample size in qualitative studies

There are no fixed rules for sample size in qualitative research. The size of the sample depends on what you try to find out, and from what different informants or perspectives you try to find that out. You can start with two or four Focus Group Discussions (FGDs) depending on the complexity of the research objectives. If the different data sets reconfirm each other you may stop at this point; otherwise you conduct one or two FGDs more till you reach the point of *redundancy*, *i.e.* no new data comes up any more. In exploratory studies, the sample size is therefore **estimated** beforehand as precisely as possible, but **not determined.** Richness of the data and analytical capability of the researcher determine the validity and meaningfulness of qualitative data more than sample size. Still,

sampling **procedures** and **sample size** should always be carefully explained in order to avoid the allusion of haphazardness.

2.9.4. Analysis Plan

Specify the analysis procedures you will use, and label them accurately. The analysis plan should be described in detail. If coding procedures are to be used, describe reasonable detail. If you are triangulating, carefully explain how you are going to do it. Each research question will usually require its own analysis. Thus, the research questions should be addressed one at a time followed by a description of the type of statistical tests (if necessary) that will be performed to answer that research question. Be specific. State what variables will be included in the analyses and identify the dependent and independent variables if such a relationship exists. Decision making criteria (*e.g.*, the critical alpha level) should also be stated, as well as the computer software that will be used (if there is a need to use one). These help you and the reader evaluate the choices you made and procedures you followed.

The work plan is the timeline that shows when specific tasks will have been accomplished.

**Issues to remember:** *Provide a well thought-out rationale for your decision to use the design, methodology, and analyses you have selected.*

A work plan informs the reader how long it will take to achieve the objectives/answer the questions.

2.10 **Work plan**

Work plan is a schedule, chart or graph that summarizes the different components of a research proposal and how they will be implemented in a coherent way within a specific time-span.

It may include:

- The tasks to be performed;
- When and where the tasks will be performed;
- Who will perform the tasks and the time each person will spend on them;
- It describes the plan of assessing the ongoing progress toward achieving the research objectives;
- The plan specifies how each project activity is to be measured in terms of completion, the time line for its completion;
- A good work time plan enables both the investigators and the advisors to monitor project progress and provide timely feedback for research modification or adjustments.

**Issues to remember:** *In the work plan:*

- *Different components/phases/stages of the study should be stated*
- *Description of activities in each phase*
- *Time required to accomplish the various aspects of the study should also be indicated*

The Budget section will show how much it will cost to answer the question.

**The GANTT Chart**

A GANTT chart is a planning tool that depicts graphically the order in which various tasks must be completed and the duration of each activity.

The GANTT chart indicates:

- the tasks to be performed;
- who is responsible for each task; and
- the time each task is expected to take.

The length of each task is shown by a bar that extends over the number of days, weeks or months the task is expected to take.

When drawing up a budget, be realistic. Do no attempt to be too frugal to demonstrate how cheaply you can run the project. At the same time, do not be too expensive so as not to deter the fund providers.

## 2.11 **Budget and funding**

Most often than not, you will require to secure funds from a funding organization to cover the cost of conducting a research project. The items to consider when drawing up a budget requirement are outlined below. In addition, it is important to remember that the funding agency will invariably also read through the whole proposal (not just the budget requirement). Therefore, it is critical that the entire proposal document is well thought out and written to effectively communicate the aim of the research and how you plan to achieve it.

Budget items need to be explicitly stated

- Cost for every budget item should be quantitatively shown
- Their might be a need for budget justification of certain costs whose requirement is not obvious

Typically, a proposal budget reflects direct and indirect costs.

<u>Direct costs:</u>

- **Personnel:** Salaries and wages of all participants of the study Principal investigator; supervisor; data collector; drivers; guards; data entry clerks, data

analysis, report writing, etc
- **Consumable supplies**: office supplies (stationeries), computers, chemicals, and educational materials
- **Equipments**: properties which are expensive
- **Travel**: cost of projected-related travel
- **Communications**: postage, telephone, telegram, fax, e-mail charges associated with a project
- **Publication**: the cost incurred of preparing and publishing the results of the research. It includes: technical reports, manuscripts, illustrations, graphics, photography, slides, and overheads
- **Other direct costs**: costs of all items that do not fit into any of the above direct costs

Indirect costs:

- Those costs incurred in support and management of the proposed activities that can not be readily determined by direct measurement. Examples includes;
  - Overhead costs for institutions or associations
  - General administrative cost
  - Operational and maintenance
  - Depreciation and use allowance

Budget justification

It is not sufficient to present a budget without explanation. The budget justification follows the budget as an explanatory note justifying briefly, in the context of the proposal, why the various items in the budget are required. Make sure you give clear explanations concerning why items that may seem questionable or that are particularly costly are needed and discuss how complicated expenses have been calculated. If a strong budget justification is presented, it is less likely that essential items will be cut during proposal review.

Obtaining funding for research projects

To conduct research, it is usually necessary to obtain funding for the research project. Such funding may be available from local, national or international agencies. In addition, to preparing a good research proposal, the following strategies are useful for researchers to increase the chances of securing adequate funds:

A. Familiarize yourself with the policies and priorities of funding agencies. Such policies and priorities may be:

- Implicit, *i.e.* known to officials in the agency and to other local

researchers who have previously been funded by that agency. Obtain the names of such persons and make direct contact with them.

- Explicit, *i.e.* available from policy documents issued by the agency. The funding policies of many agencies may emphasize:

* a priority given to research aimed at strengthening a particular program

* institution building (*i.e.* building the capacity of an institution to do research)

* targeted to a specific thematic area of research (for example, health, family planning, *etc*.)

B. Identify the procedures, deadlines an dformats that are relevant to each agency.

C. Obtain written approval and support from relevant local and national authorities and submit together with our proposal.

D. If you are a beginning researcher, associate yourself with an established researcher/advisor. Host agencies scrutinize the 'credibility' of the researcher to whom funds are allocated. Such credibility is based on previous projects that were successfully completed.

E. Build up your own list of successfully completed projects (i.e. your own reports, publications, *etc*.)

2.12 **References**

You must give references to all the information that you obtain from books, papers in journals, and other sources. References may be made in the main text using index numbers in brackets (Vancouver style) or authors name (Harvard style). You will also need to place a list of references, numbered as in the main text (or alphabetically ordered), at the end of your research proposal. The exact format for depicting references within the body of the text and as well as the end of the proposal varies from one discipline to another. It is best that you consult with someone who is familiar with the format in your particular area of research.

The information you give in the reference list must be enough for readers to find the books and papers in a library or a database. It also demonstrates to those interested in your proposal how well versed you are on the particular area of research.

As a general guideline, there are certain items that must be included from each source reference. As mentioned above, the exact format applicable to your particular area of study will be left for you to find out.

**For a journal paper give:**

- the names of the authors,
- the year of publication,
- the title of the paper,
- the title of the journal,
- the volume number of the journal,
- the first and last page numbers of the paper.

**For a book give:**

- the author,
- the year of publication,
- the title, and the edition number if there is one,
- the name of the publisher,
- the page numbers for your reference.

**For an internet reference give:**

- the author of the web page,
- the title of the item on the web page,
- the date the item was posted on the web page
- the date the item was accessed from the web page
- the complete and exact URL.

Particularly with references obtained from websites, it is important to establish the reputability and reliability of the website you are making reference to.

Every reference in your main text must appear in the list at the end of your proposal, and every reference in the list must be mentioned in your main text.

### 2.13 **Appendices/Annexes**

Include in the appendices of your proposal any additional information you think might be helpful to a proposal reviewer. For example, include:

- Questionnaire & other collection forms
- Dummy tables
- Biographical data on the principal investigator
- The consent form (if any)

### *Exercise*

*Would it be appropriate to draw your sample only from AAU graduate students to study the incidence of seasonal flu in Addis Ababa? Why?*

*Can you obtain a complete and accurate list of residents in Addis Ababa? If not, how would you proceed to gather your sample?*

*In a study that investigates the rise of sea levels due to global warming, is it meaningful to try and detect millimeter level differences every week? How about if your measurement is done every decade?*

## Summary

Scientific research commences with the writing of a research proposal which is a detailed plan that the researcher intends to follow and which will give an adjudicator or evaluator a clear idea of what the researcher plans to do and how he or she intends to complete the research. The research proposal contains a description of the research topic and the literature survey, motivation for the research, a statement of the problem, a hypothesis, the research methodology to be used, clarification of terms, and the sources consulted to demarcate the research problem

Quality writing is critical in all good proposals. It should be clear, concise, and free of jargon. There should be no spelling or grammatical errors, and the proposal should be easy to read. Sloppy proposals and proposals laden with jargon do not provide a positive image to the reader, nor do they lend confidence that solid research will follow. Proposals that are well-written and attractive are a pleasure to read, and they make a good impression with readers/reviewers.

## References

1. Bowling, A. (2002). *Research methods in health: Investigating health and health services* (2nd Ed). Berkshire: Open University Press.
2. Brownlee, A., Nchinda, T. C., and Yolande M.-G. (1984) *How to develop proposal and design research to solve priority health problems*. Boston: WHO/Boston University Health Policy Institute.
3. Day, R. A. (1996) *How to write and publish a scientific paper* (4th Ed). Cambridge: Cambridge University Press.
4. Dooley, D. (2004) *Social Research Methods*. New Delhi: Prentice-Hall of India
5. Fathalla, M.F. (2004) *A practical Guide for Health Research*.

Cairo: WHO Regional Office for the Eastern Mediterranean.
6. Majumdar, P.K. (2005) *Research Methods in Social Science*. New Delhi: Viva Book private Limited.
7. Varkevisser, C.M., I. Pathmanathon and A. Brownlee (2003) *Designing and conducting health system research projects, Vol.1: Proposal development and field work*. KIT Publisher, Amsterdam, IDCRC in association with WHO Regional Office for Africa.

## Assignment

Identify your own research topic.

---

---

Write the introduction section of the topic you identified.

---

---

Write the statement of the problem for your topic.

---

---

Review literature for your identified topic

---

---

Formulate your own research question and hypothesis (relevant to your topic)

---

---

Develop a conceptual framework (if needed)

---

---

Define clearly your general and specific objectives.

---

---

Write clearly the research design/methods for the identified topic.

---

---

Develop your work plan

---

---

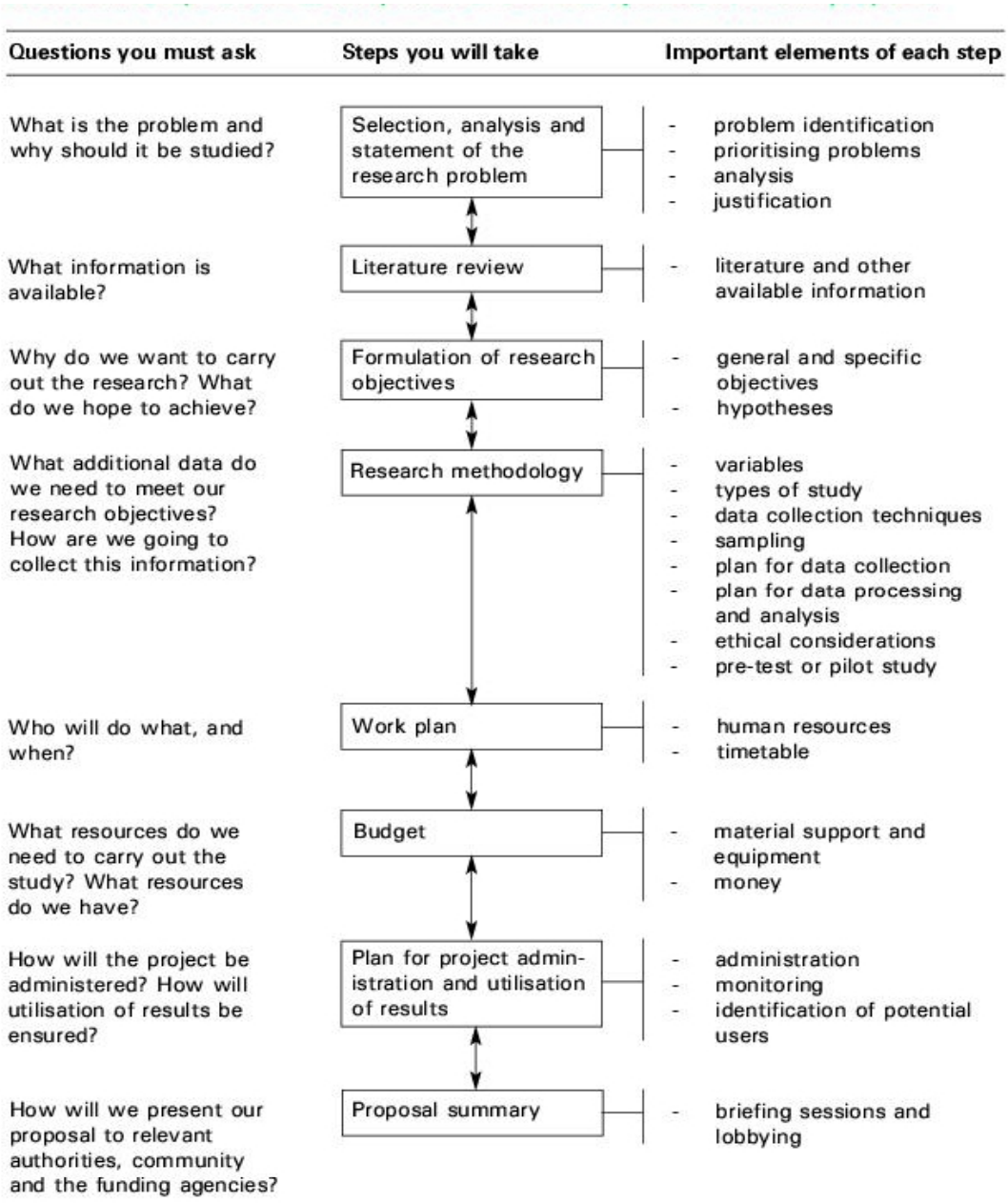
Prepare estimated budget of your research

---

---

Choose one method of citing references and write all the references you used.

Flowchart: Steps in the development of a research proposal




NB: Development of a research process is a cyclical process. The double-headed arrows indicate that the process is never linear.

*Adapted from the International Development Research Center: Designing and Conducting Health Systems Research Projects, VOLUME 1*

UNIT

• 4 •

# Process in Conducting Research

**Key Concepts**

To identify a correct problem to solve under given resources (time, material, budget and personal will) is half of the solution.

**Objectives**

At the end of this unit, you would have obtained a solid grasp of the key process required to conduct a successful research. You must remember that some processes are more appropriate to a specific field; various fields employ specific methods to conduct research, here, attempt is made to highlight

**Mode of delivery and assessment**

- Lecture;
- group discussion – to debate on common processes required in conducting research,
- group assignment – to report on finding of students group discussion

## Lesson 1: The research processes

There are a number of stages in the research process, although their number and description tends to vary between authors. One simplified view would see these as five stages which include conceptualization, contextualization, data collection and / or generation, data analysis and reporting conclusions. A brief description of the five stages are given below.

**Conceptualization:** Defining the 'problem'; establishing the research questions; identifying the aims; specifying the testable hypotheses; deciding on the research approach; identifying the most appropriate way of undertaking the data collection and/or generation. This stage is the most difficult one for novice researchers. Linking the problem and objective/aim of the research with appropriate data collection method often requires careful thinking and advice from senior researchers.

**Contextualization:** Putting the research in the context of similar research that has been done in the past. If there is similar research was done elsewhere, looking carefully the methodology used and

Utilizing a more appropriate analytical method can rectify faulty data analysis. But a faulty experimental design will require re-doing the experiment.

the way data collected and the limitation of the work may help.

**Data Analysis:** Method to collect data and the following data analysis technique should match; occasionally problem may emerge as one start to do data analysis.

**Reporting Conclusions:** Writing up and / or further dissemination.

Conceptualization and contextualization have already been covered in Unit 3; and data reporting will be covered in Unit 6. The mechanics of data analysis will covered in the sister module on "Quantitative methods and computational". In this Unit, we will cover the following:

**Data Collection and /or generation:** Applying the chosen method(s).

Although organized in a systematic stage-by-stage approach, in practice it is to be noted that the nature of the research process is intrinsically iterative. You may need to move forwards and backwards between these stages as the circumstances determine. The availability of data, for example, located only during the data gathering exercise, may influence a modification of the specified aims. In certain circumstances it may become apparent that the data required to answer a research question is not available. This can result in a rethink of the initial stages and a modification of the research design. Thus, researchers need to think carefully about the likely accessibility of data during the design phase. They must also be prepared to be flexible and adaptable during the research.

Regardless, it is still important that all available information be used to properly design the experiment. Moreover, it is also prudent to make back-up plans to accommodate necessary changes as mentioned above. And if unforeseen circumstances arise, well, then as the primary research, you must devise ways by which to salvage as much of your research project as possible.

*Exercise*

*Meseret discovers that the experimental design she is using is not suited to the type of research she is conducting. How would you advise her to proceed?*

**1.1 Research Methods – data collection and analysis**

You need to operationalise the research problem by choosing the most suitable research method, or technique, for your specific study.

There are a number of different research methods available and one should be selected which is most likely to meet the objective of the research and gather the correct type of information. Each technique is designed to get certain types of information and not others. Viable methods should be weighed up in terms of their advantages and disadvantages.

Research methods should be seen as complementing and supporting each other. In a more generalized way, research is often broken down into two different approaches:

**Quantitative research**: research involving numerical or statistical data. Emphasis is on the **quantifiable observations** of the research i.e. numbers involved. This type of research is mainly objective.

**Qualitative research**: an approach to gather non-numerical data and related ways of analysis where emphasis is on the **qualitative** results. Words and observations are used to express the reality where 'getting close to the data' and an 'in-depth' approach are key concerns. This type of research is mainly subjective.

Whilst the distinction is often made between these two approaches, they should not be seen as mutually exclusive, or alternative perspectives, and are often used in conjunction with each other.

Below follows a list of individual research methods (observation studies, questionnaires, interviews, focus groups, document analysis, experimental research, and mathematical modeling) incorporating a brief description, advantages and disadvantages, ways of collecting data, general hints for carrying out the research and some examples of their use.

