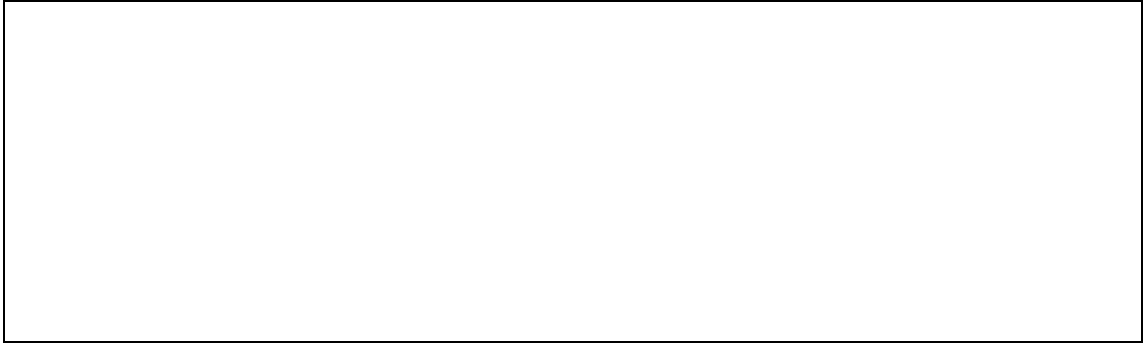




# **Educational Research**

**A student's manual for Higher Diploma in Educational  
Management**





**VVOB (The Flemish Association for Development Cooperation and Technical Assistance)  
and**

**KTTC (Kenya Technical Teachers College)**

**All rights reserved.** No part of the publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior written permission of the VVOB, Handelsstraat 31, 1000 Brussels, Belgium OR KTTC, P.O. Box 44600, Nairobi 00100, Kenya. Non-commercial reproduction by photocopying is permitted, and encouraged, but such copies are to include the credits page with the names of writers the funding organization appearing.

The development of this manual was funded by



**The Flemish Association for Development Cooperation and Technical Assistance**

Writers: Jane Safary  
Cyril Owiso

**1<sup>st</sup> edition, March 2006**



## INTRODUCTION

This manual is designed for students taking the research methods course at Kenya Technical Teachers College Distance Education and Open Learning (DOEL). It can also be useful to students undertaking research-based courses in other institutions. As a student, you will be able to develop your knowledge and skills in carrying out research independently.

The manual is organized into eleven sections.

**Section One** introduces you to the meaning of research. This section provides information that will enhance your understanding of research and help you appreciate its significance.

In **Section Two**, you will explore various types of research and the way they are classified. You need to critically examine each type to be able to select suitable ones for your study. The research designs and factors affecting them are highlighted.

**Section Three** explains the process of conducting research. Major steps in research are outlined to familiarize you with the process. Distinguishing features of quantitative and qualitative research processes are discussed.

**Section Four** introduces you to the meaning of a research problem. You will be able to explore various sources of information to use in identifying a suitable research problem for your study. This is a critical starting point for a good study.

**Section Five** provides a comprehensive guideline that will assist you in developing your research proposal.

**Section Six** highlights various data collection techniques and how to design and use them. You will use this section to develop your data collection process.

**Section Seven** explains various sampling techniques. Careful choice and use of relevant sampling methods is necessary to secure valid and reliable data.

**Section Eight** explains suitable methods and procedures for processing, and analyzing your data. In the section, quantitative (statistical) and qualitative techniques of data analysis are explained, including how and when you can use them in your study.

**Section Nine** provides useful guidelines in report writing. This will be useful to you in compiling your findings after data analysis. The quality of your research work will be assessed on the basis of your research report.

**Section Ten** gives you an opportunity to develop your skills in electronic research (E-Research).

**Section Eleven** explores the importance of ethics in your study. You are expected to appreciate and apply ethics in the research process.

It is our hope that this manual will be invaluable in promoting your research capacity for future applications.

## Visual sign posts used in this manual



**Expected learning outcomes**



**Reflective activity**



**Written activity**



**Internet search**

## Table of contents

Introduction.....	iii
<b>SECTION 1</b>	<b>INTRODUCTION TO RESEARCH</b>
	<b>METHODOLOGY..... 1</b>
Topic 1	Defining research..... 1
Topic 2	The importance of research..... 3
Topic 3	Historical development of research..... 6
<b>SECTION 2</b>	<b>TYPES OF RESEARCH..... 9</b>
Topic 1	Possible criteria for classifying research..... 9
Topic 2	Classifying research by purpose/ function ..... 11
Topic 3	Classifying research by type of data..... 15
Topic 4	Classifying research by methods..... 18
Topic 5	Research designs and factors affecting them .....29
<b>SECTION 3</b>	<b>THE RESEARCH PROCESS..... 37</b>
Topic 1	How to design a research study..... 37
Topic 2	The main steps in conducting research..... 41
Topic 3	Using the quantitative and qualitative research... 44
<b>SECTION 4</b>	<b>THE RESEARCH PROBLEM..... 51</b>
Topic 1	The research problem..... 52
Topic 2	Selecting a research problem..... 53
Topic 3	Problem identification..... 54
Topic 4	Characteristics/ criteria of a good research Problem..... 56
Topic 5	Variables in research..... 58
<b>SECTION 5</b>	<b>WRITING A RESEARCH PROPOSAL..... 70</b>
Topic 1	Meaning and importance of a research proposal...70
Topic 2	Types of proposals.....73
Topic 3	Format of a research proposal..... 74
<b>SECTION 6</b>	<b>WRITING A RESEARCH PROPOSAL..... 99</b>
TOPIC 1	Meaning and importance of a research proposal ...100
Topic 2	Types of proposals.....100
Topic 3	Problem identification.....101
<b>SECTION 7</b>	<b>METHODS OF DATA COLLECTION..... 118</b>
Topic 1	Importance of research data.....118
Topic 2	Importance of research data.....122
Topic 3	Instruments of data collection.....



<b>SECTION 8</b>	<b>SAMPLING AND SAMPLING PROCEDURES.....</b>	<b>118</b>
Topic 1	What is a sample? .....	118
Topic 2	Sampling methods.....	122
<b>SECTION 8</b>	<b>DATA ANALYSIS .....</b>	<b>128</b>
Topic 1	Introduction to data analysis.....	129
Topic 2	Data processing.....	131
Topic 3	What data analysis means.....	141
Topic 4	Descriptive statistics.....	143
Topic 5	Measures of central tendency.....	147
Topic 6	Means of variability.....	149
Topic 7	Measures of associations.....	150
Topic 8	Inferential statistics.....	165
<b>SECTION 9</b>	<b>REPORT WRITING.....</b>	<b>184</b>
Topic 1	Research report format.....	185
Topic 2	Dissemination of research.....	196
<b>SECTION 10</b>	<b>INTEGRATING ICT IN EDUCATIONAL RESEARCH.....</b>	<b>199</b>
Topic 1	Importance of ICT in research.....	200
Topic 2	Internet research.....	200
Topic 3	The qualities of an internet researcher.....	202
<b>SECTION 11</b>	<b>ETHICS IN WRITING.....</b>	<b>212</b>
Topic 1	Plagiarism.....	213
Topic 2	Informed consent.....	214

## SECTION 1

### INTRODUCTION TO RESEARCH METHODOLOGY

#### Introduction

This section introduces you to research methodology as a student enrolled in the Higher Diploma in Educational Management course through Distance Education and Open Learning (DEOL) programmes or any other research methodology programme. The purpose of this section is to provide information that will help you understand the meaning and the significance of research.

#### TOPICS

- The importance of educational research
- What is research?
- Why is research important?
- Historical development of research
- Conclusion



#### LEARNING OUTCOMES

In this particular section you will be able to work through the meaning and significance of research methodology.

This will enable you to explain

- The meaning of research
- The importance of educational research
- Challenges facing educational research

#### TOPIC 1: Defining research

The term research is a relative concept derived from the French verbs *rechercher* and *chercher*. Research stands for an activity that involves searching, investigating, search for truth or search for knowledge.

The term research also has some technical definitions. Research may be defined as a systematic and objective analysis and recording of controlled observations that may lead to the development of generalization, principles or theories resulting in prediction and possible ultimate control of events [Best, John and Kahn, 1993: 20].

Another definition by Mugenda and Mugenda [1999] states that: research means, to carry out a diligent inquiry or a critical examination of given phenomenon. It implies exhaustive study, investigation or experimentation following some logical sequence. Therefore, research means a continued search for new knowledge and understanding of the world around us.



### Activity

*Look at any two definitions of research and come up with what they have in common.*

You may have noted the following terms used in defining research:

- Study
- Analysis
- Examination
- Investigation
- Systematic/logical sequence and so on.

### Educational research

It is also important to briefly outline what our focus in this study manual is on the educational sector.

Educational research is that activity which is directed towards the development of a science of behaviour in educational institutions (Travers, 1990). Mwiria and Wamahu (1995) define educational research as a scientific or systematic and objective activity aimed at developing a theory of learning - or improving education for rural development.



### Activity

*Think of three examples of the kind of topics educational researchers might investigate.*



### Activity

*Define the term educational research using the information presented in Topic 1*

## TOPIC 2: The importance of research

Research is not merely a systematic collection of controlled observations and objective analysis leading to the development of generalizations, principles or theories resulting in prediction or ultimate management of events or solutions to problems. It is a significant aspect of an academic programme and should not be viewed as the role of the "research supervisors" in institutions of academic excellence.



### Activity

*The examples you gave in the previous Activity on educational research, may have included:*

- 1. Poor performance in mathematics by girls*
- 2. Effect of drug abuse on learning among adolescents in Nairobi Province*

*List down all the effects that use of drugs may have on adolescents' learning.*

The question on drugs was asked during a public lecture on "substance abuse among the youth" and the following responses were recorded. Does this compare with your list?

- Lack of concentration
- A drop in performance
- Lack of interest
- Truancy / Frequent absenteeism
- Poor health
- Carelessness in class work
- Loss of self-confidence

Research into the issue of effect of drugs would analyze in-depth the relationship between drugs and these possible effects.

### **Uses of educational research**

Various reasons are given for conducting educational research. Educational research could be put to many uses some of which are listed herein:

- a) Educational research is considered a problem-oriented activity that aims at improving conditions or solving problems in education. In this way, it provides new knowledge about education. This knowledge is then applied to improve educational practice. For example, a study on "The effect of teaching methods on students' performance". In this example, the research findings can help improve the teaching learning process, the curriculum design and students' performance.
- b) Empirical educational research also aims to improve decision-making and planning in education. For planners and policy makers to make sound judgment, their decisions depend on research findings.
- c) Research can be undertaken to satisfy an individual's curiosity or to spell out rumours about negative effects of an institution. For instance, an institution may introduce a new programme, like the Distance Education and Open Learning (DEOL) or team teaching, and then conduct empirical research to establish the strengths and weaknesses of the programme among the teachers, students and parents. If the findings show the unpopularity of DEOL one can look at the reasons for this so that DEOL can be improved. On the other hand, if it proves successful, then it can be developed and expanded further.
- d) Applied research, exploratory research, cause - and - effect research, and policy research may deal with interventions that improve, for example;
  - ✓ Students' learning
  - ✓ Teachers' morale
  - ✓ Promotion of self-reliance or social equality through education.



### Activity

*Think about interventions that can lead to "improvement of students' learning and achievement" in your institution.*

Here are some responses you could compare with the ones you gave:

- Teaching learning resources
- Curriculum materials
- Teaching methods that are learner centred
- Activity based lesson plans

e) Research helps to discover new knowledge that emanates from the discovery of new facts, their correct interpretation and practical application. There are other sources of knowledge. However, scientific research remains the most efficient and reliable source of knowledge because it seeks demonstrable truth that is accurate. However, qualitative research sometimes establishes subjective truth with recommendations that will only apply within the research setting.



### Activity

*Think of any other sources of knowledge besides research. List three of them down.*

Here are some of the sources that the students of a research course came up with during a brainstorming session, in class.

- ✓ Experience
- ✓ Tradition: cultural values, norms, rules and standards.
- ✓ Authority: Expert opinion
- ✓ Intuition, that is, perception and insight into phenomena by instinct.

Does your list concur with this? You could now try and see if you can explain these four sources of knowledge citing relevant examples.

- f) The other use of research is to describe phenomenon. In order to identify any event accurately one needs a thorough description, for example shape, size, weight, height, age, colour change over time and so on. A description then provides knowledge that enables prediction, which is the ability to estimate phenomenon, A, given phenomenon B. A common example would be knowledge about students' performance in trial examination enables us to predict their performance in the national examination.
- g) Research enables control. In scientific research, control is concerned with the ability to regulate the phenomenon under study. One phenomenon is manipulated in order to exert control over another.
- h) Research enables theory development, which involves formulating of concepts, laws, and generalizations about phenomenon. Research is conducted in an attempt to challenge existing theory; which is sometimes referred to as verification of theory. For example, do all human beings have a self-actualizing tendency [Abraham Maslow; Carl Rogers]

### **TOPIC 3: Historical development of research**

At the beginning of this section, you were introduced to the meaning of research. One defining characteristic is that research is a way of investigating, which leads to development of knowledge about phenomena. Examples of knowledge gained through research include: facts, principles, theories and generalizations which help us to explain, describe and predict phenomenon.