*Exercise*
*A study is conducted to assess the effect of the provision of 1mg folic acid per day to pregnant women on the birth weight of their babies. In this study, is the researcher interested in quantitative or qualitative results?*

*If the above study, was to observe the effect on the alleviation of post-partum depression would your answer be different? Suggest ways in which one can 'measure' post-partum depression.*

"What I hear is milk, but what I report is butter"

### 2.1 Observation studies

Observation refers to the process of observing and recording events or situations. The technique is particularly useful for discovering how individuals or groups of people or animals (and in some instances inanimate objects) behave, act or react.

There are two main types of observation - participant and non-participant:

Participant observation is usually limited to studies of human subjects. The researcher becomes part of the group studied and participates in their daily life and activities: observing their everyday situations and their behavior in these situations. Conversation is used in order to discover the subjects' own interpretations of events.

In non-participant observation the researchers simply observe the activities without taking part themselves. Whilst this has the advantage of preventing the researcher from unduly influencing or becoming involved in activities they may not wish to take part in (for example dangerous or criminal actions), they are less likely to understand fully the meanings behind behavior in the group studied. Beside the study of human subjects, non-participant observation can also be used to study animal behavior. The observation and recording of natural phenomenon can also be considered observation study.

In human observation studies the observer can remain covert, hiding their true identity as a researcher, or overt, where their identity is revealed to those studied. It is argued that covert research will lead to a more valid study as the subjects are less likely to modify their behavior if they do not know they are the subjects of research. However, the ethics of such studies should be questioned - have we the right to do this? In all research we have a responsibility to those being studied and research should not interfere with their physical, social or mental welfare.

Advantages and disadvantages of observation studies are described below:

"Some people see things as they are and ask why, I dream things that never were and ask why not."

| Advantages | Disadvantages |
|---|---|
| Requires little training or familiarization. | Time consuming. |
| Can understand meanings behind actions. | Problems with recording data. |
| Behavior can be observed in its natural environment, the subject is undisturbed. | Can only study a small group. |
| Can study deviant groups. | Cannot make generalizations - no way of judging whether the group is typical. |
| Flexibility - researcher may come across conditions and events previously not comprehended. | If covert is it ethical? |
| | Moral, legal and injury risks associated with this method. |

Data collection: It is impossible to keep a record of everything and you must decide at the outset where your interests lie. You may decide to film or tape record events, although the cost of this may be quite substantial. Data is often recorded through writing up notes in private after the event or you could set up your own complex system with specific categories of behavior for post-observation recordings using graphs, charts and plans. These will vary depending on the specific problem under investigation; there is no one perfect example that can be used in all situations.

What is important is careful preparation before observation begins; remember the aim of observation is to be unobtrusive so that behavior remains as normal as possible. Placing a tape recorder under someone's nose or scribbling down notes in front of them will not help to maintain this. There are disadvantages with this method of gathering data. The most common criticism is that it is highly subjective, dependent in large on the researcher's own focus and ideas of what should be recorded and their own interpretations of what they have observed.

General ideas for carrying out observation are that it is not an easy option for a research project but a method that takes meticulous planning. One should enter the field with a clear idea of exactly what it is one wishes to discover or vast amounts of time and effort can be wasted.

Examples of use of participant observation include studies of the social structure and functioning of small communities or deviant

Asking the correct (in time, structure) question is half of the answer.

groups, such as *chat* addicts.

*Exercise*
*The year 2009 marks 150 years since the publication of "On the origin of species" by Charles Darwin. The impact of this publication on the science of life on earth is well established. Recall some of the ways in which the major method of study was observational. Do you think this was participatory or non-participatory observational study? Also relate Darwin observation to Yardi new finding of October 2009.*

*A space capsule is deliberately sent on a trajectory to collide with Mars. A scientist trains the high-powered Hubble telescope on the planet's surface where the capsule will impact to observe the debris cloud. Do you think this is an observational study?*

## 2.2. Questionnaires

A questionnaire is a type of survey where respondents write answers to questions posed by the researcher on a question form. A number of respondents are asked identical questions, in order to gain information that can be analyzed, patterns found and comparisons made.

Questionnaires are extremely flexible and can be used to gather information on almost any topic involving large or small numbers of people. The commonest type of questionnaire involves closed choice or fixed questions where the respondent is required to answer by choosing an option from a number of given answers, usually by ticking a box or circling an answer. These types of questionnaires only gather straightforward, uncomplicated information, and only simple questions can be asked. The open-ended questionnaire differs in that it allows the respondent to formulate and record their answers in their own words. These are more qualitative and can produce detailed answers to complex problems.

*Example:*
*Closed choice question:*
*People go to a bar for different reasons; for which of the following four reasons do you most go?*

- *to meet friends*
- *to drink alcohol*
- *to watch sport*
- *to play pool or darts*

"When I ask you 'what is life?" I do not expect a 'yes' or 'no'; answer! And should I ask how old you are there is no need for you to give me your memoirs!"

*What is the primary reason you applied to the AAU graduate program?*

- *to expand my knowledge base*
- *to earn a better salary*
- *to get a promotion*
- *had no specific reason, but did because my friends were applying*

*Open ended question:*
*People go to the bar for different reasons; for what reason do you most go?*
.....

*List the top five reasons why you applied to the AAU graduate program?*
.....
There are advantages and disadvantages associated with each type of method. Open ended questions give a greater insight and understanding of the topic researched but may be difficult to classify and quantify and must be carefully interpreted. Fixed choice questions are easy to classify and quantify, require less time, effort and ingenuity to answer but do not allow the respondents to qualify, develop or clarify their answers.

Examples of advantage and disadvantages of questioners:

| Advantages | Disadvantages |
|---|---|
| Quick. | Limited answers only can be given. |
| Cheap. | Lack of qualitative depth results in superficiality. |
| Efficient. | No way of probing for more information in superficial responses. |
| Can reach a large number of people. | Not always accurate - not possible to verify what appears to be an inaccurate answer and little check on honesty of responses. Questions may mean different things to different people. |
| Consistent format means there is little scope for bias introduced by different researchers. | Predetermined boxes may not be appropriate. |
| | Low response rate. |
| | Construction difficult - instructions must be clear and unambiguous and questions carefully worded. |

Data collection: the information required will be recorded on the form itself by the respondent. Questionnaires can be given to the respondent personally and completed on the spot, or can be posted, which, although much quicker, increases the cost and decreases the response rate and hence representativeness. Web based questionnaires are often seen as easy to respond to by survey participants, but there is an implicit bias in that only those with internet access and are computer literate can participate.

General tips for constructing questionnaires:
***Get the beginning right*** *- this will encourage respondents to read on. One should state what the survey is about and roughly how long it will take to complete.*
***Make the questionnaire look attractive*** *- use space well and avoid a cramped appearance.*
***Use a large enough type size*** *and avoid block capitals so that questions can be easily read.*
***Keep sentences short and sentence construction simple*** *- the wording of the questionnaire is very important. Avoid leading questions which direct the respondent in a particular way e.g. isn't it true to say that.....*
***Avoid jargon and technical terms*** *- make sure the question is unambiguous - each question should only have a single interpretation.*
***Watch out for double questions*** *- that is those asking two separate questions at once.*

"If you know what you know is right, what don't you know that is wrong?"

### *Exercise*

*The census is a form of research that uses a questionnaire that all citizens are expected to provide information for. Does the census conducted in Ethiopia have open- or closed-ended questions?*

*Form groups of five students each. Each group would like to study the daily habits (routines) of unemployed youth in Addis Ababa. Each group is expected to formulate a questionnaire with five questions (you have the option of making it open- or closed ended). Compare the questions with those of the other groups, and discuss the merits and shortcomings of the ways in which each question or type of question is formulated.*

## 2.3 Interviews

Interviews are limited to cases where the subjects of study are humans. Interviews are a type of survey where questions are delivered in a face-to-face encounter by an interviewer. The

interview is like a conversation and has the purpose of obtaining information relevant to a particular research topic. It is initiated by the researcher and is focused on specific content.

As with questionnaires interviews can be approached from either a quantitative or qualitative angle and there are many variations on the general method. Purely quantitative interviews are rather like a closed ended questionnaire that the interviewer fills in for the respondent. These are highly structured, formal interviews which are determined in advance and have fixed responses.

At the other end of the scale, the unstructured, purely qualitative interview is rather like an informal conversation. Here questions are asked in the natural course of interaction and arise from the particular context.

A large number of interviews will fall somewhere in between these two extremes and are known as semi-structured interviews. These have specific questions already predetermined that are asked to the respondent in a particular order, or topics and issues to be covered in the course of the interview.

There are advantages and disadvantages associated with each type of method. Structured interviews maximize reliability and are easier to classify and quantify. By contrast unstructured interviews can give a greater insight and more in-depth understanding of the topic researched, but need more expertise to control and more time for analysis.

| **Advantages** | **Disadvantages** |
|---|---|
| High response rate. | Limited sample only. |
| Can collect complex information. | Can be difficult to analyse (especially in-depth interviews). |
| High degree of researcher control achieved. | May be a hostile reaction. |
| Can be made more responsive to early results. | Whole process is time consuming. |
| Relaxed environment. | Recording techniques may cause problems. |
| | There is room for interviewer bias - this should be acknowledged. |

Data collection: a structured format can leave the interviewer with the job of simply ticking a number of boxes on a form, however a less structured format necessitates a different technique for recording data. A tape recorder is often used to collect information in an unstructured interview. This has the advantage over note taking in that everything will have been recorded, details can not be missed, and the interviewer can give their full attention to the respondent. However, the interviewee may be uncomfortable knowing they are on tape. Alongside this, transcribing the tapes is a very time consuming process; this is something to bear in mind if embarking on this method of data collection for your research project.

General tips for carrying out interviews:

- Begin with an explanation of who you are and what the survey is about and ensure confidentiality.
- Try to achieve rapport with the respondent: be friendly and look as if you are enjoying the interview and are interested in what they have to say.
- Be aware of the importance of body language in face-to-face interviews.

Research has shown that interviewees are more at ease with someone who is like them in terms of ethnicity, class, sex, speech and dress code. Whilst the majority of these cannot be changed, you can dress in a similar manner to your interviewee; if interviewing a nomadic community in their locality they are unlikely to be wearing a suit: T-shirt and shorts would be more suitable.

Be familiar with your questions and ask them in a neutral manner, endeavor not to lead respondents to answer in a certain way. Be aware of your role as an interviewer, which is to listen, not to speak. Take a full record of the interview either through tape-recording or note taking. Prompts may be necessary if information is not given freely.

Examples of use of interviews:
When a researcher aims to discover detailed answers to complex questions in a face-to-face situation. The respondents can give quite elaborate answers e.g. opinion polls, life histories.

### *Exercise*

*Divide the class into two groups. One group will design open-ended interview questions to gauge the level of consumer confidence on*

Almost all documents reflect the inherent bias of the author.

*locally produced goods; while the other group will design close ended interview questions. Each group will interview the other group and record the answers. In the end, the class together will review the questions and answers and discuss which of the two approaches was more informative.*

### 2.4 Focus Groups

The focus group is a type of interview that involves carefully selected individuals who usually do not know each other. They generally consist of 7-10 members alongside the researcher. These individuals are selected as they hold particular characteristics which the researcher believes are necessary to the topic of focus. A group discussion is held in a permissive environment in order to extract opinions and share ideas and perceptions through group interaction. It is not necessary to reach a consensus.
Focus groups are extremely useful in providing qualitative data which gives an insight into attitudes and perceptions difficult to obtain using other procedures. The researcher acts as a moderator and listener posing predetermined open ended questions which the respondents answer in any way they choose.

### 2.5 Document Analysis

This refers to the process of using any kind of document, films, television programs and photographs as well as written sources, such as books, papers and letters, for analysis in relation to a particular research question. It can be used as the singular method of research or as a supplementary form of inquiry.
Document analysis, also referred to as content analysis, differs from the majority of research methods in two major ways.

- It is an indirect form of research; it is something that has been produced, so the investigator is not generating original data.
- It is an 'unobtrusive', or 'non-reactive' method. This refers to the fact that the document will not be affected in any way by your research; it cannot react as a human can.

In general, documents have been written from the perspective of those from official sources but a different perspective can be gained from using personal accounts and oral testaments such as letters, diaries, and autobiographies.

Reliability and validity are central concerns in document analysis. Documents generally exist for some purpose and the knowledge of this purpose is important in understanding and interpreting the

results of the analysis.

| Advantages | Disadvantages |
|---|---|
| The data never alters and can be subject to re-analysis. | Subject to bias and subjectivity - impossible to allow for biases introduced by the fact that the document studied has been written for a particular purpose and is the author's own particular account; events may be sensationalised, subject to political bias etc. |
| Unobtrusive. | Evidence may be out of date. |
| Events can be compared over time and cultures. | May not be accurately recorded. |
| Gives an expert understanding. | Documents available may be limited. |
| Cheap. | Can be laborious and time consuming. |
| Computers can aid analysis and lead to complete reliability in applying the rules you set down for coding the text. | |

Data collection: a recording unit must be defined. For example, a study of newspaper content may concentrate on the number of stories on a particular topic or the column inches devoted to a particular subject. There is a vast range of research possibilities for which document analysis may be used, however all must construct particular categories for analysis.

General guidelines for carrying out document analysis:

- Decide initially on categories for research,
- Keep focused; do not let your research become too wide.

Examples of use:

- For studying racial or sexual bias in newspapers, school textbooks *etc*.
- To obtain a historical understanding of a particular institution or group.
- Commonly used in **triangulation,** (need to define this term!)
- Can also be used for analyzing qualitative research data from interviews etc.

***Exercise***

*If you are tasked to study the last few days of the late Emperors reign, what documents would you use as reference and do you think*

*you should use recent documents or those that were contemporaneously published? Discuss and debate the reliability of contemporaneous sources and sources that were published three decades since the reign ended.*

Some scientific findings, even though widely accepted, cannot be experimental proven. Case in point: Darwin's "Theory of evolution"

## 2.6 Mathematical Modeling

Mathematical modeling can be used to analyze relationships between different variables and to predict possible outcomes, or causal effects.

Experiments can be designed from models of systems, which aim to define links between variables and outcomes.

| Advantages | Disadvantages |
|---|---|
| Can extend powers of deductive reasoning. | Does not explain why variables are linked to particular outcomes - can not explain why particular variables are important. |
| Attempts to be objective - maths is 'neutral'. | Model produced is limited to one situation and therefore may not apply to others. |
| Is an aid to causal explanation and can therefore help calculate the effects of actions. | Inability to distinguish causal from accidental relations. |
| | Could be built on preconceptions. |

*Examples of use:*

*To consider why there is gender difference in the intake of students in science and technology fields at AAU. Using mathematical modeling it is possible to isolate variables that may have an effect on the choices that men and women make.*

Exercise: *A dietician would like to construct a mathematical model that describes physical features to body weight. What variables do you think would be relevant to consider?*

## 2.7 The experimental method

This method involves setting up an experiment in order to test a particular theory or hypothesis. In its simplest terms experimentation is concerned with seeing what changes occur if something new is tried out and with the effects of these changes on something else (Robson, 1978). It is a method particularly associated with the physical and life sciences although the approach is also used in

Results: “One third of the mice responded to the treatment, one third showed no response, and one mouse escaped”

social sciences such as psychology, health care and education.

In order for an experiment to take place, using the most basic research strategy the researcher should deliberately alter at least one particular element or factor of the study, known as variables, in order to assess the effects of this change on behavior. The effect of this alteration is assessed. Measurement is required before, during and after the experiment. The experiment has to be replicable and produce more or less the same results if it is to have any significance.

There are two different types of experiment, the laboratory experiment and the field experiment.

1. In laboratory experiments the researcher will conduct a small-scale study where subjects can be manipulated, observed and tested in a highly controlled environment. In these types of studies, the data obtained is often subjected to statistical analysis (the sister module on “Quantitative and computational methods” will cover the statistical tools and methods). Such research creates an artificial situation where events normally linked are separated.

2. A field experiment is an experiment that takes place outside the laboratory. This leads to a decrease in researcher control, which may hide the effects of changes made, but the results gained can be still be generalized to the real world.

Research into human behavior tested by experimentation is subject to much criticism for ethical reasons. The method could be beneficial or disadvantageous but until the experiment has been completed it is not known which ……..

Experimental Research is often used where:

- There is time priority in a causal relationship (cause precedes effect),
- There is consistency in a causal relationship (a cause will always lead to the same effect), and
- The magnitude of the correlation is great.

If the researcher suspects that the effect stems from a different variable than the independent variable, further investigation is needed to gauge the validity of the results. An experiment is often conducted because the scientist wants to know if the independent variable is having any effect upon the dependent variable. Variables

correlating are not proof that there is causation. Experiments are more often of quantitative nature than qualitative nature, although it happens.

General tips for carrying out experiments:

- Careful preparation is essential and experienced researchers should be consulted before experimentation begins.
- Project design, sample selection and measurement of dependent variables are crucial to the success of the research.

| **Advantages** | **Disadvantages** |
|---|---|
| Ideas can be tested in a controlled way. | Where human subjects are involved it is generally viewed as unethical. |
| Ideal for investigating causal relationships. | Results may be different in the real world to those discovered in a controlled environment. |
| Can generalize effects. | The influence of all variables can never be eliminated; many different circumstances potentially function as variables that can affect the outcome. |
| Scientifically validated findings give greater value to research. | Restricted range. |
| | Large amount of preparation is required. |
| | Humans may respond to expectations of the experiment not to the experiment itself. |

Advantages and disadvantages of experimental method are given below.

### *Exercise*

*A trial is conducted to study the effect of an environmental pollutant (lead in paint) on the occurrence of pancreatic cancer in mice. What is the cause and effect that the researcher is trying to establish? If the outcome of this study shows that there is no causal relationship, does this imply that the experiment was a failure?*

## References

Bell J. (1993) Doing Your Research Project. A Guide for First-Time Researchers in Education and Social Science*, Buckingham: Open*

*University Press. See Part two: Selecting methods of data collection pp. 61-122.*

Blaxter L, Hughes C. and Tight M (1996) How to Research*, Buckingham: Open University Press*
*See Chapter three: Thinking about methods pp. 53-91.*

Burgess RG (1984) In the field: An Introduction to Field Research*, London: Allen and Unwin.*
*See Chapter 6: Using personal documents pp. 123-142.*

*Campbell D T & Stanley JC (1963). Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally.*

Cook T and Campbell D (1979) Quasi-experimentation: Design and Analysis for Field Settings*, Chicago: Rand McNally.*

Douglas J (1985) Creative Interviewing, *Beverley Hills, CA: Sage.*

Fisher R A (1959). Statistical Methods & Scientific Inference. New York: Hafner Publishing.

Hague, P. (1993) Questionnaire Design*, London: Kogan Page.*

Holstein JA and Gubrium JF (1995) The Active Interview*, Newbury park (Ca): Sage.*

Kane E (1990) Doing Your Own Research. How to do Basic Descriptive Research in the Social Sciences and Humanities*, London: Marion Boyars. See Part two: How do you find it pp.151-120.*

Krueger R (1994) Focus groups. A practical guide for applied research, 2nd edition*, Sage: London.*

Lipsey, MW (1990) Design Sensitivity: Statistical Power of Experimental Research*, Newbury Park: Sage.*

McCall G and Simmons JL *(eds)* (1969) Issues in Participant Observation *Reading: Addison-Wesley*

Patrick J (1973*)* A Glasgow Gang Observed, *London: Eyre-Methuen.*
*Whyte, WF (1993)* Street Corner Society: The Social Structure of an Italian Slum, *4th edition,Chicago: University of Chicago Press.*

Pedhazur, E. J. (1997). Multiple Regression in Behavioral Research (Third Edition). Fort Worth: Harcourt Brace. Student (1931). *The Lanarkshire milk experiment. Biometrika, 23, 398-404.*

Scott J (1990) A Matter of Record: Documentary Sources in Social Research*, Cambridge: Polity Press.*

*Scott J (1991)* Social Network Analysis*: A Handbook, London: Sage.*

Spradley J P (1980) Participant Observation*, London: Holt, Rinehart and Winston*

Stewart, D. and Shamdasani, P. (1990) Focus Groups: Theory and Practice*, Newbury Park: Sage*

Sudman, S. (1982) Asking Questions: A Practical Guide to Questionnaire Design*, San Fransisco: Jossey-Bass.*

Thiessen H (1997) Measuring the Real World: A Textbook of Applied Statistical Methods*, Chichester: Wiley.*

## Annex I: Some Key Concepts for the Design and Review of Empirical Research.

Adapted from Dayton, C. Mitchell

In the social and health sciences, statistical methods based on probabilistic reasoning are routinely employed in the evaluation of empirical studies.

**SEVEN CRITERIA FOR EMPIRICAL RESEARCH**

(A) **Randomization:** Ideally, subjects should be randomly selected from the target population and then randomly assigned to treatment conditions. Internal validity (though not external validity) can be attained if available samples are randomly assigned to treatment conditions.

Quasi-experimental designs such as cohort studies require pre-measures and other covariates that allow for statistical adjustment in an attempt to control for history and other threats. Similarly, case-control studies require covariates for adjustment purposes.

However, it should be noted that adjustment for all relevant, non-randomized competing causes in non-experimental studies is an essentially hopeless task. Pedhazur (1997) notes that analysis of covariance (ANCOVA) can be used for increasing precision in

experimental studies and for attempting to adjust for initial differences in non-experimental studies. The application of ANCOVA for the first purpose is well founded, and may prove useful in diverse research areas. The applications of ANCOVA for the second purpose, however, is highly questionable because it is fraught with serious flaws (p. 628). Unfortunately, application of ANCOVA in quasi-experimental and nonexperimental research is by and large not valid (p. 654).

(B) **Control:** Extraneous factors associated with variation in an outcome variable can be controlled by techniques such as selection, stratification, and possibly statistical adjustment or can be randomized. For example, if there are known socio-economic status (SES) differences on a dependent variable, the researcher can: (i) select cases within a relatively narrow range of SES so that its impact becomes negligible or, at least, lessened; (ii) stratify experimental cases into SES blocks that can be incorporated into the design and analysis; or (iii) obtain a suitable measure of SES and partial out its influence. In experimental settings, the benefit of all of these procedures is to reduce unexplained within-group variation and, thereby, both increase the likelihood of detecting an effect (i.e., increase power) and reduce the uncertainty associated with the magnitude of an effect (i.e., decrease the width of confidence intervals). Alternatively, the research can ignore SES differences, randomly assign cases to groups, and lose the above benefits.

(C) **Reliability**: It is preferred that outcomes (and covariates) be assessed with relatively little measurement error. Other things being equal, unreliability increases unexplained variation within groups and reduces the power of the analysis. In practice, it may be impractical to assess the reliability of measurement procedures within the scope of a given study, but the selection of measurement instruments should certainly take this factor into consideration. On the other hand, if a study involves observations or ratings by judges, some effort must be undertaken to assure consistency of measurement across raters or judges.

(D) **Validity:** In selecting a relevant measure for an outcome variable, it is critical that logical inferences can be made from the operationalizations upon which the measure was based to the theoretical constructs relevant to the study. Construct validity refers to the degree to which inferences of this type can legitimately be made.

(E) **Implementation of Treatment Variable**: An overlooked consideration in many studies is the provision of evidence that the independent variable of interest has actually been applied as intended. Student (1931) described a famous failure of implementation. In 1930 in Scotland the Department of Health conducted the Lanarkshire Milk Experiment to investigate the advantage of giving extra milk to schoolchildren. The experiment, involving 20,000 children, was seriously compromised by some teachers who gave the extra milk to students they considered most needy as opposed to those selected by randomization. The lesson is that there must be some record or documentation supporting the fact that the intended treatment has taken

place.

(F) **Analysis Issues**: Research studies without serious design limitations may nevertheless suffer from inadequate or inappropriate analyses. While there are often alternative analytical approaches that result in equivalent analyses with respect to interpretation of results, it is also the case that inappropriate analysis may limit interpretability. Among issues that arise reasonably often are: (a) failure to utilize an appropriate unit of analysis (e.g., ignoring nesting of students within schools and employing ordinary ANOVA when hierarchical linear modeling would be more appropriate); (b) arriving at models by exploratory procedures but interpreting results as if models were confirmed (e.g., using stepwise multiple regression to "confirm" the importance of predictor variables or using model modification indices in structural equation modeling to alter an initial model to improve fit to data); (c) deriving estimates from complex survey designs without considering design issues (e.g., neither using weighted estimates nor modeling the design when analyzing NAEP data); and (d) ignoring distributional assumptions with parametric procedures such as multiple regression, ANOVA, structural equation modeling, etc. (e.g., ignoring the impact of outliers, extremely skewed distributions of residuals, or lack of homogeneity of variance). There are, of course, many more subtle issues such as the mistaken notion that non-parametric tests for location (e.g., Mann-Whitney U) are insensitive to homogeneity of variance assumptions.

(G) **Interpretation Issues:** While the use of inferential statistical methods has been a valuable tool in many applied research fields, their use has also led to some unfortunate opportunities to make incorrect or misleading interpretations of results. Recent emphasis on reporting effect sizes may be viewed as valuable, but all too often this takes the form of comparing a computed effect size (e.g., standardized absolute mean difference) with some completely arbitrary standard (e.g., .5 as indicating a "medium" effect). In fact, a statistically significant outcome for, say, a two-independent-sample t test for means merely suggests that the result is "surprising" when compared to a model of chance variation. The practical interpretation of the observed outcome must be made within the context of the research setting.

## Annex II: Research design

Different research designs have different attributes. The design is the structure of any scientific work. It gives direction and systematizes the research. The method you choose will affect your results and how you conclude the findings. Most scientists are interested in getting reliable observations that can help the understanding of a phenomenon.

There are two main approaches to a research problem:

i) Quantitative Research

What design you choose depends on different factors.

What information do you want?
How reliable should the information be?
Is it ethical to conduct the study?
What is the cost of the design?

ii) Qualitative Research

There are various designs that are used in research, all with specific advantages and disadvantages:

i) True Experimental Design

ii) Quasi-Experimental Design

iii) Double-Blind Experiment

iv) Descriptive Research

v) Archive Study

vi) Literature Review

vii) Case Study

viii) Survey

ix) Twin Studies

x) Meta-analysis

xi) Systematic Reviews

xii) Observational Study

xiii) Naturalistic Observation

xiv) Field Experiment

xv) Cohort Study

xvi) Longitudinal Study

xvii) Factorial Design

xviii) Case Control Study

xix) Pilot Study

## Annex III: Some useful terms

**Action research** is a methodology that combines action and research to examine specific questions, issues or phenomena through observation and reflection, and deliberate intervention to improve practice.

**Applied research** is research undertaken to solve practical problems rather than to acquire knowledge for knowledge sake.

**Basic research** is experimental and theoretical work undertaken to acquire new knowledge without looking for long-term benefits other than the

advancement of knowledge.

**Qualitative research** is research undertaken to gain insights concerning attitudes, beliefs, motivations and behaviors of individuals to explore a social or human problem and include methods such as focus groups, in-depth interviews, observation research and case studies.

**Quantitative research** is research concerned with the measurement of attitudes, behaviors and perceptions and includes interviewing methods such as telephone, intercept and door-to-door interviews as well as self-completion methods such as mail outs and online surveys.

**Clinical trials** are research studies undertaken to determine better ways to prevent, screen for, diagnose or treat diseases.

**Epidemiological research** is concerned with the description of health and welfare in populations through the collection of data related to health and the frequency, distribution and determinants of disease in populations, with the aim of improving health.

UNIT

• 5 •

# Research Ethics

## Key Concepts

| | |
|---|---|
| **Ethics** | **Code of ethics** |
| **Justice** | **Beneficence** |
| **Non- maleficence** | **Respect for persons/autonomy** |
| **Protection of the impaired/diminished autonomy** | |
| **Informed consent** | **Confidentiality** |
| **Identifiers** | |

## Objectives

At the end of this unit, you will:

- be sensitized about research ethics and be able to decipher the basic principles of research ethics, duties and responsibilities as a researcher towards study participants;
- have increased awareness about research ethics and thereby respect the rights of study participants and uphold research ethical standards while conducting research;
- have enhanced awareness of the existence of relevant standards of ethics in research; and
- have enhanced competence in research ethics so that you adhere to ethical principles and rules by following existing ethical clearance standard operating procedures in Ethiopia.

## Mode of delivery and assessment

- Lecture
- Review, presentation and discussion of selected case materials
- Preparation of informed consent form and information sheet by trainees
- Review of standard operating procedures
- Group discussion

## Lesson 1: The Basics

This unit of the module entitled **research ethics** aims at introducing you to the concept of ethnics in research in general and basic principles of

. "…training in research ethics should be able to help researchers grapple with ethical dilemmas in that it introduces researchers to some important concepts, tools, principles, and methods that can be useful in resolving these dilemmas" (Resnik, ND).

research ethics in particular. It is intended to sensitize you about research ethics and provide a context for discussion of ethical issues and ethical dilemmas in research and enhance your awareness about basic ethical principles and procedures for safeguarding research participants' interests.

Ethics is one of the most crucial areas of research, with deception, misconduct and abuses in research increasingly becoming a crucial area of discussion, for instance, between psychologists, philosophers, ethical groups, health professionals and researchers engaged in various fields of research.

The history and development of international research ethics guidance is, for example, strongly reflective of abuses and mistakes made especially in the course of biomedical research. Today it is widely acknowledged that researchers without training and awareness of principles of research ethics are at risk of perpetrating abuses or making mistakes of real consequences. Thus, there is a growing recognition that any researcher conducting research, particularly on/with human participants, should undergo formal research ethics training.

Research ethics deals primarily with the interaction between researchers and the people they study (and in recent decades, on laboratory animals as well); while professional ethics deals, among others, with additional issues such as collaborative relationships among researchers, mentoring relationships, intellectual property, fabrication of data and plagiarism (plagiarism will be covered in the last unit of this module).

Agreed-upon standards for research ethics help ensure that as researchers we explicitly consider the needs and concerns of the people we study, that appropriate oversight for the conduct of research takes place, and that a basis for trust is established between researchers and study participants.

Ethics in research are very important when you're going to undertake a research (perform an experiment, conduct an interview, participant observation, *etc*.). They apply when you are planning, conducting and evaluating research. Whenever we conduct research on/with people, the well-being of research participants must be our top priority. The research question is always of secondary importance. This means that if a choice must be made between doing harm to a participant and doing harm to the research, it is the research that is sacrificed.

### 1.1 What is ethics in research?

The word e**thics** comes from a Greek word '**ethos**' (**character**). **Ethics** is a systematic study of value concepts, 'good', 'bad', 'right', 'wrong' and the general principles that justify applying these concepts. It is not considering

the poor hapless participant at the expense of science and society. It is to learn how to make research “work” for all concerned.

Ethics is not about etiquette.

When most people think of **ethics** (or morals), they think of rules for distinguishing between right and wrong, such as the Golden Rule ("Do unto others as you would have them do unto you"), a code of professional conduct like the Hippocratic Oath ("First of all, do no harm"), a religious creed like the Ten Commandments ("Thou Shalt not kill..."), or wise aphorisms like the sayings of Confucius. This is the most common way of defining "ethics": ethics are **norms for conduct** that distinguish between acceptable and unacceptable behavior.

Most people learn ethical norms at home, at school, in religious institutions, or in other social settings. Although most people acquire their sense of **right** and **wrong** during childhood, moral development occurs throughout life and human beings pass through different stages of growth as they mature. **Ethical norms** are so ubiquitous that one might be tempted to regard them as simple commonsense. On the other hand, if morality were nothing more than commonsense, then why are there so many ethical disputes and issues in many societies? One plausible explanation of these disagreements is that all people recognize some common ethical norms but different individuals interpret, apply, and balance these norms in different ways in light of their own values and life experiences.

It is important to remember that ethics and law are not the same

Most societies also have legal rules that govern behavior, but ethical norms tend to be broader and more informal than laws. Although most societies use laws to enforce widely accepted moral standards and ethical and legal rules use similar concepts. An action may be legal but unethical or illegal but ethical. We can also use ethical concepts and principles to criticize, evaluate, propose, or interpret laws. Indeed, in the last century, many social reformers urged citizens to disobey laws in order to protest what they regarded as immoral or unjust laws. Peaceful civil disobedience is, for instance, an ethical way of expressing political viewpoints.

Another way of defining 'ethics' focuses on the **disciplines that study** standards of conduct, such as philosophy, theology, law, psychology, or sociology. For example, a "medical ethicist" is someone who studies ethical standards in medicine. Finally, one may also define ethics as a **method, procedure, or perspective** for deciding how to act and for analyzing complex problems and issues. For instance, in a complex issue like global warming, one may take an economic, ecological, political, or ethical perspective on the problem. While an economist might examine the cost and benefits of various policies related to global warming, an environmental ethicist could examine the ethical values and principles at stake in the issue.

Many different disciplines, institutions, and professions have norms for behavior that suit their particular aims and goals. These norms also help members of the discipline to coordinate their actions or activities and to establish the public's trust of the discipline. For instance, ethical norms govern conduct in medicine, law, engineering, and business. Ethical norms also serve the aims or goals of research and apply to people who conduct scientific research or other scholarly or creative activities, and there is a specialized discipline, **research ethics**, which studies these norms.

### 1.2 Why is research ethics important?

Education might be the vessel that helps you cross the vast ocean of knowledge, but where would you land without an ethical compass?

There are **several reasons** why it is important to adhere to **ethical norms in research**. First, some of these norms **promote the aims of research**, such as knowledge, truth, and avoidance of error. For example, prohibitions against fabricating, falsifying, or misrepresenting research data promote the truth and avoid error. Second, since research often involves a great deal of cooperation and coordination among many different people in different disciplines and institutions, many of these ethical standards promote the **values that are essential to collaborative work**, such as trust, accountability, mutual respect, and fairness. For example, many ethical norms in research, such as guidelines for authorship, copyright and patenting policies, data sharing policies, and confidentiality rules in peer review, are designed to protect intellectual property interests while encouraging collaboration. Most researchers want to receive credit for their contributions and do not want to have their ideas stolen or disclosed prematurely.

Third, many of the ethical norms help to ensure that researchers can be held **accountable to the public**. For instance, US federal policies on research misconduct, on conflicts of interest, on the human study participant’s protections, and on animal care and use are necessary in order to make sure that researchers who are funded by public money can be held accountable to the public. Fourth, ethical norms in research also help to build **public support** for research. People are more likely to fund research project if they can trust the quality and integrity of research. Finally, many of the norms of research promote a variety of other important **moral and social values**, such as social responsibility, human rights, animal welfare, compliance with the law, and health and safety. Ethical lapses in research can significantly harm human and animal subjects, students, and the public. For example, a researcher who fabricates data in a clinical trial may harm or even kill patients and a researcher who fails to abide by regulations and guidelines relating to radiation or biological safety may jeopardize his health and safety or the health and safety of staff and students.

***Exercise***
*Form the class into two groups: one group will argue the position that 'ethics is absolute' and the other groups will argue the position that 'ethics is relative'. Allow the groups to discuss their position and prepare debating points and opening remarks. After which, the two groups will select leaders who will lead the debate. The instructor will serve as moderator while the rest of the class will be observers (and at times be allowed to pose questions to the opposing side).*

*It is common knowledge that aiding a fugitive from the law is illegal. If the fugitive happens to be someone you know very well and s/he asks you to pass a message to his/her family … will you do it? Do you consider this act contrary to the law forbidding 'assistance to a fugitive'? And is it ethical?*

## Lesson 2: Research Ethics Explained

### 2.1 Some theories of ethics

**Utilitarianism:** founded on the ability to predict the consequences of an action; the choice that yields the greatest benefit to the most people is the choice that is ethically correct. One benefit of this ethical theory is that the utilitarian can compare similar predicted solutions and use a point system to determine which choice is more beneficial for more people. This point system provides a logical and rationale argument for each decision and allows a person to use it on a case-by-case context.

**There are two types of Utilitarianism:** *act utilitarianism* and *rule utilitarianism*
**Act utilitarianism** adheres exactly to the definition of utilitarianism. A person performs the acts that benefit the most people, regardless of personal feelings or the societal constraints such as laws.
**Rule utilitarianism** takes into account the law and is concerned with fairness. A rule utilitarian seeks to benefit the most people but through the fairest and most just means available. Therefore, added benefits of rule utilitarianism are that it values justice and includes beneficence at the same time.