People developed knowledge variously before scientific research methods came to existence. Kerlinger (1986) explains that four general ways of knowing were used, namely:

- Method of tenacity
- Method of authority
- The *priori* method
- The method of science

The *method of tenacity* is where people held firmly to the truth because they have always known it to be true. Facts or evidence to support the truth was not a major concern. In this case, the validity of such truths would be enhanced, as people repeatedly regarded them as truth. This is a situation where, despite clearly conflicting facts, people continually clung to their beliefs.



## Activity

*Identify two examples where people cling to beliefs as truths, in your own community.*

The *method of authority* emerged as another way of fixing beliefs. It refers to the means of established belief. For instance, if the Bible says it, then it is so. In some populations, an idea that is based on tradition and public consensus is viewed as truth. Pierce in Nagel (1934) points out that method of authority is superior to the method of tenacity. A large body of facts and information is developed through the method of authority.

A third way of developing knowledge is the *priori method*. It is also referred to as the *method of intuition* (Cohen and Nagel, 1975). The *priori* position is based on logical reasoning and not merely on experience. Reason may sometimes be biased because facts or evidence could be lacking to support it.

The *method of science* forms the basis of current research studies. This method is based on: development of truth that is independent of our opinions, beliefs or simply reason. Pierce in Buchler (1955) says that the method of science emphasizes that: there are real things whose characters are entirely independent of our perceptions about them.

The scientific method forms the basis of modern quantitative research. In this case, research is seen as an investigation, which involves careful observation and measurement of phenomenon. The measurement is carried out by means of objective or reliable instruments. The instruments generate data, which is then subjected to statistical analysis. The results of statistical analysis are used to explain, describe or predict the phenomenon, which constitutes new knowledge. The investigation must, however, be based on hypothesis. The hypothesis is verified through data collection and analysis.

## Conclusion

In this section, you observed that research is an investigation that is systematic, objective and scientific. The purpose of the investigation is to discover new knowledge; apply existing knowledge or interpret current



knowledge. This knowledge represents facts, principles or theories that enable us understand, explain and control phenomena.

Research plays significant roles in educational practice. It enables us to describe, explain, predict and evaluate educational programmes. This enables educational practitioners to control educational programmes to achieve desired outcomes.

## **SECTION 2**

### **TYPES OF RESEARCH**

#### **Introduction**

In this section, you are introduced to various types of research. This section will guide you in identifying suitable methods to use in your study. It highlights possible purpose(s) for which your study may be conducted as well as the type of data you may use.

#### **TOPICS**

- Classifying research by purpose or function
- Classifying research by type of data
- Classifying research by methods or procedure
- Research Designs and factors affecting them
- Conclusion



#### **LEARNING OUTCOMES**

In this section you will be able to:

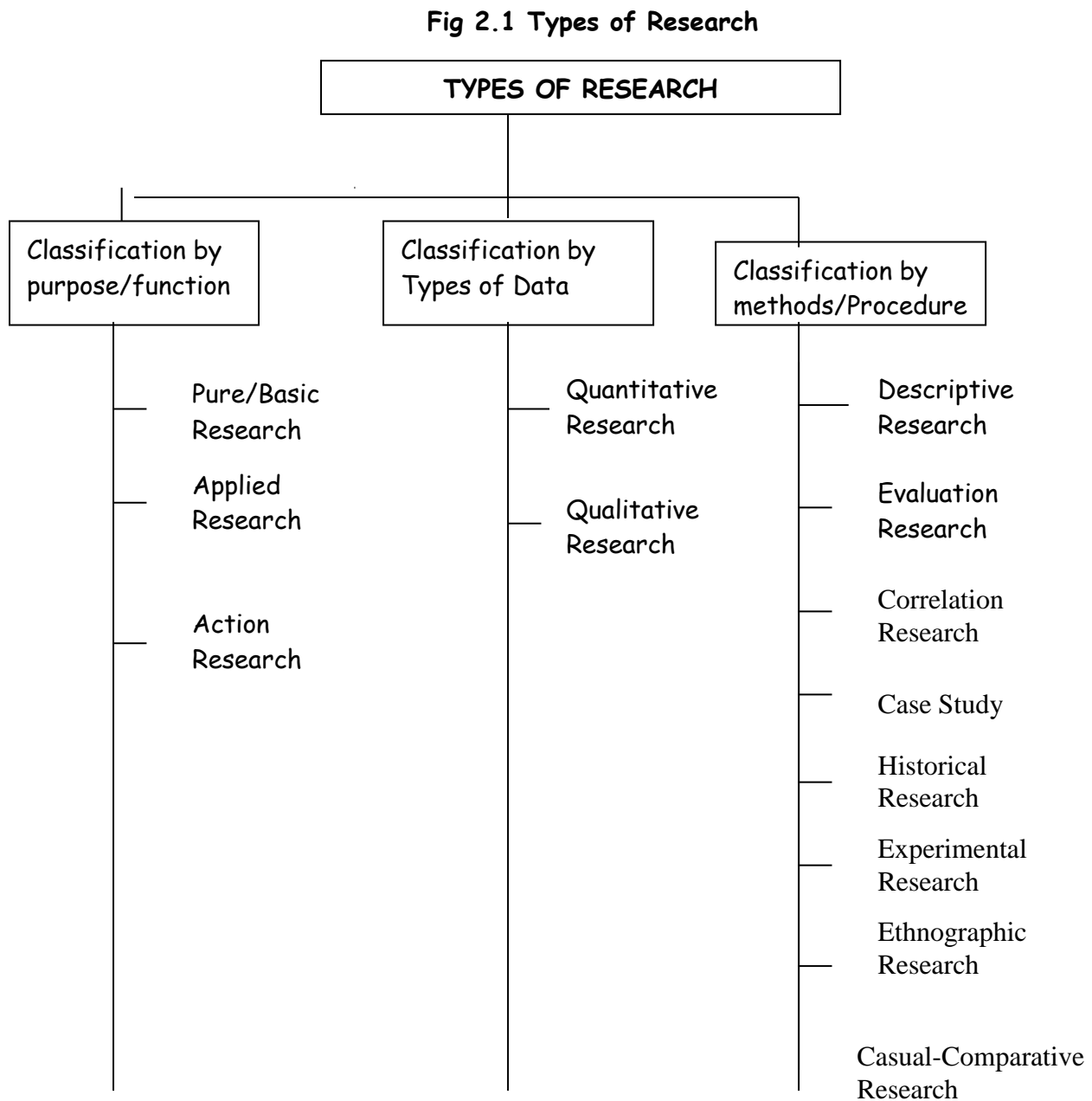
- State the criteria for classifying research
- Explain the functions or purposes of various types of research
- Distinguish between quantitative and qualitative research and discuss the relevance of various methods / procedures to a specified research study

#### **TOPIC 1: Possible criteria for classifying research**

Research can be classified on the basis of three major criteria, namely:

- The purpose or function of a research study
- The type of data used in a research study
- The methods or procedures employed in a research study

Figure 2.1 summarizes the classification of research types.