Inherent in both are the flaws associated with predicting the future. Although people can use their life experiences to attempt to predict outcomes, no human being can be certain that his predictions will be true. This uncertainty can lead to unexpected results making the utilitarian look unethical as time passes because his choice did not benefit the most people as he predicted. Another assumption that a utilitarian must make is that he has the ability to compare the various types of consequences against each other on a similar scale. However, comparing material gains such as money against intangible gains such as happiness is impossible

since their qualities differ to such a large extent; it does not allow for the existence of supererogation or heroes. In other words, people are obligated to constantly behave so that the most people benefit regardless of the danger associated with an act.

**Deontology**

The deontological theory states that people should adhere to their obligations and duties when analyzing an ethical dilemma. A person who follows this theory will produce very consistent decisions since they will be based on the individual's set duties. Deontology provides a basis for special duties and obligations to specific people. It also praises those deontologists who exceed their duties and obligations, which is called "supererogation".

One weakness of this theory is that there is no rationale or logical basis for deciding an individual's duties. Sometimes a person's duties conflict; deontology sometimes is not concerned with the welfare of others.

**Rights**

The rights set forth by a society are protected and given the highest priority. Rights are considered to be ethically correct and valid since a large or ruling population endorses them. Individuals may also bestow rights upon others if they have the ability and resources to do so.

A major complication is that one must decipher what the characteristics of a right are in a society. The society has to determine what rights it wants to uphold and give to its citizens. In order for a society to determine what rights it wants to enact, it must decide what the society's goals and ethical priorities are. Therefore, in order for the rights theory to be useful, it must be used in conjunction with another ethical theory that will consistently explain the goals of the society.

**Virtue:** Judges a person by his character rather than by an action that may deviate from his normal behavior. It takes the person's morals, reputation and motivation into account when rating an unusual and irregular behavior that is considered unethical. Major flaw is that it does not take into consideration a person's change in moral character.

**Casuist:** compares a current ethical dilemma with examples of similar ethical dilemmas and their outcomes. This allows one to determine the severity of the situation and to create the best possible solution according to others' experiences. A casuistical theory also assumes that the results of the current ethical dilemma will be similar to results in the examples. A major drawback to this ethical theory is that there may not be a set of similar examples for a given ethical dilemma.

## 2.2 Research ethics when dealing with human participants

### 2.2.1 Basic principles

A researcher's aim should always be to benefit humanity. And humanity is each and everyone of us.

What are the fundamental research ethics principles? All research involving human beings should be conducted in accordance with three basic ethical principles, namely respect for persons, beneficence and justice. These three core principles, originally included in The Belmont Report which came out in 1979, form the universally accepted basis for research ethics. It is generally agreed that these principles, which in the abstract have equal moral force, guide the conscientious preparation of proposals for scientific studies. In varying circumstances they may be expressed differently and given different moral weight, and their application may lead to different decisions or courses of action. Below the aforementioned three basic research ethics principles are briefly discussed one by one.

1. **Respect for persons/autonomy** incorporates at least two fundamental ethical considerations, namely:

a*) **Respect for autonomy***, which requires that those who are capable of deliberation about their personal choices should be treated with respect for their capacity for self-determination; and

b) ***Protection*** **of persons with impaired or diminished autonomy**, which requires that those who are dependent or vulnerable be afforded security against harm or abuse (**For the details please see the Nuremberg Code 1979**).

Autonomy or respect for persons requires a commitment to ensuring the autonomy of research participants, and where autonomy may be diminished, to protect people from exploitation of their vulnerability. The dignity of all research participants must be respected. Adherence to this principle ensures that people will not be used simply as a means to achieve research objectives. According to this principle a study participant has rights to privacy and confidentiality.

**2. Beneficence** refers to the ethical obligation to maximize benefits and to minimize harms. This principle gives rise to norms requiring that the risks of research be reasonable in the light of the expected benefits, that the research design be sound, and that the investigators be competent both to conduct the research and to safeguard the welfare of ("mental integrity", psychological well-being) of the study participants. Beneficence further proscribes the deliberate infliction of harm on persons; this aspect of beneficence is sometimes expressed as a separate principle, **non-maleficence** (do no harm). Beneficence requires a commitment to minimizing the risks associated with research including psychological and social risks and maximizing the benefits that accrue to research participants. Researchers must articulate specific ways this will be achieved.

**3. Justice** refers to the ethical obligation to treat each person in accordance with what is morally right and proper, to give each person what is due to him or her. In the ethics of research involving human research participants the principle refers primarily to **distributive justice,** which requires the equitable distribution of both the burdens and the benefits of participation in research. Justice requires a commitment to ensuring a fair distribution of the risks and benefits resulting from research. Those who take on the burden of research participation should share in the benefits of the knowledge gained. In other words, the people who are expected to benefit from the knowledge should be the ones who are asked to participate.

Differences in distribution of burdens and benefits are justifiable only if they are based on morally relevant distinctions between persons; one such distinction is vulnerability. **"Vulnerability"** refers to a substantial incapacity to protect one's own interests owing to such impediments as lack of capability to give informed consent, lack of alternative means of, for instance, obtaining medical care or other expensive necessities, or being a junior or subordinate member of a hierarchical group. Accordingly, special provision must be made for the protection of the rights and welfare of vulnerable persons.

Sponsors of research or investigators cannot, in general, be held accountable for unjust conditions where the research is conducted, but they must refrain from practices that are likely to worsen unjust conditions or contribute to new inequities. Neither should they take advantage of the relative inability of low-resource countries or vulnerable populations to protect their own interests, by conducting research inexpensively and avoiding complex regulatory systems of industrialized countries in order to develop products for the lucrative markets of those countries.

In general, the research project should leave low-resource countries or

communities better off than previously or, at least, no worse off. It should be responsive to their health needs and priorities in that any product developed is made reasonably available to them, and as far as possible leave the population in a better position to obtain effective health care and protect its own health.

Justice requires also that the research be responsive to the conditions or needs of vulnerable research participants. The research participants selected should be the least vulnerable necessary to accomplish the purposes of the research. Risk to vulnerable research participants is most easily justified when it arises from interventions or procedures that hold out for them the prospect of, for example, direct health-related benefit. Risk that does not hold out such prospect must be justified by the anticipated benefit to the population of which the individual research participant is representative.

The researcher is a product and member of a community; and thus cannot, in the sole pursuit of his research interest, discount the values, norms, cultures, and traditions of the community.

We evaluate the cost and benefits for most decisions in life, whether we are aware of it or not. This can be quite a dilemma in some research projects and/or experiments. The first thing to do before designing a study is to consider the potential cost and benefits of the research**.** Are the benefits so good that they will outweigh the costs? Stem cell research is one example of an area with difficult ethical considerations. As a result, stem cell research is restricted in many countries, because of the major and problematic ethical issues.

In addition to the three above mentioned established principles, some bioethicists have suggested that a fourth principle, **respect for communities**, should be added. Respect for communities "confers on the researcher an obligation to respect the values and interests of the community in research and, wherever possible, to protect the community from harm". Some scholars believe that this principle is, in fact, fundamental for research when community-wide knowledge, values, and relationships are critical to research success and may in turn be affected by the research process or its outcomes.

Animal use in research is often critical to the success of a project. The researcher has an ethical obligation to treat the animals in a humane manner.

2.2.2 Informed consent

Informed consent is a process by which a study participant voluntarily confirms his or her willingness to participate in a particular trial/study, after having been informed of all aspects of the trial/study that are relevant to the study participant's decision to participate.

Research on/with human study participants should be carried out only by, or strictly supervised by, suitably qualified and experienced investigators and in accordance with a protocol that clearly states: the aim of the research; the reasons for proposing that it involves human beings; the

nature and degree of any known risks to the study participants; the sources from which it is proposed to recruit study participants; and the means proposed for ensuring that study participants' consent will be adequately informed and voluntary. The protocol should be scientifically and ethically appraised by one or more suitably constituted review bodies, independent of the investigators/researchers.

New vaccines and medicinal drugs, for instance, before being approved for general use, must be tested on human study participants in clinical trials; such trials constitute a substantial part of all research involving human study participants.

As you have seen above informed consent is a process and acknowledges respect for persons. It is not a legal document. It is rather a risk management tool for an investigator/researcher.

***Exercise***

*It is sometimes said that it is easier to do research using human participants than laboratory animals, because humans can speak for themselves and agree or decline to participate in a research project. However, the rights of animals are advocated by animal rights groups and in some countries dictated by laws. How far should the researcher go to protect the animals? What would you consider inhumane treatment of animals?*

*Even among animals, a crude distinction is made between "beady eyes" (such as mice, birds, etc) and "sad eyes" (such as dogs, rabbits, etc) in the level of protection afforded to them. Do you think those animals who, by virtue of being domesticated, should be afforded a more rigorous standard of treatment than those that are not domesticated? Should mammals be give special consideration over reptiles or amphibians?*

A signature at the bottom of the consent form simply implies that the study participant has understood and agreed to what he was told, it does not mean that he was fully and completely informed.

*A vaccine for HIV/AIDS is nearing clinical trial. You, as the researcher, believe you are at the brink of major breakthrough. What are some of the ethical issues you will need to navigate to undertake the clinical human trial? Does the potential benefit for many supersede the harm that the trial might cause to a few?*

*What if the clinical trial is for a drug to treat HIV/AIDS? Would it be ethical to subject some study participants to a placebo under the false pretense that they are receiving an experimental drug?*

**Goal of informed consent**

The main goal of informed consent is to make sure that the study

participant has understood and make choices freely whether to begin or continue participation in a study. And the essential elements of **informed consent** are: **information, comprehension** and **autonomy of study participants and consent**. In short it is a process which addresses three important questions namely, Who? When? How? The provision of information about the proposed research project to potential study participants is of critical important in informed consent.

The **information** should consist of statement of objectives//purpose, invitation to participation (voluntary participation and withdrawal), explanation of procedure (selection criteria), description of discomforts & risks, expected costs and benefit for participation, availability of provision of care and compensation in case of injury, disclosure of alternatives, confidentiality/privacy, compensation for injury, voluntary participation/withdrawal (no-coercive disclaimer), offer contact persons for answering questions, consent to incomplete disclosure. Additional information on source of funding, conflict of interest, new information will be provided.

**Comprehension**: while preparing a consent form the researcher has to use local language with simple & clear language (understood by the study participants), short words & sentences. The researcher should use educational intervention prior to obtaining the consent of study participants. The researcher should avoid the use of technical terms, statements of waiver of study participants' rights, avoid wording that suggests coercion or overly reassuring language and claims of, for example, safety or efficacy.

**Informed consent**: upholds autonomy or respect for persons which requires legal capacity to give consent; free power of choice, without undue force, fraud, deceit, duress, constraint or coercion. Fiduciary relationship (duty to protect) between investigator and study participants; signing of the consent form with written documentation, the contract signify agreement, not legally binding; no statement abandoning legal cover; commitment to a fiduciary relationship; and renegotiation from time to time.

The researcher should also remember that: a **signature** by a study participant is required but the process is more important. And the "witness" signature implies the participant did sign, but not necessarily understood the informed consent form.

The researcher has to be trained and be knowledgeable about the proposed study. S/he has no relationship with the potential study participant. Moreover whenever there is significant new information that may affect the study participant's voluntarily participation before the proposed research is begun, then the researcher has the obligation to make sure that the information is made available to a study participant and

continue to consent when there is significant new information.

In general a researcher has to answer all questions raised by a study participant and provide the study participant with adequate information and make sure that s/he understood the information; and s/he is given enough time to consider all options. And the process is free from coercion/undue influence. Coercion in this context is understood to be absence of any overt threat of harm presented by a person in order to obtain compliance; undue influence; and offering an excessive, improper reward to obtain compliance. The researcher has also the obligation to make sure that the study setting is: quiet, comfortable, and takes place in a private setting.

**Privacy and confidentiality**

The concept of confidentiality is a key element of research ethics in that the researcher needs to know which types of information can or cannot be shared with a third part with/without the consent of the study participant. In this regard attention should be paid to the following **kinds of information.**

**1) Individually identifiable:** they directly identify the individual or reasonably could be used to identify an individual.

**2) De-identified;** those without individual identifiers.

**Identifiers:** names, all geographic information, all elements of dates (except year), including birth, death admission and discharge dates, telephone and fax numbers, electronic mail addresses, social security numbers, medical record numbers, health plan beneficiary numbers, account numbers, certificate/license numbers, vehicle identifiers and serial numbers, including license plate numbers, device identifiers and serial numbers, web universal resource locators (URLs), internet protocol (IP) address numbers, biometric identifiers, including finger and voice prints, full face photographic images and any comparable images, and any other unique identifying number, characteristic or code..

The **confidentiality of records** that could identify study participants should be protected, respecting the privacy and confidentiality rules in accordance with the applicable regulatory requirements. Records that contain the following types of information can be included in this category: genetic information; psychological well-being, sexual attitudes, preferences, practices; substance abuse or illegal behavior; and other information which may “stigmatize” or alienate study participants; may be culture specific.

2.2.3 Research on/with vulnerable groups

**Vulnerable and less advantaged persons** are: persons who are

A society is not judged by the way it caters to the strong and invincible, but rather by the way it tends to the weak and vulnerable.

absolutely or relatively incapable of protecting their interests; have insufficient power, intelligence, resources, strength or other needed attributes to protect their own interests through informed consent.

**Special populations**

This category often include, fetuses, pregnant women and human in vitro fertilization, prisoners and children.

**Uncomprehending study participants**

Persons unable to understand and cooperate may defeat purpose of the research or harm themselves. These includes, mentally retarded, uneducated, senile, linguistically disadvantaged, inebriated, unconscious and dying.

**Sick study participants**

Illness is indicative of the disturbance of the capacity to perform roles and tasks effectively. Types: persons with prolonged chronic illness – more prone to take risks to gain relief, even if remote; depressed persons; suffering persons; emergency cases; hospitalized patients; dying.

**Dependent study participants**

The dependence of the study participant on the researcher by virtue of his/her relationship/s with an investigator; and types of dependence can include: **administrative availability** – patients, students, employees, prisoners, etc.; **threatened relationships** – fear of jeopardizing relationships if they refuse to participate; **poor persons** – unable to secure money by ordinary means.

**Minority groups**

Determined by age, race, sex, ethnicity, etc.; gays; elderly (ageism – there seems a deep and profound prejudice against the elderly in many societies).

**Study participants in unusual circumstances**

Such persons include sexual abuse / rape victims; domestic violence victims; HIV-AIDS / STD cases; and victims of war.

**Protection of vulnerable and /or special populations**

Protection of vulnerable populations: public concern for vulnerable study

participants has been expressed by the reactions to the following studies/expedients: Nazi Experiments and the Nuremberg Trials; Tuskegee Syphilis Study – involvement of black males; Willowbrook Study – hepatitis study among children in New York State institution for mentally defective persons; Jewish Chronic Disease Hospital Study – injection of live cancer cells into patients to study transplant rejection process; and San Antonio Contraceptive Study – study of side effects of contraceptives on Mexican American women.

The use of vulnerable persons as study participants that are **not forbidden by ethical codes** or **regulations** needs justification for their inclusion such as unsuitability of less vulnerable populations for the proposed study; and it requires the use of mitigating measures to address their vulnerabilities. For instance, in a study on health issues that involves fetuses, pregnant women and human in virtro-fertilization the researcher has to ensure that appropriate studies on animals and non pregnant individuals have been conducted; and therefore there is a minimal risk. And the investigator should have no part and no procedures introduced to terminate pregnancy or determine viability of fetus; and there is no inducement (monetary, etc.) to terminate pregnancy.

The protection of special populations such as prisoners requires that one prisoner or prison representative be on Institutional Review Board (IRB); no special privileges are given to prisoners recruited to the study; there is fair selection of prisoner study participants; that the risks are commensurate to the risks of non prisoners; information is given in understandable language; that parole boards do not credit prisoner participation; and follow up examination/assessment is done when necessary.

The protection of special populations like children first the researcher has to establish the existence of the need for a generalizable knowledge about the study participants, and second due consideration is given to the appropriateness of the age group (adults before children) and appropriate consent form is used to obtain consent. Further more, permission of parents or guardians is required; children's assent (take into account age, maturity and psychological state of children); documentation of consent and assent, and so on depending on the specific rules and regulation of the country in question. In such a study the risks are determined by IRB as follows: category one- Minimal risk; category two - Direct benefit; category three- No direct benefit.

In general the protection of special populations entails that: use of less risky study participants if possible; regular hospital patients should not be deprived of standards of care; determination of appropriate study participant population's related to risks in study intervention; vulnerability issues should take higher precedence than investigator convenience; and risk of washout periods should be assessed.

### 2.2.4 **Mitigating procedures for protection of vulnerable persons**

Some suggested mitigating procedures for the protection of vulnerable persons includes the following measures. Exclusion of vulnerable study participants; increasing the capacity of vulnerable study participants to give free consent; improvement of quality of consent process; creative and innovative ways of giving information and improving comprehension; putting institutional policies regarding recruitment of patients, students, etc. in place; careful calculation of fees paid to participants; adherence to confidentiality rules; setting up physical structures to ensure protection of privacy; debriefing procedures after data gathering; counseling study participants at risk; and avoiding circumstances that will expose study participants to social risks or stigmatization during the research process.

### 2.2.5 **Deception and misconduct in research: some examples**

Ethics is one of the most crucial areas of research, with deception and research increasingly becoming a crucial area of discussion between psychologists, philosophers and ethical groups. There is no doubt that, for many psychological and sociological experiments, the less that the study participant knows the better. Unfortunately, this intent can stray into harming people, intentionally or otherwise, and psychology associations across the world have to constantly update their ethical codes to incorporate new discoveries about the human mind.

Many of you may be wondering why you are being required to have training in research ethics. You may believe that you are highly ethical and know the difference between right and wrong. You would never fabricate or falsify data or plagiarize. Indeed, you also may believe that most of your colleagues are highly ethical and that there is no ethics problem in research.