### **Activity**

*Suppose you are planning to carry out a research study. What would be the purpose of your study?*

## **TOPIC 2: Classification of research by purpose/function**

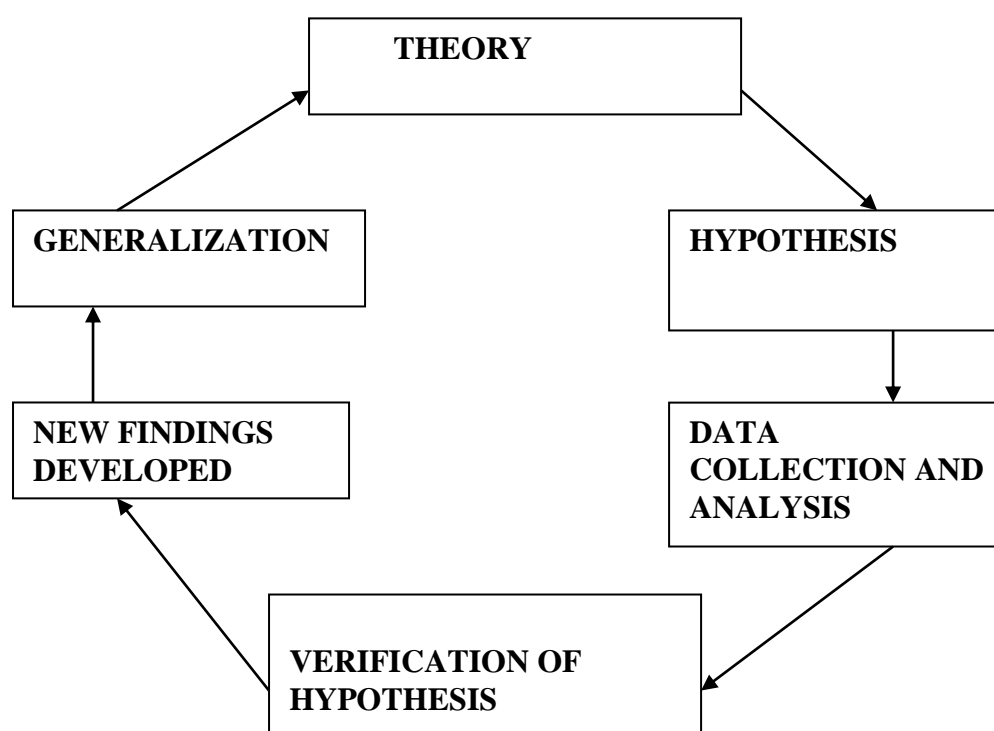
This criterion classifies research into three main types of research, namely:

- Pure/Basic Research
- Applied Research
- Action Research.

### **Pure or basic research**

This is a research study conducted for the purpose of developing or refining theory models. The cycle is illustrated in Figure 2.2 here below:

**Figure 2.2: Pure/Basic Research Cycle**



### **Activity**

*Identify two theories in education and identify who developed them. Outline the steps they undertook to develop the theories. Compare these steps with the ones in the cycle in Figure 2.2.*

Theory is developed through the scientific process of investigation. A theory is an explanation of how a specific phenomenon exists or changes and what makes it exist or change.

Basic or pure research is, therefore, conducted to develop or expand the frontiers of current knowledge. It is, however, not concerned with the application of knowledge.

Pure/basic research begins from existing or previous theory. The previous theory will help you to formulate new hypothesis. Data is then collected to verify or test the research hypothesis. After verification of the hypothesis, it

means that it can be accepted or rejected. If the hypothesis is accepted, then new findings are developed. The findings are then generalized to formulate a new theory.

Generalization is a process of confirming the validity of research findings in other situations or settings other than where the original study was conducted. Other settings may mean: other populations or other locations. The aim is to confirm whether the results represent universally acceptable or applicable knowledge. For example, if a study was conducted in Kenya, we must then confirm whether the results are valid in other populations, say in Europe, Africa and other areas.

**?** *What does the term validity mean to you? Look up the dictionary definition?*

### **Applied research**

Applied research is conducted to test or evaluate the usefulness of (basic/pure) research in solving practical problems or improving current conditions

Basic or pure research is primarily designed to develop knowledge about phenomenon, simply for the sake of understanding it better. Applied research, on the other hand, seeks knowledge that will modify or improve the present situation (Shaughnessy, et al, 2000)

Applied research is designed to determine specifically whether theory predicts specific outcomes in known circumstances. For example, we can carry out a study to determine the effectiveness of teaching methods in improving the performance of secondary school students in national examination. Here, the issue is "the effectiveness of teaching methods" as explained in educational theory. How well can the theoretical knowledge be transformed into real practice in the classroom situation? Will the applications of these theories yield expected outcomes in performance improvement?



### **Activity**

*Give two examples of applied research in your school*

A good example of applied research in education is Research and Development (R&D). Research and Development in education is concerned with inventions, modifications and improvements. It creates new methods, processes, and products, among other application.

Steps in research and development:

1. A new idea is generated. This is meant to modify or improve a situation
2. Application of basic / pure research knowledge is to transform the ideas into tangible / concrete results / outcomes
3. Design of relevant methods / techniques / products / processes is made based on pure research knowledge.
4. Field-testing: Can the design work? Is it viable? What are the strengths, weakness or limitation / gap?
5. Improvement and refinement: How can the new design be modified/ improved to fit expected requirements/standards/quality?
6. Development/application/use of final product/outcome.



### Activity

*Explain, using the steps in research and development (R&D), how the example you have given in the previous Activity could be developed as applied research.*

Consider a case of using computer applications to improve teaching/-learning mathematics. Some of the answers you could give would include the following:

1. The use of computers could be seen as a new idea, in this case, e-learning.
2. The next step is to identify scientific knowledge from pure/ basic research findings, which could be applied to transform this new idea into a tangible outcome. Theories of learning explain the significance of practical work and discovery through problem solving as viable approaches in improving understanding of mathematics concepts.
3. Step 3 would involve designing suitable computer software's with programmes that provide opportunities to students to learn mathematics independently using computers.
4. Introducing the new project in the mathematics curriculum in selected or pilot schools would then involve carrying out field-testing. Project evaluation would be carried out at specific time intervals to assess the viability, strengths and limitations associated with the project.

5. Evaluation results would provide feedback for further improvements and refinement until acceptable standards are achieved. This is when computer applications would be introduced in schools, on a large scale, to improve teaching/ learning of mathematics.

### **Action research**

In educational research, action research is a study conducted for the purpose of solving educational problems of immediate / urgent concerns within a local situation or environment

Burns (2000) defines action-research as the application of fact-finding to practical problem solving in a social situation with a view to improving the quality of action within it. It is an interactive process where researchers, practitioners and laymen collaborate and cooperate in solving a problem. The problem situation is identified. A plan of action to solve the problem is developed and implemented. The effects of the remedial action are monitored to check if improvement is realized.

This process, however, involves the application of scientific methods of investigation. The essence of action research is that urgent findings are required to form a basis for action towards solving identified problems. The features that define action research include the following

- It is situational: The local situation on environment is the problem context
- It is collaborative: People work together in a team: practitioners, researchers, and other stakeholders collaborate
- It is participatory: Stakeholders work together in implementing the study.
- It is self-evaluative Solutions are constantly monitored to improve practice.

### **TOPIC 3: Classifying research by type of data**

Research that is classified by type of data is either quantitative or qualitative.

#### **Quantitative research**

Quantitative research is a scientific method of investigation that is based on the use of numeric data. To quantify means to express the quantity of, or to



express in numerical terms. Quantitative research involves observation and measurement. To achieve measurement, we must use instruments or tools that provide specific, focused and accurate data. In research, questionnaires, tests or observation schedules can be designed to achieve this measurement.

### *How to express data in numeric form*

It is possible to express students' performance in class in numeric form. For example, by determining levels of performance in terms of excellent, very good, good, and so on. Alternatively, performance can be expressed in numeric values such as 90%, 60% and so on. Is it possible to quantify the concept of occupation in measurable categories such as Doctor, Engineer, and Accountant?

Quantitative research is a scientific process of investigation. As a scientific process, it must involve careful observation and measurement of phenomenon. Where phenomenon can be "a process, event, person, document or any other things of interest to the researcher" (Gall, et al 1996)



### **Activity**

*As a researcher you intend to study the effects of teaching methods on students' performance. Do the following:*

- *Examine how teaching methods can be quantified into numeric values, levels or categories.*
- *Explain how performance can be quantified into numeric values, levels or categories of observed student behaviour.*

Quantitative Research is sometimes referred to as positivistic inquiry. Gall (1996) explains that this inquiry is based on the doctrine that physical and social reality is independent of those who observe it and that the observations of this reality, if unbiased, constitute scientific knowledge.

The implication is that the observer (researcher) should not influence the (reality) about what he /she is investigating. Instead, the reality should depend on the instruments used to obtain numeric data, which are then used to describe, predict or explain the truth about the phenomenon under investigation. Statistical methods must be applied to achieve the results.

## Qualitative research

Qualitative research is a method of investigation that is based on the use of non-numeric data (data in textual form). This definition neither includes the term "scientific method" nor "numeric data". This automatically precludes measurement using precision (objective) instruments. Textual data is developed in the form of documentation, discussions, reports and other forms of written or oral information. 'Text' means the actual structure of words in a piece of writing. It also means the actual or original words used by an author, the exact or original words of a speaker (Webster's New World Dictionary, 1986). People express their perceptions and interpretations of their social environment through text.

Qualitative research is primarily used to study social phenomenon. Social phenomenon means having to do with human beings living together as a group or in a situation in which their dealings with one another affects their common welfare (Webster, 1:86)



### Activity

*Explain two examples of a social phenomenon in your school environment.*

Qualitative Research is also known as post-positivistic inquiry. This is based on the assumption that social reality is a construction. Construction means the way people develop meanings and interpretations of their social environment. These constructions differ from one individual to another. For example; different students construct 'Mathematics' differently. Some students *like* mathematics while others *hate* it.

These constructions are also dynamic, that is to say, they change according to changes in people's perceptions and interpretations of the same things. For example, today we may like a fashion design but after a period of time, we may not like it any more.

Qualitative research studies social problems by attempting to understand and explain the problem from *the way people perceive it or interpret it*. This is what reflects the real situation of that social problem. (How to carry out quantitative research or qualitative research is discussed in Section 3.)

#### **TOPIC 4: Classifying research by methods / procedures**

When research is classified using the methods or procedures it is referred to as descriptive, co-relational, experimental or evaluative. Each of these is discussed herein

##### **Descriptive research**

Descriptive research is a scientific method of investigation that involves collection and analysis of quantitative data in order to determine the current status of some phenomenon.

In a descriptive study, the researcher determines the status, relative incidence and conditions of a problem at the present time. In some cases, casual relationships may be involved.



##### **Activity**

*Give two examples of studies that require the use of descriptive research.*

Descriptive research uses *survey designs* as a strategy for collecting and analyzing data to answer research questions about the current status of the stated problem.

- In the data collection process, questionnaires, interviews and observations are predominantly used.
- Descriptive study primarily uses the quantitative research methodology. However, qualitative data is sometimes collected and used.

##### **Correlational research**

Correlational Research is a scientific method of investigation, which involves collection and analysis of quantitative data with the purpose of determining relationship between variables. Correlational research uses a survey design. In a Correlational study, the researcher specifies two or more variables and formulates hypotheses about the presumed relationships among/between them.

Data is collected using structured questionnaires, structured interviews or structured observation. These methods of data collection are designed to generate quantitative data. The resulting data is then analyzed using the statistics of correlation.

Correlational statistics are used to determine how a change in one variable is associated with changes in another variable. This relationship describes concomitant variation between the stated variables. It does not, however, imply a cause-effect relationship.



• *What is the difference between concomitant variation and cause-effect relationship between variables?*

The use of correlation statistics is designed to provide two measures namely:

- The magnitude or strength of relationship
- The direction of relationship.