If you feel this way, relax. No one is accusing you of acting unethically. Indeed, the best evidence we have shows that misconduct is a very rare occurrence in research. For example, there have been 200 confirmed cases of misconduct in federally funded research in the USA in the last 200 years, which works out to a rate of 1in 10,000 (or 0.01%). Of course, this estimate may be extremely low due to various biases related to under-reporting. Several studies have surveyed researchers to ask them whether

Recent studies show that Gregor Mendel, the father of modern day genetics, altered his data to make it more convincing.

they have observed misconduct or know about a case of suspected misconduct. There is a great deal of variation in these results, ranging from 3% to 12% who say they have observed misconduct or know about a case of suspected misconduct. These results, though much higher than 0.01%, still do not support the hypothesis that is common in science, especially when you consider these results in relation to the larger body of research. If 5-10% of drivers have witnessed a fatal traffic accident, this does not prove that fatal traffic accidents are common, if you consider this in light of total numbers of hours that people drive.

Clearly, it would be useful to have more data on this topic, but so far there is no evidence that science has become ethically corrupt. However, even if misconduct is rare, it can have a tremendous impact on research. Consider an analogy with crime: it does not take many murders or rapes in a town to erode the community's sense of trust and increase the community's fear and paranoia. The same thing is true with the most serious crimes in science, i.e. fabrication, falsification, and plagiarism. However, most of the crimes committed in science probably are not tantamount to murder or rape. Most of the crimes in science, like most of the crimes in society, are probably the less serious but ethically significant misdeeds that are classified by a government as 'deviations.' Moreover, there are many situations in research that are genuine ethical dilemmas.

Will training and education in research ethics help reduce the rate of misconduct in science? It is too early to tell. The answer to this question depends on how one understands the causes of misconduct. There are two main theories about why researchers commit misconduct. According to the "bad apple" theory, most scientists are highly ethical. Only researchers who are morally corrupt, economically desperate, or psychologically disturbed commit misconduct. Moreover, only a fool would commit misconduct because science's peer review system and self-correcting mechanisms will eventually catch those who try to cheat the system. In any case, a course in research ethics will have little impact on "bad apples," one might argue. According to the "stressful" or "imperfect" environment theory, misconduct occurs because various institutional pressures, incentives, and constraints encourage people to commit misconduct. Often cited here pressures to publish or obtain grants or contracts, career ambitions, the pursuit of profit or fame, poor supervision of students and trainees, and poor oversight of researchers. Moreover, defenders of the stressful environment theory point out that science's peer review system is far from perfect and that it is relatively easy to cheat the system. Erroneous or fraudulent research often enters the public record without being detected for years. To the extent that research environment is an important factor in misconduct, a course in research ethics is likely to help people to get a better understanding of these stresses, sensitize people to the various ethical concerns, and improve ethical judgment and decision making.

Misconduct probably results from environmental and individual causes, i.e. when people who are morally weak, ignorant, or insensitive are placed in stressful or imperfect environments. In any case, a course in research ethics could still be useful in helping to prevent deviations from norms even if it does not prevent misconduct. Many of the deviations that occur in research may occur because researchers simple do not know or have never thought seriously about some of the ethical norms of research. For example, some unethical authorship practices probably reflect years of tradition in the research community that have not been questioned seriously until recently. If the director of a lab is named as an author on every paper that comes from his lab, even if he does not make a significant contribution, what could be wrong with that? That's just the way it's done, one might argue. If a drug company uses ghostwriters to write papers "authored" by its physician-employees, what's wrong about this practice? Ghost writers help write all sorts of books these days, so what's wrong with using ghostwriters in research?

Deception in research is one area where balancing the needs for statistical accuracy and validity against ethics is always a very difficult process.

Another example where there may be some ignorance or at least some mistaken traditions is the problem of conflicts of interest in research. A researcher may think that a "normal" or "traditional" financial relationship, such as accepting stock or a consulting fee from a drug company that sponsors her research, raises no serious ethical issues. Or perhaps a university administrator sees no ethical problem in taking a large gift with strings attached from a pharmaceutical company. Maybe a physician thinks that it is perfectly appropriate to receive a $300 finders fee for referring patients into a clinical trial.

If "deviations" from ethical conduct occur in research as a result of ignorance or a failure to reflect critically on problematic traditions, then a course in research ethics may help reduce the rate of serious deviations by improving the researcher's understanding of ethics and by sensitizing him or her to the issues.

Finally, training in research ethics should be able to help researchers grapple with ethical dilemmas in that it introduces researchers to some important concepts, tools, principles, and methods that can be useful in resolving these dilemmas.

It is often difficult to balance ethics in research. The case studies presented in the exercise below are examples of how science has to constantly refine and update ethical codes. The some researcher projects are unambiguously evil extreme (such as the ones conducted by the Nazi era doctors on Jews and even those considered genetically ‘inferior’ Germans). But most cases deemed unethical, are well -intentioned researches that can ended up straying onto the wrong side of the divide. It is because this

balancing act is so difficult that an independent ethics committee reviews and approves so that unintended unethical lapses do not occur.

***Exercise***

*Each student is expected to read the below presented case studies about ethics in research beforehand. During the discussion session, some students will be required to make a five minutes presentation on one of the cases. The presentation will center on identifying the ethical lapses, and the remedial measures that it requires. The case studies are classic, illustrative and true; they are:*

*The Tuskegee experiments*

*The Zimbardo's Stanford Prison Experiments*

*The Piliavin and Piliavin Experiment*

The urge by researchers is to overlook data that does not fit nicely into their preconceived expectation. If they report a modified data, then it would be unethical commission; or they may not report it at all and then it would be unethical omission. But if they can find a scientifically grounded explanation for the unexpected result, then they are true scientists.

## Lesson 3: Codes and Policies for Research Ethics

### 3.1 Underlying principles of ethics codes

Given the importance of ethics for the conduct of research, it should come as no surprise that many different professional associations, government agencies, and universities have adopted specific codes, rules, and policies relating to research ethics. Other influential research ethics policies include, for example, the Uniform Requirements (International Committee of Medical Journal Editors), the Chemist's Code of Conduct (American Chemical Society), Code of Ethics (American Society for Clinical Laboratory Science) Ethical Principles of Psychologists (American Psychological Association), Statements on Ethics and Professional Responsibility (American Anthropological Association), Statement on Professional Ethics (American Association of University Professors), The Nuremberg Code and The Declaration of Helsinki (World Medical Association). The following is a rough and general summary of some ethical principals that various codes address:

**Honesty**: Strive for honesty in all scientific communications. Honestly report data, results, methods and procedures, and publication status. Do not fabricate, falsify, or misrepresent data. Do not deceive colleagues, granting agencies, or the public.

**Objectivity**: Strive to avoid bias in experimental design, data analysis, data interpretation, peer review, personnel decisions, grant writing, expert testimony, and other aspects of research where objectivity is expected or

If others cannot believe the words you utter, cannot trust the numbers you publish and cannot depend on the integrity of your work … then who will be there to call you a scientist.

required. Avoid or minimize bias or self-deception. Disclose personal or financial interests that may affect research.

**Integrity:** Keep your promises and agreements; act with sincerity; strive for consistency of thought and action.

**Carefulness**: Avoid careless errors and negligence; carefully and critically examine your own work and the work of your peers. Keep good records of research activities, such as data collection, research design, and correspondence with agencies or journals.

**Openness:** Share data, results, ideas, tools, resources. Be open to criticism and new ideas.

**Respect for Intellectual Property**: Honor patents, copyrights, and other forms of intellectual property. Do not use unpublished data, methods, or results without permission. Give credit where credit is due. Give proper acknowledgement or credit for all contributions to research. Never plagiarize.

**Confidentiality**: Protect confidential communications, such as papers or grants submitted for publication, personnel records, trade or military secrets, and patient records.

**Responsible Publication**: Publish in order to advance research and scholarship, not to advance just your own career. Avoid wasteful and duplicative publication.

**Responsible Mentoring**: Help to educate, mentor, and advise students. Promote their welfare and allow them to make their own decisions.

**Respect for colleagues:** Respect your colleagues and treat them fairly.

**Social Responsibility**: Strive to promote social good and prevent or mitigate social harms through research, public education, and advocacy.

**Non-Discrimination**: Avoid discrimination against colleagues or students on the basis of sex, race, ethnicity, or other factors that are not related to their scientific competence and integrity.

**Competence:** Maintain and improve your own professional competence and expertise through lifelong education and learning; take steps to promote competence in science as a whole.

**Legality**: Know and obey relevant laws and institutional and governmental policies.

**Animal Care**: Show proper respect and care for animals when using them in research. Do not conduct unnecessary or poorly designed animal experiments.

**Human study participants' protection**: When conducting research on human study participants minimize harms and risks and maximize benefits; respect human dignity, privacy, and autonomy; take special precautions with vulnerable populations; and strive to distribute the benefits and burdens of research fairly.

### 3.2 Ethical decision making in research (case studies)

Although codes, policies, and principals are very important and useful, like any set of rules, they do not cover every situation that arises in research, they often conflict, and they require considerable interpretation. It is therefore important for researchers to learn how to interpret, assess, and apply various research rules and how to make decisions about how to act in various situations. The vast majority of decisions that people must make in the conduct of research involve the straightforward application of ethical rules. For example, consider the following cases:

**Case 1:**
The research protocol for a study of a drug on hypertension requires the administration of the drug at different doses to 50 laboratory mice, with chemical and behavioral tests to determine toxic effects of the drug. Tom has almost finished the experiment for Dr. Q. He has only 5 mice left to do. However, he really wants to finish his work in time to go to Florida on spring break with his friends, who are leaving tonight. He has injected the drug in all 50 mice but has not completed all of the tests. He therefore decides to extrapolate from the 45 completed results to produce the 5 additional results.

Many different research ethics policies would hold that Tom has acted unethically by fabricating data. If this study were sponsored by a federal agency, such as the NIH, his actions would constitute a form of **research misconduct**, which a government can define as "**fabrication, falsification, or plagiarism**" (or FFP). Actions that nearly all researchers classify as unethical are viewed as misconduct. It is important to remember, however, that misconduct occurs only when researchers **intend to deceive**: honest errors related to sloppiness, poor record keeping, miscalculations, bias, self-deception, and even negligence do not constitute misconduct. Also, **reasonable disagreements** about research methods, procedures, and interpretations do not constitute research misconduct. Consider the following case.

**Case 2:**
Dr. T has just discovered a mathematical error in a paper that has been accepted for publication in a journal. The error does not affect the overall results of his research, but it is potentially misleading. The journal has just gone to press, so it is too late to catch the error before it appears in print. In order to avoid embarrassment, Dr. T decides to ignore the error.

Clearly, Dr. T's error is not a form of misconduct nor is his decision to take no action to correct the error. Most researchers as well as many different policies and codes, including ECU's policies, would say that Dr. T should tell the journal about the error and consider publishing a correction or errata. Failing to publish a correction would be unethical because it would violate norms relating to honesty and objectivity in research.

There are many other activities that a government may not define as "misconduct" but which are still regarded by most researchers as unethical. These are sometimes called "**other deviations**" from acceptable research practices. Some of these might include:

Withholding the truth is tantamount to deliberate deception.

- Publishing the same paper in two different journals without telling the editors
- Submitting the same paper to different journals without telling the editors
- Not informing a collaborator of your intent to file a patent in order to make sure that you are the sole inventor
- Including a colleague as an author on a paper in return for a favor even though the colleague did not make a serious contribution to the paper
- Discussing with your colleagues data from a paper that you are reviewing for a journal
- Trimming outliers from a data set without discussing your reasons in paper
- Using an inappropriate statistical technique in order to enhance the significance of your research
- Bypassing the peer review process and announcing your results through a press conference without giving peers adequate information to review your work
- Conducting a review of the literature that fails to acknowledge the contributions of other people in the field or relevant prior work
- Stretching the truth on a grant application in order to convince reviewers that your project will make a significant contribution to the field
- Stretching the truth on a job application or curriculum vita
- Giving the same research project to two graduate students in order to see who can do it the fastest

Even the smallest of dishonest acts are unacceptable.

- Overworking, neglecting, or exploiting graduate or post-doctoral students
- Keeping original data at home or taking it with you when you move
- Failing to maintain research data for a reasonable period of time
- Making derogatory comments and personal attacks in your review of author's submission
- Promising a student a better grade for sexual favors
- Using a racist epithet in the laboratory
- Making significant deviations from the research protocol approved by your institution's Animal Care and Use Committee or Institutional Review Board for Human Subjects Research without telling the committee or the board
- Not reporting an adverse event in a human research experiment
- Wasting animals in research
- Exposing students and staff to biological risks in violation of your institution's biosafety rules
- Rejecting a manuscript for publication without even reading it
- Sabotaging someone's work
- Stealing supplies, books, or data
- Rigging an experiment so you know how it will turn out
- Making unauthorized copies of data, papers, or computer programs
- Owning in stock or having some other form of benefit in a company that sponsors your research and not disclosing this financial interest
- Deliberately overestimating the clinical significance of a new drug in order to obtain economic benefits

Many of these actions would be regarded as highly unethical and some might even be illegal depending on the society in question. Most of these would also violate different professional ethics codes or institutional policies. However, they might not fall into the narrow category of actions that a government classifies as research misconduct. Indeed, there has been considerable debate about the definition of "research misconduct" and many researchers and policy makers are not satisfied with a government's narrow definition that focuses on "fabrication, falsification, or plagiarism". However, given the huge list of potential offenses that might fall into the category "other deviations," and the practical problems with defining and policing these other deviations, it is understandable why government officials might choose to limit their focus.

Finally, situations frequently arise in research in which different

people disagree about the proper course of action and there is no broad consensus about what should be done. In these situations, there may be good arguments on both sides of the issue and different ethical principles may conflict. These situations create difficult decisions for research known as **ethical dilemmas**. Consider, for example, the following case:

**Case 3:**

Dr. S is a post-doctoral student in computer science working on some programs that eliminate computer viruses. Two other graduate students are working with her on the project, which is directed by a senior researcher. Dr. S has just received an email from a research team that is working on a similar project at another university. The other team would like Dr. S to share some preliminary data and designs related to the project. Dr. S has not applied for a patent on this research, although she has discussed possible patents with her supervisor.

Dr. S faces a difficult choice. On the one hand, the ethical norm of openness obliges her to share data and designs with the other team. If both teams work together, they may both benefit and help each other as well as the profession and society. On the other hand, if she shares data and designs with the other team, then they may not give her (or her team) proper credit and they may win the race to be the first team to be credited with the discovery. By sharing information, Dr. S could jeopardize potential patents and other intellectual property interests. It seems that there are good arguments on both sides of this issue and Dr. S needs to take some time to think about what she should do. What are some steps that researchers, such as Dr. S, can take to "solve" ethical dilemmas in research? The following is a series of questions that can help people resolve ethical dilemmas:

**What is the problem or issue?**

It is always important to get a clear statement of the problem. In this case, the issue is whether to share information with the other research team.

**What is the relevant information?**

Many bad decisions are made as a result of poor information. To know what to do, Dr. S needs to have more information concerning such matters as university policies that may apply to this situation, the team's intellectual property interests, the possibility of negotiating

A dilemma arises when a personal choice and an ethical imperative are not in congruence.

some kind of agreement with the other team, whether the other team also has some information it is willing to share, etc.

**What are the different options?**

It is important to spell out the various options as well. People may fail to see different options due to a limited imagination, bias, ignorance, or fear. In this case, there may be another choice besides 'share' or 'don't share,' such as 'negotiation.'

**How do ethical codes or policies as well as legal rules apply to these different options?**

The university may have its own policies on intellectual property or data management that applies to this case. Broader ethical rules, such as openness and respect for intellectual property, may also apply to this case. Relevant laws that would apply to this case might include laws relating to patents, such as laws on prior disclosure and preliminary patents.

**Are there any people who can offer ethical advice?**

It may be useful to seek advice from a colleague, a senior researcher, your department chair, or anyone else you can trust. In this case, Dr. S might want to talk to her supervisor before making a decision.

After answering these questions, a person facing an ethical dilemma may decide to ask more questions, gather more information, explore different options, consider other ethical rules, and so on. However, at some point he or she will have to make a decision and then take action. Ideally, a person who makes a decision in an ethical dilemma should be able to **justify** his or her decision to himself or herself, as well as colleagues, administrators, and other people who might be affected by the decision. He or she should be able to articulate **reasons** for his or her conduct and should be able to explain how he or she arrived at his or her decision. He or she should therefore examine carefully the different options in light of the information and problems raised. The following are some questions one might consider at arriving at a final decision.

- Which choice could stand up to further publicity and scrutiny?
- Which choice could you not live with or be unable to defend?
- Think of the wisest person you know.
- What would he or she do in this situation?
- Which choice would be the most just, fair, or responsible?

- Which choice will probably have the best overall consequences?

After considering all of these questions, one still might find it difficult to decide what to do. If this is the case, then it may be appropriate to consider other ways of making a decision, such as going with one's gut feeling, seeking guidance through prayer or meditation, or even flipping a coin. Endorsing these methods in this context need not imply that ethical decisions are irrational or that these other methods should be used only as a last resort. The main point is that human reasoning plays a pivotal role in ethical decision-making but there are limits to its ability to solve all ethical dilemmas in a finite amount of time.

### 3.3 Bioethics

Bioethics requires special mention because of the current trend and progress in use of modern day molecular genetics, molecular biology, human reproductive technology, *etc* and its direct impact on the lives of millions of people and its assault on the common sensibilities of today's world.

The goal of Bioethics is not only the development of, or adherence to a code of set of precepts but a better understanding of the issues. It is prepared to ask deep philosophical questions about the nature of ethics, the value of life, what it is to be a person, the significance of being human. Bioethics embraces issues of public policy as well as the direction and control of science.

Examples: new technology (organ transplant) and developments (stem cell research) in health care and biomedical sciences; Increasing power of scientists and doctors over patients and communities; The value-laden nature of medical decision-making and a critical questioning of the bases of decisions; and New social perspectives – abortion, right to die, etc.

***Exercise***

*Just over three decades ago, the first test tube baby was born in England, and thus ushering in the age of in vitro fertilization (IVF). At the time, there was heated debate about whether the practice is ethical, but now the technology is so pervasive and common place not many people consider it a moral assault. Do you consider IVF unethical?*

*Human cloning is likely to be possible in the next couple of decades. The bioethicists are rushing to lay the ethical ground rules for the inevitable. However, some biologists do not consider producing human clones any more controversial than was IVF many years ago. Do you think there will come a time, when the majority in society will accept human cloning as a*

*simple medical procedure?*

*Are persons highly trained in the field of ethics more ethical than the average lay person on the street?*

### 3.4 Roles of ethical review board/committee

*National (centralized) or local review.* Ethical review committees may be created under the aegis of national or local health administrations, national (or centralized) medical research councils or other nationally representative bodies. In a highly centralized administration a national, or centralized, review committee may be constituted for both the scientific and the ethical review of research protocols. The authority of a local ethical review committee may be confined to a single institution or may extend to all institutions in which biomedical research is carried out within a defined geographical area. The main **responsibilities of an ethical review board/committee** are:

- to determine that all proposed interventions, particularly the administration of drugs and vaccines or the use of medical devices or procedures under development, are acceptably safe to be undertaken in humans or to verify that another competent expert body has done so;
- to determine that the proposed research is scientifically sound or to verify that another competent expert body has done so;
- to ensure that all other ethical concerns arising from a protocol are satisfactorily resolved both in principle and in practice;
- to consider the qualifications of the investigators, including education in the principles of research practice, and the conditions of the research site with a view to ensuring the safe conduct of the trial; and to keep records of decisions and to take measures to follow up on the conduct of ongoing research projects.

### 3.5 Ethical clearance procedures in Ethiopia

**Highlights of the review process**

The National Ethical Review Committee works under the auspices of the Ethiopian Science and Technology Ministry. The committee is composed of members with a diverse educational background drawn from different research institutes and universities. The committee's work is facilitated by the Office of the Secretariat and reports to the National Health Science and Technology Council of the Ministry. The committee is expected to be neutral and operate independently. The

Committee reviews research proposals on health issues, clinical trials and social science and behavioral research proposals on sensitive issues like HIV/AIDS. The ethical review process is rigorous. Researchers are expected to follow the guideline prepared by the Ministry in 2005. The guideline has detailed information on the obligations and responsibilities of the researcher, the rights of study participants, data safety and management procedures, material (specimen) transfer agreements and so on. The committee uses the following ethical review form while assessing the ethical implications of a proposed research project.

**National Health Science and Technology Council**
**National Ethical Clearance Committee**
**ETHICAL REVIEW FORM**

**Title:**_____

| No | Criteria/item | Rating |
|---|---|---|
| 1 | **Consent form**<br>**Does the consent form contain all the necessary information that the subject should be aware of?** | -yes<br>-requires revision<br>-no<br>-not applicable<br>-not attached |
| 2 | **Are the objectives of the study clearly stated?** | -yes<br>-no |
| 3 | **Are the methods ethically sound?**<br>**-**justice<br>-beneficence<br>-respect for persons | -yes<br>-not well described<br>-no |
| 4 | **Are provisions to overcome risks well described and acceptable?**<br>-DSMC | -yes<br>-no<br>-not applicable |
| 5 | **Are there provisions to provide standard/best proven care?** | -yes<br>-no<br>-not applicable |
| 6 | **Are the safety procedures in the use of vaccines, drugs and other biological products acceptable?** | -yes<br>-no<br>-not applicable |
| 7 | **Are the procedures to keep confidentiality well described?** | -yes<br>-no<br>-not applicable |
| 8 | **Are the proposed researchers competent to carry out the study in a scientifically sound way?** | -yes<br>-no<br>-not applicable<br>-unable to assess |
| 9 | **Does it have a material transfer agreement?** | -yes<br>-no<br>-not applicable |
| ***Recommendation: ----Approved ----Approved on conditions----Not approved*** | | |
| **Remarks:** | | |

**Summary**

**What are the fundamental research ethics principles?** All research involving human beings should be conducted in accordance with three basic ethical principles, namely respect for persons, beneficence and justice. It is generally agreed that these principles, which in the abstract have equal moral force, guide the conscientious preparation of proposals for scientific studies. In varying circumstances they may be expressed differently and given different moral weight, and their application may lead to different decisions or courses of action.

1.**Respect for persons/autonomy** incorporates at least two fundamental ethical considerations, namely: a*) **Respect for autonomy***, which requires that those who are capable of deliberation about their personal choices should be treated with respect for their capacity for self-determination; and b) ***Protection*** **of persons with impaired or diminished autonomy**, which requires that those who are dependent or vulnerable be afforded security against harm or abuse. Autonomy or respect for persons requires a commitment to ensuring the autonomy of research participants, and where autonomy may be diminished, to protect people from exploitation of their vulnerability. The dignity of all research participants must be respected. Adherence to this principle ensures that people will not be used simply as a means to achieve research objectives. According to this principle a study participant has rights to privacy and confidentiality.

**2. Beneficence** refers to the ethical obligation to maximize benefits and to minimize harms. This principle gives rise to norms requiring that the risks of research be reasonable in the light of the expected benefits, that the research design be sound, and that the investigators be competent both to conduct the research and to safeguard the welfare of ("mental integrity", psychological well-being) of the study participants. Beneficence further proscribes the deliberate infliction of harm on persons; this aspect of beneficence is sometimes expressed as a separate principle, **non-maleficence** (do no harm).

**3. Justice** refers to the ethical obligation to treat each person in accordance with what is morally right and proper, to give each person what is due to him or her. In the ethics of research involving human research participants the principle refers primarily to **distributive justice,** which requires the equitable distribution of both the burdens and the benefits of participation in research. Justice requires a commitment to ensuring a fair distribution of the risks and benefits resulting from research. Those who take on the burden of research participation should share in the benefits of the knowledge gained.

In addition to the three above mentioned established principles, some

bioethicists have suggested that a fourth principle, **respect for communities**, should be added. Respect for communities "confers on the researcher an obligation to respect the values and interests of the community in research and, wherever possible, to protect the community from harm". Some scholars believe that this principle is, in fact, fundamental for research when community-wide knowledge, values, and relationships are critical to research success and may in turn be affected by the research process or its outcomes.

**Why is research ethics important?** There are **several reasons** why it is important to adhere to **ethical norms in research**. First, some of these norms **promote the aims of research**, such as knowledge, truth, and avoidance of error. Second, since research often involves a great deal of cooperation and coordination among many different people in different disciplines and institutions, many of these ethical standards promote the **values that are essential to collaborative work**, such as trust, accountability, mutual respect, and fairness. Third, many of the ethical norms help to ensure that researchers can be held **accountable to the public**. Fourth, ethical norms in research also help to build **public support** for research. People are more likely to fund research project if they can trust the quality and integrity of research. Fifth, many of the norms of research promote a variety of other important **moral and social values**, such as social responsibility, human rights, animal welfare, compliance with the law, and health and safety. Ethical lapses in research can significantly harm human and animal subjects, students, and the public.

**Informed consent** is a process by which a study participant voluntarily confirms his or her willingness to participate in a particular trial/study, after having been informed of all aspects of the trial/study that are relevant to the study participant's decision to participate. Research on/with human study participants should be carried out only by, or strictly supervised by, suitably qualified and experienced investigators and in accordance with a protocol that clearly states: the aim of the research; the reasons for proposing that it involves human beings; the nature and degree of any known risks to the study participants; the sources from which it is proposed to recruit study participants; and the means proposed for ensuring that study participants' consent will be adequately informed and voluntary. The protocol should be scientifically and ethically appraised by one or more suitably constituted review bodies, independent of the investigators/researchers.

The following is a rough and general summary of some ethical principals that various codes address: honesty, objectivity, integrity, carefulness, openness, confidentiality, responsible publication, responsible mentoring, respect for colleagues, nondiscrimination, competence, legality and respect for intellectual property.

## Appendix I: Terminologies

**Assent:** Agreement of the potential study participant to participate in a research. It usually required for research involving children and adults with diminished capacity.

| Assent | |
|---|---|
| ≤ 6 yr | No assent |
| 7-12 yr | Separate assent form |
| 13-17 yr | Assent section of |
| Adult | informed consent |

**Respect for persons**
Autonomous persons
Autonomous choices
**Autonomy**
Freedom of will
Freedom of action
Free to choose and act
Privacy and confidentiality
Promotes informed consent

**Autonomy in research**
Voluntary participation
Adequate information to make informed consent
Comprehension
Full disclosure of risks and benefits
No undue inducement
Voluntary termination
Continuing disclosure
Legally authorized representative
Culturally appropriate consent

**Beneficence**
Common definition – acts of kindness or charity that go beyond strict obligation
To do good
Prevent evil or harm
Ought to remove evil or harm
Endeavor to benefit where possible
In health care; an obligation to improve health
In research; Maximize benefits and minimize risks of possible harms
Balance risks and benefits
Promotes risk benefit analysis, post trial benefits, etc
"I will follow that system of regimen which according to my ability and judgment, I consider for the benefit of my patients and abstain from whatever is deleterious and mischievous." Hippocratic Oath, 400 BC

**Types of harm**
Physical
Psychological
Financial
Harm to ones reputation

**Types of Benefits**
Individual benefit
Community benefits
Social benefits

**Types of Community Benefits, for example, in Health Research**
Provision of health care in resource poor communities;
Salaries, infrastructure, incentives to research participants, etc.
Sustaining health care improvements by planning for gradual phase-out with the community and local authorities;
Appropriate training and technology transfer; and
Access to trial products, infrastructure and knowledge by the research participants, the community and the host country.

**Community Benefits**
**Post study benefits may also include**:
a) disseminating the study results with the study participants, the community and health authorities;
b) presenting results in simple, understandable language; and
c) establishing personal contacts and attendance of community meetings.

**Justice**
To each his or her due
**Equal treatment** – Different treatment requires justification (experience, age, deprivation, competence, merit, position, etc.)
**What is deserved** – People should be treated fairly, and should be given what they deserve in the sense of what they have earned (Beauchamp and Childress)
Promotes issues on study participant selections, what is owed them, how they are treated during and after research, etc.

**Fair distribution**
Principles of distribution of burden and benefits
To each person an equal share
To each person according to individual need
To each person according to individual effort
To each person according to societal contribution
To each person according to merit

**Application to health research, for example,**
Recruitment of charity ward patients while benefits of health care enjoyed by private patients
Nazi use of war prisoners perceived as grave injustice
Tuskegee patients deprived of treatment when it was already available
Recruitment of vulnerable population because they are available, easier to manipulate and not because they manifest any condition related to the study
**Application to health research**
Applicant should not be selected due to social characteristics such as socioeconomic class or race, unless justified by study objectives
Women have been underrepresented in certain research studies
Counselor client relationship
Teacher student relationship

**Appendix II: International instruments and guidelines**

The first international instrument on the ethics of medical research, the Nuremberg Code, was promulgated in 1947 as a consequence of the trial of physicians (the Doctors' Trial) who had conducted atrocious experiments on unconsenting prisoners and detainees during the Second World War. The Code, designed to protect the integrity of the research subject, set out conditions for the ethical conduct of research involving human subjects, emphasizing their voluntary consent to research.

The Universal Declaration of Human Rights was adopted by the General Assembly of the United Nations in 1948. To give the Declaration legal as well as moral force, the General Assembly adopted in 1966 the International Covenant on Civil and Political Rights. Article 7 of the Covenant states "*No one shall be subjected to torture or to cruel, inhuman or degrading treatment or punishment. In particular, no one shall be subjected without his free consent to medical or scientific experimentation".* It is through this statement that society expresses the fundamental human value that is held to govern all research involving human subjects – the protection of the rights and welfare of all human subjects of scientific experimentation.

The Declaration of Helsinki, issued by the World Medical Association in 1964, is the fundamental document in the field of ethics in biomedical research and has influenced the formulation of international, regional and national legislation and codes of conduct. The Declaration, amended several times, most recently in 2000, is a comprehensive international statement of the ethics of research involving human subjects. It sets out ethical guidelines for physicians engaged in both clinical and nonclinical biomedical research.

Since the publication of the CIOMS 1993 Guidelines, several international organizations have issued ethical guidance on clinical trials. This has included, from the World Health Organization, in 1995, *Guidelines for Good Clinical Practice for Trials on Pharmaceutical Products*; and from the International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH), in 1996, *Guideline on Good Clinical Practice*, designed to ensure that data generated from clinical trials are mutually acceptable to regulatory authorities in the European Union, Japan and the United States of America. The Joint United Nations Program on HIV/AIDS published in 2000 the UNAIDS Guidance Document *Ethical Considerations in HIV Preventive Vaccine Research*.

In 2001 the Council of Ministers of the European Union adopted a Directive on clinical trials, which will be binding in law in the countries of the Union from 2004. The Council of Europe, with more than 40 member States, is developing a Protocol on Biomedical Research, which will be an additional protocol to the Council's 1997 Convention on Human Rights and Biomedicine.

Not specifically concerned with biomedical research involving human subjects but clearly pertinent, as noted above, are international human rights instruments. These are mainly the Universal Declaration of Human Rights, which, particularly in its science provisions, was highly influenced by the Nuremberg Code; the International Covenant on Civil and Political Rights; and the International Covenant on Economic, Social and Cultural Rights. Since the Nuremberg experience, human rights law has expanded to include the protection of women (Convention on the Elimination of All Forms of Discrimination Against Women) and children (Convention on the Rights of the Child). These and other such international instruments endorse in terms of human rights the general ethical principles that underlie the CIOMS International Ethical Guidelines. Nuremberg Code 1947 Declaration of Helsinki 2000 WHO guidelines

**References**

Angell, M.. (1988) "Ethical Imperialism? Ethics in International Collaborative Clinical Research." New England Journal of Medicine.

Berg, Bruce L. (1995). Qualitative Research Methods for the Social Sciences. 2nd ed. Boston: Allyn & Bacon.

Churchill LR, Assessing Benefits in Clinical Research. Why Diversity in Benefit Assessment Can Be Risky.

Dooley, D. (2003) Social Research Methods. 3rd ed. New Delhi: Prentice-Hall of India PLC.

Ethiopian Science and Technology Commission, National Health and Science and Technology Council, Health Department (2005) National Health Research Ethics Guideline, (4th Edit.). Addis Ababa, Ethiopia

Goldner, J. A. (2000) Dealing with Conflict of Interest in Biomedical Research: IRB Oversight as the Next Best Solution to the Abolitionist Approach. Journal of Law, Medicine and Ethics. 28: 379-404.
Jones, J. H. (1993). Bad Blood: The Tuskegee Syphilis Experiment. New York: Free Press.

Kuper, J. (ed.) (1987) Methods, Ethics and Models. London & New York: Rutledge & Kegan Paul.

Lewis, J. A. et al. (2002) Placebo-Controlled Trials and the Declaration of Helsinki. The Lancet Publishing Group. WWW. thelancet.com

Miller FG. (2003) Ethical issues in research with healthy volunteers: risk-benefit assessment. Clinical Pharmacology and Therapeutics.

Weijer C. (2000) The ethical analysis of risk. Journal of Law, Medicine & Ethics..

UNIT

• 6 •

# Reporting Research Findings

**Key Concepts**

| | |
|---|---|
| **Effective communication** | **Audience/reader** |
| **Purpose of report** | **Organization** |
| **Style** | **Delivery** |
| **Clarity** | **Informativeness** |

**Objective**

After completing this unit you will have acquired the skills necessary to effectively communicate your research findings using both a written and oral medium.

- to prepare a scientific presentation
- to identify your audience
- to organize your presentation to be informative
- stylistic issues to make your presentation interesting
- avoiding common errors

**Mode of Delivery**

The content of this Unit are delivered through lectures, mock presentations, and peer evaluation of mock presentations. For best outcome, the active and full participation of the entire class as an audience and evaluator of the mock presentations is essential. Students will be assessed based on assignments, class participation, and the mock presentation.

## Lesson 1: Writing a Scientific Report

In today's digitized world, written scientific reports are ubiquitously accessible to readers all over the planet. A masters thesis generated in AAU maybe read by another scientist sitting in Mongolia. Therefore, the revolutionary effect of the Internet and the digital work place has ratcheted up the need to produce written scientific reports that are of good quality and standard. In cyberspace, where a multitude of similar reports are available, the only reason that a reader chooses to read a paper is if it is informative, clear, and understandable.

Today, one of the most basic means of communication in our professional life is written presentation, such as scientific paper, technical report, assignment report, abstract, theses, conference report, *etc*. Written presentations have one striking characteristics which is different from that of verbal presentations, that is, written presentations are exposed to readers. The communication between author(s) and readers are in indirect way. In contrast, verbal presentations are exposed to an audience, Poster is a kind of combination of written presentation and verbal representation. Thus, to avoid any confusion on the part of the reader, written presentations demand logic, clarity and precision.

## 1.1 The fundamental elements of good writing

Writing is an art. And this lesson will not impart the artistic skills to turn you into an accomplished author. However, it will provide you with guidelines and tips that will improve your writing skills sufficiently to serve a purpose.

Writing is a purpose driven activity.

### 1.1.1 Purpose

A specific type of written presentation has to meet a specific need which depends on the purpose of the writing. We will limit our discussion to technical papers that are most likely to be read by individuals with sufficient level of scientific background. Even amongst these types of written papers, a variety of formats, editorial requirements, *etc.* are applicable depending on the particular area of scientific endeavor and/or the specific publication (E.g. journal, technical manual, *etc*). It would be unrealistic to cover all possible formats, therefore, we will limit ourselves to a generic format that is more widely pertinent to what you, as a graduate student, will encounter.

Writing, like any other human activity, is driven by a purpose. So the initial step to writing well is knowing the purpose of writing. In the case of scientific writing, the purpose is to get across an idea, a finding, *etc.* across to a wider readership. Once you become fully aware of the purpose of your writing, the quality of the paper you write will show substantial improvement (at least in form, if not in style). Hence, a poorly written paper is either a consequence of deficiency in understanding the purpose of writing, or lack of proper implementation.

The purpose of writing a scientific report is to communicate an idea or set of ideas to people who want to understand the level of scientific progress in a specific area of specialization, and many a

times to even carry the idea(s) further. Scientific progress is the cumulative effect of ideas that were effectively communicated over many centuries. Some ideas are obviously better than others and one cannot argue that effective writing by itself will ensure that the idea will push the frontiers of science. On the contrary, a very good idea that is not effectively communicated may be lost in the growing volume of reports and thus not impact or contribute to the advancement of science.

For this lesson, we will assume that you have a promising idea that will add value to the pursuit of knowledge or towards solving a problem. The idea could be a result from an experiment, a model to describe an event or phenomenon, or a new technique. If you do not have an idea that you wish you to communicate, then you should seriously reconsider whether preparing a scientific report is the right thing to do.