From the data collected using a Correlational design the researcher computes the coefficient of correlation,  $r$ .

In assuming the strength of relationship, you will determine the magnitude (size) of the correlation coefficient,  $r$ . The magnitude of  $r$  varies between 0 and 1. (Various methods of computing relationships are presented in section 8).



### Activity

*Supposing that a researcher computes two values of  $r$ , for two different sets of relationships as:*

$$r_1 = 0.855$$

$$r_2 = 0.025$$

- Which measure of  $r$  has a higher magnitude?*
- Explain how you would interpret each measure for the target population.*

In measuring the direction of relationship, one determines if  $r$  has positive or negative value. If  $r$  has a positive value, we conclude that the relationship is

direct. Taking two variables, A and B, we conclude that an increase in A is associated with an increase in B, and vice versa. If on the other hand, the value of  $r$  is negative, we conclude that the relationship is inverse. This is to say that an increase in A is associated with a decrease in B, and vice versa. The researcher should, however, test the significance of relationship using inferential statistics (see Section 8, for test of hypotheses.)

## **Experimental research**

Experimental research is a scientific method of investigation that involves collection and analysis of quantitative data to establish *cause-effect* relationship between/among variables. In the experimental study, the researcher specifies two or more variables and formulates hypotheses about the presumed cause-effect relationship amongst them. One variable is presumed to cause or influence the other variable(s) to change. This is called the independent variable. The other variable is presumed to be the effect by responding to changes in the previous variables. This is called the dependent variable.

During the experimental study, the researcher deliberately manipulates the independent variables by changing or altering its values or levels, or its specified categories. At the same time, the researcher carefully observes and measures any resulting changes in the dependent variables. This is examined and analyzed to establish the cause-effect relationship. In most experimental studies, the researcher selects two or more groups of subjects. Subjects are the population units or individuals selected to participate in a research study. A group of subjects constitute a sample. The subjects are then assigned to two major groups called the:

- i.) Experimental group
- ii.) Control group

The *experimental group*: Comprises the subjects who will be exposed to experimental treatment, that is, to the influence of the independent variable(s).

The *control group*: Comprises subjects who will not be exposed to the influence of the independent variable. Instead, they are used as a baseline measure or a comparison group to measure the extent of change resulting from the independent variable. (See the example in Case Study I, presented here below).

It is important to note that, some experimental studies use only one group (experimental group), while others could use four or more groups. This depends on the nature and complexity of the experimental design.

In more efficient experimental studies, deliberate efforts are made to minimize the influence of other variables that could negatively affect the outcome(s) of the experimental study. These variables are commonly referred to as extraneous variables (see Section 4). The method used to control extraneous variables is called randomization.

Randomization is a procedure used in selecting subjects. In this case the subjects are selected at random from the target population. The subjects are then assigned to experimental and control groups, at random. Random selection and random assignment of groups is expected to minimize the influence of extraneous variables.

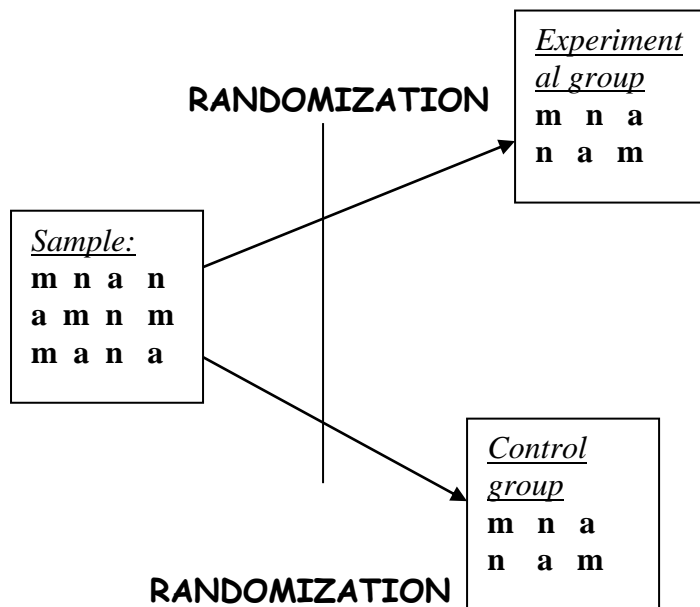
Study the following illustration of experimental research:

*Case study I: A sample, randomly selected from the target population comprises students with various characteristics or attributes. In this case, the researcher intends to carry out an experimental research on: effects of e-learning on performance improvement of students in mathematics computation skills.*

- *The independent variable is e-learning*
- *The dependent variable is computation skills in mathematics.*
- *Possible extraneous variable: other methods of teaching (m), students' personal attributes (a) such as talents, etcetera; students who have negative attitudes towards mathematics (n).*

*Supposing a sample of 12 students is selected from a population of students, at random. Take, for instance, that, in the sample, there are 4 students with m characteristics, 4 with a characteristics and 4 with n characteristics.*

The next stage is to assign the students to experimental and control groups at random. Random assignment is highly likely to distribute the characteristics in the two groups equally, as shown below.



Randomization makes the experimental group (X) and control group (C) to be equivalent, thus:

$$X - C = 0$$

This minimizes the effects of the extraneous variables; **m**, **n** and **a**. hence, the influence of the experimental variable will be **valid**, *other things being equal*.

### Evaluation research

Evaluation research is a method of investigation that involves collection and analysis of data, either quantitative or qualitative to assess projects or programmes

A project can be said to represent a set of activities designed deliberately to fulfil certain objectives or outcomes. For instance, an HIV awareness promotion campaign in schools can be launched to help improve the students' awareness of its negative effects. The purpose of the project is to increase awareness among the students. Projects are short-term activities and terminal. They are intended to last a specified time frame; that is, a time within which the objectives are expected to be attained.

Programmes are continuous and long-term activities designed to fulfil specified purposes. For example, educational programmes in schools are continuous over years. Projects may form part of such programmes.



### Activity

*Give examples of programmes and projects in schools*

Evaluation research is intended to assess the programmes at three different phases or stages. These are:

- a) *Situation Analysis studies.* These are designed to investigate the viability or practical relevance of intended projects or programmes. They seek to establish the needs, problems and resource requirements of the intended programme / project. They also check on whether the programme / project will succeed or not. Examples include: feasibility studies, training needs assessment study, among others.



### Activity

*Discuss two examples of situation analysis studies you have experienced in relation to specified educational programmes / projects.*

b) *Performance Evaluation study,* represent another type of evaluation research. This is initiated when the projects or programme is already in place. It determines the extent to which the methods, resources and personnel used are performing according to expectations. For example, you may want to assess the extent to which Free-Education programmes are performing in schools. This type of evaluation is sometimes referred to as formative evaluation.