One does not write to himself, writing is targeted for the benefit of others.

### 1.1.2 The target audience

Once an idea has been identified or formulated, then the effort will be to present this idea in the best possible way to the target audience. Which brings us to the question, "Who is the relevant target audience?". Writing a scientific report to a narrow base of esoteric experts is not desirable. After all, we want the report to be read by as many interested current and future researchers as possible. In your case, it is safe to assume that the potential reader will be intelligent and have some basic scientific background, but no more. In other words, someone like you … a post-graduate student. Of course, at times it may be necessary to prepare a report for policy makers, general public, *etc.*, in these instances you should tailor your report to the perceived level of scientific understanding.

Focus on the need of the reader, not on the writer's desire.

Unfortunately, while writing their thesis, most graduate students focus on their advisor or at most the graduate examining committee as their target reader. This is a common fallacy that you need to avoid at all cost. Your thesis, your seminar report, *etc.* should be written for all interested current and future researchers. Not properly identifying your reader usually leads to some mistakes in writing (such as use of abbreviations).

Having properly identified the relevant reader of the scientific paper, we need to understand this audience. Anyone who picks up to read your writing is either interested in acquiring new information or achieving a better understanding. Therefore, in order to serve the reader, your paper should have pertinent information. Moreover, the information you would like to convey must be presented in an

arrangement such that the reader will not spend an inordinate amount of time in extracting the information. It is usually the case that graduate students tend to forget who the thesis/paper is being written for and thus their written products do not appeal to a wider audience.

### 1.2 The Organization

Again, please remember that we are here dealing with a generic scientific paper. Therefore, the mode of organization presented here is applicable in most cases, but not necessarily all cases. Regardless the mode of organization, organization is very important to convey your 'idea' in a comprehensive and meaningful way.

The key to making writing informative is organization.

Perhaps more frequently with graduate students than seasoned scientists, you will have a set of things you want to say and feel compelled to say it somewhere in the paper … which may not necessarily be the most suitable place. A hotchpotch of information is not the aim of writing a scientific report. Due emphasis should be given to how the flow of information is organized to attain a fluidity and cohesiveness to the reader. Remember you are writing to provide a scientific service to the reader, not to unload all that you know onto a white sheet of paper.

The organization of the paper refers to the structure, *i.e.* the sequence in which you present each type of information. The scientific report should have distinctive and clearly evident component parts. It is always desirable for you to create an outline of the paper based on the component parts and filling in the major points you want to cover in each part. This will organize your thoughts and will make the writing process less painful. Below you will find the list of the parts of a typical scientific report:

Sometimes you can judge a book by its cover.

- Title
- Acknowledgement
- Abstract
- Introduction
- Materials and methods
- Results
- Discussion/Conclusion
- References
- Appendices, where applicable

A more detailed discussion on what each component constitutes and an effective way to determine what type of information is included in

each component is presented.

1.2.1 Title

The title is a short statement that encapsulates the main thrust of the paper. Perhaps thousands of people will read the title, but only those interested will continue to read through the entire paper. But for those interested few, the first exposure they have to what the paper covers is the title. The title should accurately reflect the content of the paper. A specific and concise title is crucial to persuade the reader to continue reading the paper. As a general guideline, avoid overtly general terms, idiosyncratic abbreviations. And always pay proper attention to syntax that may convey unintended meanings.

Title should accurately reflect the content of the paper. A specific and concise title is part of the paper's life. General terms in the title are meaningless. Additionally, proper syntax has to be carefully arranged to avoid any misunderstanding. Abbreviations usually should not appear in the title.

The title is not the only item that goes on the title page. The list of authors is the next important item on the title page. Authorship represent honor and responsibility. The list of authors should include only those who made significant contribution to the work. Conventionally, the first author is the person who made the major contribution to the work and is responsible for most of the data presented in the paper. The last author is the principal investigator who initiated the idea and supported the study. The authors whose names are listed in between the first and the last are the people who contributed intellectually to the research significantly in the order of the list.

In your case, the thesis will only have your name. However, should your thesis work lead to a publication in a journal, others who contributed to the work, including your advisors. will be part of the list of authors.

An abstract is the summary of the paper that is read the most.

Depending on the type of publication, the month and year, institutional identifiers, *etc* will also make up part of the title page. Please consult the Council of Graduate Study's or your department's manual for the specifics.

1.2.2 Acknowledgement

The acknowledgement is non-contentious in most respects. Generally, those persons who have professionally contributed to the

work be it in kind or in ideas must be acknowledged. This is a professional courtesy that not only is a show of gratitude, but also truthfully indicates to the reader who has played a part in project.

Next, you also need to acknowledge the institutions that have provided funding, research space, manpower, *etc* towards your research project. This is particularly important since most of these institutions extend their resources with the express intent to have their names mentioned in publications. Not including institutional sponsors will likely result in these institutions being reluctant in future collaborations.

Finally, you may want to mention those individuals who have provided personal support and assistance that is separate from professional help. However, do not overdo it. It is not necessary to mention your entire extended family and their spouses.

A point of note: avoid using the publication from making political or religious declarations. Your scientific report is the result of a scientific endeavor; it is best to keep it that way. Mentioning God as the Almighty that made this work possible is not an appropriate acknowledgement. Or thanking a political party that has created the political system that enabled you to conduct your research is unseemly.

Be courteous at all times. There is no need to mention those individuals that hampered or somehow made your work more difficult. This is an absolute no-no. The scientific report is not the place to settle scores or air grievances … whether they be personal, professional or institutional.

### 1.2.3 Abstract

Even though, the abstract immediately follows the title page, it is usually best to write it after you have written the entire paper. Next to the title, the abstract is the next thing that an enticed reader will peruse. The abstract is a summary of the information in the paper. It enables the readers to identify the basic content of the document quickly and accurately. Therefore, in less than 250 words (may extend to 500 words, see specific guidelines), an abstract should include (1) the principal objective and scope of the investigation; (2) describe the methodology employed; (3) summarize the results; and (4) state the principal conclusion.

If you think this is easy to do, you will be mistaken. It is much harder to summarize an entire body of work in a few hundred words than it

is to write the entire paper. To appreciate the enormity of this task, try and summarize the most interesting work you have read into an abstract.

If the title is the bait that lures the reader, the abstract is the hook that captures his/her attention to continue reading.

### 1.2.4 Introduction

In writing the introduction, ask yourself, what is the problem? why am I and why would others be interested in it? And what is the body of scientific work that supports this work and makes it scientifically feasible?

You must remember that that there are slight variations in how the organization of the paper progresses. In some disciplines, there is a separate component that reviews the literature. So make note of these distinctions as you continue to read.

The introduction starts the paper itself. The purpose of the introduction should be to provide sufficient background information to allow the readers to understand and evaluate the results of the present study without needing to refer to previous publications on the topic. Your aim is to guide readers to understand your research; the introduction should present the nature and scope of the problem you studied. By reviewing the pertinent literature you orient the readers to the present problem that you are attempting to address. Readers are interested in knowing why you chose the research project and why it is that important. In this section, definitions of problem should be given with some explanations. Also, the necessary information related to the problem to be solved should be provided here. This part shows specific background of the project to readers.

Usually at the end of the introduction, you will insert an itemized list of the general and specific objectives/aims of the research project. This will provide the reader an anchor against which s/he will view your approach to the problem and the answer/conclusion you derive in the end.

### 1.2.5 Materials and methods

By now your reader is fully aware of the basic scientific work that has led to your research work, and what problem your research is attempting to address. In the current component, you will describe in

detail on how and with what means you accomplished your project.

The materials and methods section answers the question: “how did you study the problem?”. The contents of this component are discipline specific. In the social sciences, you may not have laboratory equipment, but you may list the questionnaire you used. It is also important to describe the experimental design used, and how the data was analyzed (the statistical tools employed – which is covered in the sister preparatory module “Quantitative and computational methods”). This will allow the reader to assess whether you have properly planned and executed the research project.

The information provided should be as detailed as possible. Remember you are not writing the scientific report to gather dust on some shelf. It is likely that another researcher with similar interests might want to replicate your experiments or employ your material and methods to conduct another experiment in a similar line.

### 1.2.6 Results

This component is the core section of the scientific report and will be heavy on tables, figures, charts, *etc*. The results component answers the question: “What did you obtain from the experiments you conducted?”. You are expected to present the results you obtained from the materials and methods described above. The presentation of the results must be clear and arranged in a logical order.

If your research was quantitative, then it is best to present your results in tables and figures instead of words. However, make sure that you properly label your tables and note the legends of your figures. Each table or figure should be a stand alone as an information snippet. The words in the body of the paper that accompany each table or figure are to provide further elaboration of the results. At times the reader may chose to skim through the charts, tables and figures presented in your results section to get a quick grasp of the results you obtained to help him/her decide on whether to read the entire paper.

It is important that you draw the attention of the reader to those results that you deem significant or interesting. But this is not limited only to those portions of the results that support your hypothesis, but also to those results that seem to go contrary to your expectation. Indicate trends or changes that the average reader may not easily observe.

The results component is the body of your entire work. There is always the temptation to not include those outcomes that do not support or go contrary to your expectation. Omitting these results is unprofessional and will not present the entire picture to your reader.

A not uncommon practice is to include comparative results from other works in the results section. This may be acceptable in some disciplines, but in most cases, the results component only states the results you obtained from your original work.

1.2.7 Discussion/Conclusion

Depending on your area of specialization this component may be called discussion or conclusion. It basically answers the question: “What do the results mean?”. The results you obtained are not isolated from previous scientific knowledge. Therefore, you not only provide the reader with interpretation of the results, but you are also expected to put your interpretation in context of the existing body of scientific knowledge.

At this point, you would have reached a point where you can incorporate your objective in the discussion and establish a clear and unambiguous statement on how your interpretation of the results has addressed your objectives.

A common mistake by graduate students is to make overreaching generalizations that go beyond the scope of the results you obtained. Avoid hyperbole at all costs! An illustrative example would be the graduate student who found that a nomadic community consumes an average of half liter of camel milk a day, and then extrapolates to state that an average Ethiopian consumes that amount of milk a day. Overreaching conclusions are hazards that, at times, even seasoned scientists fall into.

In totality, the results component should contain the following considerations: summing the work in the output of the work accomplished; give further research direction or suggestions. In this way, the paper leaves the readers with a clear impression about your work.

1.2.8 References

The references section lists all the previously published sources of information that you have cited in the body of the paper. Only the papers cited, not all the papers that you have read or consulted, are referenced. If you deem a source of information should be cited in

the references section, then you must have mentioned it in the body of the paper.

Sources of information are not limited to articles in refereed journals. At times you may even include unscientific sources such as newspaper articles, notes from interviews, *etc*. In rare occasions you may require to include unpublished results that you obtained through professional acquaintances.

The format in which the references are cited various from one discipline to the next. It is best to consult the conventional format pertinent in your area of study. However, generally, you include the authors, the title of the article, the journal name, the year of publication, the volume and number of the journal and finally the page numbers in which the article cited is found. When the source of information is a book, a newspaper article, web page, *etc*. the manner in which they are references may be different (Refer to Unit 3). The most important thing to keep in mind is that the references section is for the benefit of the reader. Should the reader wish to go back to the original paper s/he should be able to do so easily.

The reference section is the one section of a thesis or other similar publication that a graduate student gives the smallest attention to. But it must be remembered that, a person assessing your written report will view your references section as a bellwether on how meticulous you are in your work. A sloppily prepared reference section reflects negatively on the author of the paper. Do not assume that the person reviewing the paper will not pay due attention to the references section.

### 1.2.9 Appendices

The written scientific report may also include appendices where you may present forms used, a more detailed presentation of your results, *etc*. The inclusion of an appendix is decided on a case-by-case basis and is not essential to make the report technically complete.

### *Exercise*

*Do you think the purpose of writing a newspaper article and that of a scientific report are the same? How?*

*Does a novel (other work of fiction) require organization as does a scientific report? Discuss.*

## Lesson 2: Presenting Research Findings

At the end of the last lesson, we covered how to properly communicate research findings through written reports. Most often than not, you will be called upon to present the same findings as an oral presentation and an accompanying written report. And at times, you may also be asked to review literature and present your finding as an oral presentation.

An oral presentation, unlike written presentations, is a direct communication between presenter and audience. If writing a scientific report for the first time is viewed as challenging cerebral exercise analogous to mountain climbing, then oral presentation is even more exigent when you embark on it for the first time. If you approach it methodically however, it is not too difficult to undertake.

In this section, we will cover some basic guidelines that will help you prepare and execute both oral and written presentations effectively. Effectiveness, in this case, does not imply overwhelming your audience with mountains of indecipherable data thus leaving them wondering whether to admire your ability to actually understand the material or to be irritated that there time was wasted with no gain of information.

Presentation, particularly oral presentation, requires a lot of practice before you can master the art of gauging your presentation to your audience in a clear, interesting and informative manner. The content of this lesson will help you overcome some of the shortcomings commonly observed in a novice presenter --- typically post-graduate students.

### 2.1 Oral Presentation

Just over a decade ago, most public scientific oral presentations were supported with slides. Thanks to the ubiquity of computers and LCD projectors, the chore of having to take pictures of notes, charts and figures has now been supplanted by a presentation software (the most commonly used being PowerPoint™).

The presentation software makes the task of preparing, editing and displaying slides much more facile and user friendly. However, it goes without saying that one should be computer literate and possess the basic skills in using presentation software. It is beyond the scope of this module to delve into the mechanics of using

presentation software such as Microsoft's PowerPoint™. However, this material will be covered by the sister preparatory module on "*Computational and quantitative methods*". The discussion henceforth focuses on the style and substance of making an oral presentation and not on the techniques required to make PowerPoint slides.

2.1.1 Preparing an oral presentation

**Stylistic Issues: The Slide**

Despite the fact that it is commonly called "oral presentation" An oral presentation is equally visual as it is an auditory medium. Therefore emphasis should also be given to the way the slides are designed and presented.

The slide should be clearly visible and legible to the audience members sitting at the very back of the room. Therefore there are certain points to consider:

1. Layout: The background color of the slide and the color of the text should have a sharp contrast. If the background of the slide is dark then the text should be light in color and provide ample contrast ("light" does not necessarily mean "bright"). For example, if the background is midnight blue, then the text could be white or bright yellow. At times even different hues of color do not provide sufficient contrast. For example, using orange on black background is tiring to the eye and not sufficient contrast is available. If unsure about what color combination to use for the text and background, the safest choice is to use black text on white background.
2. Background: After you have chosen an appropriate background for your slides. Stick to your choice and use the same background throughout the presentation. Also, particularly for scientific presentations, a plain background is preferred (a gradient of the shades of the same color is also acceptable). If you are inclined to add graphic, picture, *etc.* in your background, make sure that it is subject appropriate and does not draw attention away from the text and figures that you are attempting to communicate. Party balloons, a motorcycle flying off a cliff, *etc* are not deemed appropriate.
3. Font: 'Small' case letters are easier to read than 'CAPITALIZED' letters. If you feel you need to use CAPITAL letters, use them sparingly. The type and size of

the font are equally important. Do not use *script* fonts; they may seem fancy on an invitation card, but are unsuitable for professional/ scientific presentations. Select a font type that is easily legible and has sufficient spacing between letters (do not use **condensed** fonts, where one letter appears to overlap with the next). As to the font size, a good starting point is twenty-four, however, you may need to adjust the font size particularly for titles, graph legends, *etc*. There is also a strong inclination to use **bold** font types throughout. This is not necessary: limit the use of bold fonts for titles, headers and words you want to emphasize.

The best way to assess whether your slides are clear and legible is to view them projected on a white wall or screen and yourselves seated a fair distance away (if opportunity allows, you should preview your slides in the same auditorium or conference room where the actual presentation is scheduled to take place). In this pre-presentation screening, view all your slides critically. If you need to make adjustments to enhance the view-ability of your text, figures, *etc*. then this is the best time to do it. This will help you avoid making apologies during the actual presentation for incompatible colors, fonts that are too small, *etc*.

As stated earlier, the oral presentation is a visual as well as an auditory medium. Most of your slides should contain figures (whether images, graphs or tables) whenever possible. You should limit the use of text only to state the problem, frame the problem in the appropriate context, summarize results and state major conclusions.

Even in cases where you need to use text, a slide with more than a few lines of text will bore your audience. State key concepts in bulleted phrases or short declarative statements and cover the details verbally.

One of the most common errors committed by graduate students is to write every single word on their slides in full sentences to help them remember what they want to say. This usually leads to the penchant of reading the text from the slide verbatim. It is safe to assume that the audience is literate and can read for themselves, making the presenter a redundant actor that does not add value to the presentation.

Moreover, crowding each slide with a dense thicket of text is mind-numbing. The same applies to tables that are overcrowded. Simplify

the tables so that you only have a few columns. If need be, breakdown your table into bite-sized snippets that the audience can absorb and digest.

Minor errors such as misspelled words, grammatical errors, punctuation mistakes, *etc*. convey to the audience that you have not put in enough attention to the work that you planned to present in public. The corollary from these types of errors is the audience will be skeptical about the soundness of the work you are presenting. If you did not pay attention to the material displayed in public, can you really be trusted to pay due diligence during the actual conduct of the research? Errors that you could have easily corrected in a few minutes will taint the entire body of your work. Avoid such errors at all costs! If your spelling and grammar is not up to par, you can always make use of the built-in spelling and grammar checker in the presentation software, or even better consult a friend or an advisor.

**The Presenter**

Even though a work being presented in an oral presentation may be a collaborative effort, it is customary that only one person takes up the role of a presenter. Particularly at the postgraduate level, you are most likely to be the sole candidate to prepare and present an oral presentation.

An oral presentation is not only a presentation of the body of your work, but you are also presenting yourself as the person who conducted the research project. So you should pay attention to your own present-ability as you do your work. Oral presentations, such as seminars and defenses are venues that provide you with an opportunity to impress your colleagues, and fellow scientists. Who knows, perhaps your future prospective employer may be in the audience!

There are accepted norms that a presenter should generally follow. Primary among these is physical appearance. Try and dress appropriately. There is no defined dress code, but there are certain "don'ts" that you should always follow.

- Do not dress shabbily
- Do not come with unkempt hair
- Do not wear slippers
- Do not wear jeans and T-shirt, or other extremely casual attire

The audience has taken the time and effort to attend your presentation; proper attire returns that show of respect. Further,

shabby dress unnecessarily draws the attention of the audience away from the slides and the core ideas you are trying to communicate.

Aside of your clothing and grooming, certain mannerisms may be magnified and in full display when standing in front of an audience. You may already have these mannerisms, or they may be the symptoms of standing nervously in front of an unfamiliar crowd. Regardless, you are not alone, anxiety over public appearances are all too common in persons who have little or no experience in public speaking. The mannerisms could be manifested in many ways, for example, gestures such scratching your nose or behind the ear, straightening your eyebrows, vigorously rubbing the palms, *etc.*; or they could be vocal such as clearing your throat frequently, pausing with “umms”, mumbling, *etc.*; or they could be motions, such as pacing back and forth, swaying on your heals, *etc.*

You, as the presenter, may not be aware of these symptoms of anxiety. It usually takes another person to point them out to you. But once you are made aware of the peculiarities, you should consciously try to suppress them while rehearsing your presentation. In time, as your exposure and experience in public speaking grows, you will gain confidence and will overcome the anxiety and the symptoms that go along with it.

**Organization**

A well-organized oral presentation is smooth and effectively communicates the core concepts of the presentation to the audience. The presentation could be a graduate seminar, thesis/dissertation defense, a scientific meeting talk, *etc*. Regardless the venue for the presentation, there are some basic organizational principles that are common to all.

The entire presentation should be related to the topic thesis, hypothesis, objective or question you are addressing. Side issues usually distract the audience from the core idea(s) you are trying to impart.

2.1.2 Practicing for an oral presentation

After completing the slide preparation, it is imperative that you rehearse the presentation.

It is not sufficient that you memorize every single word. The slides (as described above) are essentially talking points for you the

presenter and highlights for the audience. Practice the talk until it is smooth and you no longer require supplemental notes to guide you. Even for material that you are very familiar with, it may at times stump you … and the presentation is neither the time nor the place to pause in search of an appropriate word. But it is OK for you to prepare notes as a security blanket in case you hit a mental block.

It helps to memorize an opening remark for the beginning of the talk to break the ice, as well as alleviate the sense of anxiety that you may be feeling and propel you into the automatic mode. For example, you may say “Thank you everyone for coming to this talk.” or “I am happy to have this opportunity to deliver this talk.” Moreover, include transition sentences that will make the move from one slide to the next a natural progression. Also prepare closing remarks for the conclusion of the talk. Sentences that start with phrases such as “In conclusion …”, “In summary …” or “The final point I would like to make …” indicates to your audience that the talk is nearing an end.

It is not uncommon for inexperienced presenters to just giggle nervously, or say “That’s is it!” at the end of a talk. Have an ending prepared such as “Thank you for your attention, does anyone have any questions?” or “That concludes my talk, I will be happy to take your questions.”

There is no substitute for repeatedly practicing the talk. Once you have put the final touches to your preparation, rehearse and practice the talk until it becomes second nature and you no longer need to refer to your notes. Do it in front of a mirror, for friends, while walking, *etc.* The practice exercise will strengthen your confidence about the impending presentation, thus lowering your anxiety to a manageable level. Your goal when rehearsing should be to make the actual presentation seem effortless, well thought out and effective.

Oral presentations commonly have strict time limits for the presentation and QandA sessions. The rehearsal will also assist you in timing yourself. The rule of thumb is that it takes one minute per slide. Nonetheless, there is a lot of leeway depending on the content of a slide and how much you want to dwell on it.

The predilection of post-graduate students is to use up all the time allotted for the talk and the QandA session just for the talk, so as to cut back on the amount of questions they will receive. But you should remember that the QandA session is part and parcel of the presentation, and after sitting through your talk, the audience will want to and has the right to ask questions at the end.

If you have practiced sufficiently and adjusted your presentation to the time allotted, there will be no need to skip over slides without discussing them, or to increase your pace to finish on time. After all, the oral presentation is not for your benefit, but for the benefit of the audience.

2.1.3 Delivering an Oral Presentation

**The talk**

If you had sufficient practice with your presentation, the delivery of the oral presentation will be straightforward and easy. Regardless, there are certain points you should heed during the actual delivery of the oral presentation. Moreover, the points we discussed above in terms of your personal appearance, the stylistic and editorial issues of the slides, *etc* all contribute to the success --- or failure of the effectiveness of the presentation.

The seminar or thesis defense is a professional talk --- make your talk professional. A few pointers are:

- Before heading to the venue of the presentation, it will be extremely helpful to have copies of the abstract of your presentation to later handout to the audience. Additionally, you should prepare a few items that the person introducing you for the day can refer to during the introduction.
- Begin your presentation on time. You should actually arrive at the venue of the presentation well ahead of time to set up your audiovisual equipment and to check that they are working appropriately. Moreover, arriving early will give you the opportunity to check that your slides are clearly view-able to the audience in that particular room/hall and what lighting conditions are ideal.
- Familiarize yourself with where the light switches are located, how the audiovisual equipment works, and how to get on and off the stage if there is one.
- Arriving early will also afford you some time to discuss with the organizer(s) of the seminar about outstanding issues such as the preparing copies of the abstract, to go over the introductory notes, *etc*.
- If you have availed yourself on time and set up your gear for the presentation, the actual start of the seminar is up to the individual organizing the event. The organizer may decide to wait a few minutes to allow the audience to take their seat, to allow invited guests to arrive, *etc*. These considerations are up to the organizer, therefore, do not

be pushy in insisting to start on time. You must make allowance for time that may be wasted before the start of the talk. Therefore, it is not advisable to have made prior plans to attend to immediately after the end of the seminar. If you are in a hurry to leave because of another engagement, your impatience will be evident and not kindly received.

- During the presentation, project your voice to the person seated at the very back. This does not mean you should shout, but that you speak loud enough to be heard. This may not be a major problem if the venue is equipped with a sound system.
- Enunciate your words clearly so that your audience is not left guessing what it is you said. Mumbling through a talk usually means you will lose the attention of your audience.
- Do not speak in a monotone. If you sound bored about your own presentation, it will be hard to raise the interest of the audience.
- It is natural to be nervous at an oral presentation and thus talk rapidly to get over the process as quickly as possible. If you have rehearsed your talk, this should not be a major problem, but it could still arise. In such instances focus on talking deliberately and purposefully. This will dampen your urge to rush through the presentation.
- Make eye contact with your audience. One of the symptoms of anxiety is to face the slide projection on the screen to avoid having to look into a room full of people who hang on your every word. Avoiding eye contact sends the subtle signal that you are unsure and ill at ease. Moreover, if you are turned away from your audience, your talk will not be audible beyond the first few rows in the room.
- Take sufficient time to describe the axes on graphs, the symbols in your figures, the columns in your tables, *etc.* Even though you are seeing the slides for the umpteenth time, remember that this is the first exposure your audience has to them. You should provide your audience with basic descriptions of figures to help them assimilate the information.
- Draw the attention of your audience to the points you wish to highlight by using a pointer such as a laser, a stick or the computer mouse. If none of these tools are available to you, you may also use your finger.
- Make sure that you do not block the view of the audience. This can be easily achieved by positioning the visual aid in a neutral spot where you or others will not be an

obstruction.

- When making reference to the work of others, always mention the name(s) of those responsible for the work. Do not just say “The people who did this work …” or “They determined that …”. Instead say “Fisseha *et al.* studied this same problem …” or “Netsanet and Samrawit suggest …”. When your presentation is a course seminar where all the data presented is generated by others, it is prudent to source the citation on the slide (Usually at the bottom of the slide).
- When discussing a certain value or figure, actually state the number or outcome. It is not uncommon to hear a graduate student say “The growth was by <u>that</u> much …” *[while pointing at the number]* without actually stating the value; or “You can see the trend in the graph …” without actually describing the trend. Alternatively, it is best to say “The growth was 25 percent more …” *[while pointing at the number]*; or “The trend shows a steep decline…” *[while pointing at the graph]*.
- Begin the presentation confidently, progress from one slide to the next smoothly and end the presentation gracefully. This can easily be achieved by the pointers indicated above: have an introductory remark, transition statement and concluding remark prepared and memorized.
- If you had assistance from others during the conduct of your research project (such as your research advisor, a statistician who helped with the data analysis, a fellow scientist who loaned you equipment, etc.) then it is expected that you acknowledge and thank these individuals. This is usually done on the very last slide of the presentation.
- Actually, the more seasoned presenters usually have one last slide after acknowledgements. In order not to leave the screen blank, it is desirable to have a slide with a pithy comment, an overarching statement, a relevant picture, *etc* that will stay on the screen during the QandA session.
- After you have completed your talk, ask the organizers to please turn on the light so that the QandA session will be conducted in an illuminated room. A lit room will allow you to easily and quickly see those participants in the audience who are raising their hands to ask a question or make a comment. It will also make the back and forth with the audience more engaging (Have you ever tried to talk to someone in a dark room?).
- Finish on time! The beginning of the talk is usually beyond

your control. But it is up to you to make sure you do not go over the allotted time.

**Questions and Answers**

At the end of the talk, you should have opened the floor by inviting questions about the talk. At this juncture, it is important to note that the success of your talk in terms of arousing interest and being informative can indirectly be gauged by the type and number of questions asked. Particularly with graduate students such as yourself, the tendency is to inundate the audience with vast amounts of incomprehensible information to illicit awe at your mastery of the subject while at the same time to preemptively dissuade the audience from asking questions.

If the audience does not come forward to ask questions, it is either because it did not find the presentation interesting or else no new information has been gained. Having several people raising their hands to ask questions is actually a confirmation that the audience is engaged and is a form of flattery to the speaker.

That said, even with a very interesting presentation, the QandA session is also limited by time and therefore, you should try and give as many people as possible the opportunity to ask. Usually, at the end of the talk, the organizer of the seminar will take the floor alongside the speaker and thank the presenter and open the floor for questions. At times the organizer will take the lead in identifying persons in the audience who want to pose a question; at other times the speaker him/herself may be the one leading the QandA session. (This is the type of issue that you, as the speaker, should discuss before the presentation).

To keep the rest of the audience involved, it is always good to restate a question as you understand it before beginning to answer. This will give the entire audience a chance to hear the question, and the one asking the question a chance to see if you have understood the question put forth. If you do not clearly understand the questions posed, do not feel obliged to answer --- instead, politely ask the person to clarify or repeat the question.

Once you are satisfied that you understand the question, and the person asking seems likewise satisfied, then proceed to answer the question to the entire audience and not to just the person who posed the question. At all costs, try and avoid turning the QandA session into a dialogue between yourself and the person asking the question. At times, it is probable that the person is not satisfied with the

answer and may pose a follow-up question. In such instances, it is customary to attempt to clarify your answer. But if the person is insistent and continues to ask subsequent questions, you should courteously decline to engage in a verbal altercation with a single member of the audience. You may say things like “Perhaps, I have not clearly understood the question. I would be happy to continue this discussion right after the talk.” Or “That probably requires a fair amount of time to discuss. Will you be available to continue this after the talk is over?”

Never be rude to the audience or a member of the audience! An audience member who is persistently and insistently asking questions is not because s/he wants to embarrass you in front of your peers, but rather because s/he wants to engage in an honest scientific debate about a matter of importance or interest to him/her.

The one thing that the vast majority of graduate students fear is being asked a question that they have no answer for. If you have had sufficient preparation for the talk, and you know the subject material well, this should not occur frequently. But you must remember, that even the best experts in any field do not have all the answers. If you do not know the answer to a question, do not just state “I do not know the answer”. If you have absolutely no idea on how to answer the question, you can simply acknowledge the importance of the question and state that you do not have a ready answer. For example, you can say “That is really an interesting question, but I can not provide you with a satisfactory answer now.” Or “ Your question is a very good observation, if you have the time, I would like to hear your thoughts right after the talk is concluded”.
But if you can, it is always better to speculate than not provide a response to a question. Just make sure that the audience fully understands that you are merely speculating and not stating a definitive answer.

DO NOT under any circumstance make up an answer if you do not have one! Fibbing an answer usually leads to more questions on the topic for which you are not equipped to deal with. Making up a false answer diminishes your credibility as a scientist in the eyes of your peers, and will significantly lower the acceptability of your otherwise well prepared and delivered talk.

2.1.4 Attending other oral presentations

In most instances, particularly during scientific symposia, there will be other presentations scheduled along with your own. This may also hold true where you have several thesis defenses or seminar

courses presentations scheduled in succession.

In such situations, it is extremely impolite to just show up to deliver your talk and then leave without attending the other talks. It is professional courtesy to attend as many talks as possible within a single session, if not all of them.

This may mean that you will be attending talks that you have tangential or no interest in, or in an extreme case, you cannot follow the content very well. Regardless, professional courtesy dictates that you continue to attend such talks. As much as possible, listen closely and try to acquire as much information as you can. You should pay particular attention to the conclusion so that you can at least take away something from the talk.

### 2.2 Research Seminars

Research seminars are presentations of original research conducted by the presenter only or the presenter in collaboration with other colleagues who have contributed to the work. In the case of MSc/MA students, the most likely and only time you will deliver a research seminar is during the defense of your thesis. However, research seminars also include presentations at symposia, conferences, *etc*. that communicate your original research work to a wider pool of other interested individuals.

If the presentation is a product of your own research, then the topic is your research, and the remaining components of your presentation will be the methods employed, the results obtained, the conclusion drawn and at times the recommendations made. In addition, you should survey the current literature related to your area of research and integrate it into your presentation. In most cases, the literature search would already have been mostly done during the development of the research proposal and write-up of the thesis. The methods used, the results obtained and the conclusions and recommendations drawn should come naturally since it is your own work.

A research seminar is typically organized with the same order and elements of a research publication, that is: Introduction, Objectives, Methods, Results, and Conclusions/ Recommendations; and the Acknowledgement (where appropriate) usually comes at the end in an oral presentation.

## 2.3 Course seminar

A course seminar's primary function is to succinctly review recent progress on a particular topic. Overall, the paper summarizes the current state of knowledge of the topic. It creates an understanding of the topic for the reader by discussing the findings presented in recent original research papers.

There is an inclination among graduate students to view course seminars as a report. It is not merely a report on some references you come across. Instead, it is a review process that synthesizes the results from several primary publications to produce a coherent argument about a topic or focused description of a field. The course seminar should succinctly review recent progress in a particular topic. Overall, the paper summarizes the current state of knowledge of the topic. It creates an understanding of the topic for the reader by discussing the findings presented in recent research papers.

When the presentation is a graduate seminar course, it is likely that you will select a topic in conjunction with your seminar advisor. The topic should encapsulate the hypothesis or question you are trying to address. It is important that the topic not be too broad since the seminar has a short time restriction: but the topic should neither be too narrow such that the available background material is insufficient to make the seminar factual and interesting. Once you have selected a topic, clearly state the hypothesis or question at hand. You then proceed to collect the relevant data and do a thorough analysis of the data. This should not be limited to those studies that support your hypothesis, but should also touch upon those that contradict your hypothesis or offer alternate hypothesis.

### *Exercise*

*What are some of the consequences of preparing slides with the entire talk and reading each word verbatim? Think in terms of voice projection, maintaining eye contact, keeping the interest of the audience.*

*As regards to question 1 above, would it be better to read of your notes instead of the slides?*

*What would be the best way of suppressing peculiar mannerisms that surface during public speaking?*

## Summary

The culmination of a research project is the dissemination of the output to the wider scientific community. The communication of the research outcome can be in the form of a written report, an oral presentation and/or a hybrid of the two (poster).

Aside of the factualness of the report, there are also other points to consider to ensure that the 'idea' you are trying to convey is effectively communicated.

Always remember that scientific findings are reported for the benefit of the reader/audience. And keep in mind the purpose behind a scientific report is to convey an 'idea'. Hence, your report must be clear, well organized, thoroughly edited, informative and interesting. If you can not attract and then capture the attention of the reader/audience your scientific report will not garner any interest from your colleagues and peers.

Common errors in written a report, such as misspelled words, in accurately cited reference, *etc* will diminish what may otherwise be a well written report. Be meticulous in your writing to maintain the credibility of your report. Also with oral presentations, stylistic mishaps of slides and peculiar mannerisms of the presenter lessen the audience's reception of your presentation.

Particularly with written reports, there are variations in terms of the organization, format and style of writing from one field of specialization to the other. You must familiarize yourself with the accepted norm within your area of study.

## Assignment

1. Why do you need to effectively communicate your research findings?

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2. Where, within a written scientific report, is it most appropriate to include your opinions as regards your findings?

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3. You find, in a published paper, a very well written sentence that captures exactly what you have been trying to compose yourself. You decide to use the sentence within your thesis without citing it. You justify this to yourself by saying that you had the idea but just did not have the words for it until you came across this sentence. Would this be an acceptable practice? Why?

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4. What do you believe is your biggest drawback in delivering a public oral presentation? How do you propose to overcome it?

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5. As a graduate student you will have ample opportunity to attend various seminars, conferences, workshops, thesis/dissertation defenses, presentation by guest speakers, *etc.* What would be the benefit of attending as much of these as possible?

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6. Clarity in writing is essential in any scientific report. At times, a novice scientist may try to impress the reader with an overtly complex wording and turn of phrase. For example, can you re-write the following saying in everyday language that most anyone can understand: “Positioning the non-motorized mobility contraption anterior to the equine.”

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7. By now, you would have completed, or nearly completed your mini-proposal. Summarize your mini-proposal in 60 words of less.

## References

Alley, Michael (2008) *The craft of scientific presentations: Critical steps to succeed and critical errors to avoid.* New York, Springer-Verlag, LLC.

Alley, Michael (2008) *The craft of scientific writing*, 3rd Ed. New York, Springer-Verlag, LLC.

Jackson, Sherri (2007) *Research methods: A modular approach.* Cengage Learning.

## Comments and suggestions

The compilers of this module have exerted due diligence to make it as complete and accurate as possible in short period of time. Regardless, it is possible that you will come across errors, omission, etc. We would be very grateful if you would communicate your comments and suggestions for further refinement of this module.

You may write your comments on this sheet of paper and submit it to your instructor or email your comments to abiyze@yahoo.com (please indicate in the subject line "Comments on Research Methods Module".