*What is formative evaluation?*



c) *Impact Assessment study*. This is the type of evaluation research that seeks to establish the impact of a specified programme / project. It is carried out after the completion of the project, or after a long period of programme implementation. The aim is to determine the extent to which the programme / project objectives have been attained. It is sometimes referred to as *summative evaluation*.



What is *summative evaluation*?

#### *How to conduct evaluation research*

You can carry out evaluation research by using two major approaches, namely;

- i) Quantitative evaluation study
- ii) Qualitative evaluation study

A quantitative evaluation study could be carried out when there is need to collect numerical data and analyze such data using statistical methods. In this process, data is collected using structured or semi- structured questionnaires, structured or semi-structured interviews, and structured observation. The survey research design is therefore used in this type of evaluation study.

For any evaluation study of this type, there must be some criteria for judging programme / project feasibility, performance or impact.

The context - inputs - process and product evaluation methods (CIPP) is illustrated here below. This model is mainly applied in the quantitative evaluation approach. It has the following types of analyses:

- *The Context Analysis*: examines the project / programme needs, gaps which were to be filled, the location among other pre-requisite for implementations.
- *The Impact Analysis*: Examines the adequacy of the resources, funding, personnel and other factors that are considered necessary to enable the implementers to make the programme or project be completed successfully.
- *The Process Analysis* examines the techniques or methods used during the project / programme implementation.
  - Were the methods relevant?

- How well was the project/ programme managed?

Such questions may be asked to focus on process analysis.

- *Product Analysis:* Examines the adequacy of the project outcomes. It assesses the extent to which the objectives were attained. New lessons can be learned for future activities.

A qualitative evaluation study focuses on social-oriented projects or programmes such as community development projects, project for social change and sensitization, empowerment among others.



### Activity

*Give four examples of social- oriented projects or programmes in schools.*

In the evaluation study, the researcher seeks to assess the viability, performance or impact of the project / programme from the perspectives of the participants or beneficiaries. Feedback is also drawn from the perceptions and interpretations of the participants to judge on the relevance, and success of the programme /project.

Participatory evaluation approaches have become very popular with NGO's and donor related programmes or projects. They are considered to promote higher sustainability levels after project / programme completion. Participatory evaluation gives the participants an opportunity to define their own agenda about their needs and expectations. This is synthesized with the project / programme implementers' plans to enhance collaboration and success.

In the qualitative evaluation research the following take place:

- In depth textual data is collected using: in depth interviews, key informant interviews, participant observation, focus group interviews and content analysis.
- Exploratory research design is used as a strategy for collecting and analyzing qualitative data in order to answer research questions about the feasibility and impact of the project or programme.
- Qualitative analysis techniques are used to analyze the textual data.

- The most commonly used qualitative evaluation approach is: Participant Oriented Evaluation Model. (POEM)



### Activity

Read or research on the following concepts:

- *Participants Oriented Evaluation Model (POEM)*
- *Participatory Rural Appraisal (PRA)*
- *Rapid Rural Appraisal Procedures (RRA)*

### Use of case studies

A case study is a method of investigation that involves in depth collection and analysis of data to determine the characteristics of a unit, such as an individual, a group or organization/institution. The rationale of a case study is that the selected unit has some unique or special characteristics that need to be unveiled or understood.

A case study in education may target a school, a group of students with special characteristics or individual learners whose characteristics differ significantly from others.

Since a case study is specific to a unit or specific location, generalization of results may not be possible or extensive. Majority of case studies in education use qualitative methods. In such studies, majority of the data collected is in textual form.

Data collection techniques commonly used in case studies are in depth interviews, key informant interviews, focus group interviews and participants observation. Other instrument may, however, be used depending on the research requirement.

The exploratory research design is therefore commonly used. This is because most of the case studies in education involve fieldwork.



*What is field work and how is it used in research?*



### **Activity**

*Examine the table below and do the following:*

*Give two examples of types of studies in your institution that could apply to: Experimental research, Correlational research, a case study, descriptive research, historical research and causal comparative study.*

Below is a summary of the distinguishing characteristics of the major research methods.

## Distinguishing Characteristics of the Major Research Methods/Procedures

Method	Source of Data	Research Design	Methodology	Typical Purposes	Typical forms stating results
1. Historical	Direct observation, as an eye-witness; indirect observation through documents. Remains an eye witness' account	Exploratory design	Qualitative	Accurate record of past events. Status of phenomena at given times. Interpretation of present day problems and procedures. Determination of causal relationships.	Verbal exposition and interpretation.
2. Normative Survey (Descriptive)	Direct observation, as in the interview and measurement; indirect observation through questionnaires, check list etcetera	Survey design	Quantitative	Status and comparison of objects and conditions at the present time. (in some cases causal relationships may be involved)	Measures of central tendency and variability.
3. Experimental	Direct observation and measurement	Experimental Design	Quantitative	Determination Of causal relationships evaluation and comparison experimentally of educational procedures	Amounts and reliabilities of experimentally produced changes.
4. Causal comparative	Direct observation and measurement	Survey design	Quantitative	Determination of causal relationships	Group likeness and differences
5. Correlational	Direct observation and measurement	Survey Design	Quantitative	Determination of relationships and prediction	Correlation co-efficient and regression equations
6. Case Study	Direct and indirect observation, measurement and documentary evidence	Explanatory design	Qualitative	Special characteristics of a single group or organization	Individual case histories
7. Evaluation	Direct observation and measurement	Uncontrollable observation	Qualitative and quantitative	Assessment of Status against expected	Descriptive

## TOPIC 5: Research designs and factors affecting them

A research design is the overall strategy used by the researcher as a means of collecting and analyzing data in order to test research hypotheses or to answer research questions. The following section explains types and qualities of a good research design.

### Types of research designs

#### 1. Experimental designs

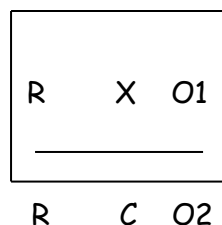
Experimental research designs use the symbols discussed herein:

- R = Random selection of subjects and assignment to experimental and control groups.
- X = Experimental treatment (variable) applied.
- C = Control condition.
- O = Observation or test.
- = A line between levels indicates equivalence of groups.

a) True experimental designs have the following characteristics

- They employ randomization to provide for equivalence between experimental and control groups.
- They are the strongest type though difficult to arrange especially in social sciences, but used whenever possible.

i) The post - test only, equivalent groups



- The experimental and control groups are equated by randomization.

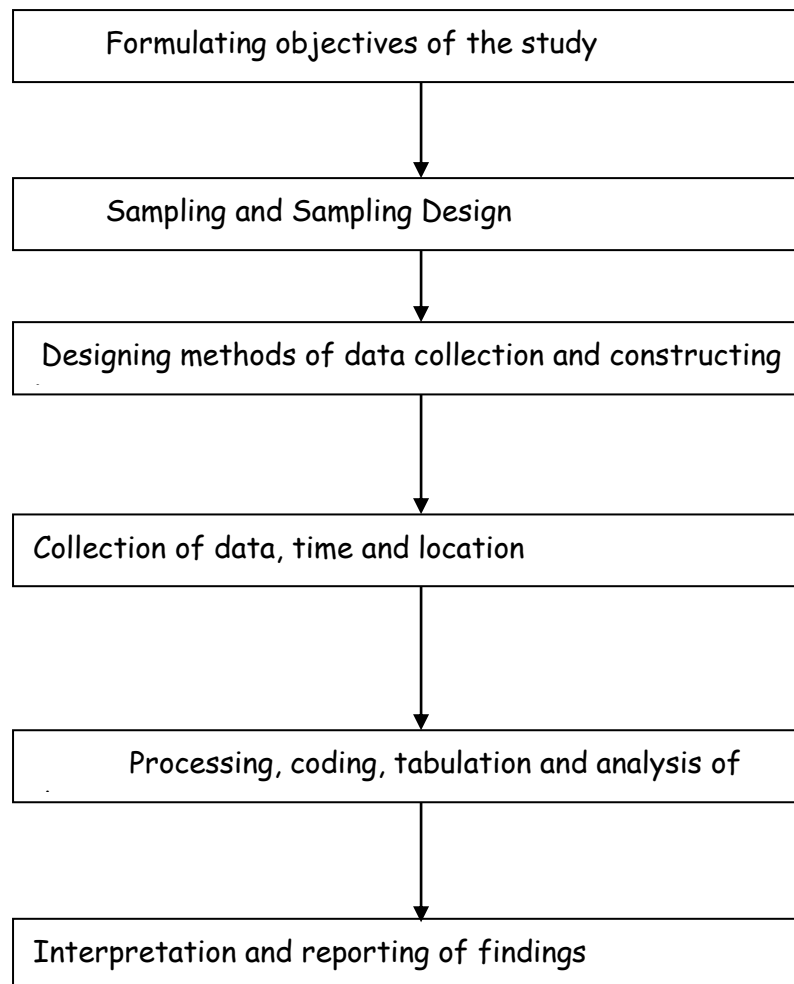
b) The Solomon four - groups design, for example,

R	O1	X	O2
R	O2	C	O4
R		X	O5
R		X	O6

- i) Subjects randomly assigned to four groups
- ii) Two groups receive treatment (x)
- iii) One experimental group receives a protest (O1).
- iv) Two control groups receive no treatment.
- v) One control group receives a pro-test.

## 2. *Survey designs (survey research)*

These are research designs which study large and small populations (or universe) by selecting and studying samples chosen from the population to discover the relative incidence, distribution and interactions of variables. They employ a flow plan or chart to outline the design and subsequent implementation of a survey. The flow plan starts with the objectives of the survey, lists each step to be taken and ends with a final report as illustrated here below:



### **3. Exploratory design (field studies)**

The exploratory design is mainly used in qualitative studies. It is a non-experimental scientific investigation aimed at discovering the relation and interaction between variables in real social structures. The investigation in a field study first looks at a social or institutional situation and then studies the relation among the attitude, values, perceptions and behaviours of individuals and groups in the situation. Data is mainly collected through observation and interviews.

Purpose of exploratory study is to discover significant variables in the field situation; to discover relations among variables; and to lay groundwork for later, more systematic and vigorous testing of hypothesis.

Exploratory research primarily uses qualitative research.



## Validity and reliability of a research design

The two essential characteristics of research designs in terms of the arrangement of conditions that ensures relevance to the research purpose and accuracy of results are:

- i) Reliability
- ii) Validity

### 1. Reliability

It means the consistency or accuracy of the research instrument, in measuring whatever it measures. It is the degree to which an instrument will give similar results for the same individuals at different times.

Statistically, or in any measurement process, theory assumes that there is an 'error' contained in all forms of measurements. An observation score can be seen as consisting of two parts, namely:

- The individual's 'true score'
- An 'error score', which is due to the inaccuracy in measurement

$$\text{'True score' + 'error' = 'observation score'}$$

Reliability is related to these scores. If scores have large error components, then reliability is low, but if there is little error in the scores, then reliability is high. Reliability is thus a statistical concept based on the association between two sets of scores representing the measurement of individuals on two different occasions.

### 2. Validity

Validity refers to the extent to which a measurement does what it is supposed to do. Validity may be determined by use of well-devised research designs which:

- Provides a good strategy for the hypothesis (es) or answering research questions
- This means an adequate plan of procedures for data collection and analysis that should be undertaken to evaluate a particular theoretical perspective: accurately and purposefully.

*Internal validity:* refers to the extent to which relationships between independent and dependent variables in a research study can be said to be genuine. It implies the minimum control arrangement of conditions necessary to interpret the results. It is concerned with the adequacy of procedures for collection and analysis of data and interpretation of results in a manner that is relevant to the research purpose. Specifically, it refers to the extent to which

the independent variable (s) can be said to have a genuine effect on the dependent variable(s).

Internal validity, therefore deals with the degree of control of the influence of extraneous and other variables factors.



### Activity

*Find out the meaning of extraneous variables*

**External validity:** refers to the, extent to which the research findings / results can be generalized to other populations, other than the research setting. It is concerned with such questions as:

- i) To what group of people can the findings be generalized?
- ii) In which type of settings and under what conditions can the results be generalized
- iii) To what other variables, situations and so forth do the results generalize?

Thus, external validity is a matter of sampling .The broader or wider, the sampling from a given population, (for example, work, home school), and conditions (for example, work demand, income levels, educational attainment), the greater the independent - dependent variables relation.

### *Factors affecting internal validity*

#### *i) History*

History is made up of specific external events beyond the control of the researcher that may have stimulating or disturbing effect on the performance of subject. It is also made up of the unanticipated events occurring while the research is in progress that can affect the dependent variable. Examples are anxiety, emotional stress and fatigue.

#### *ii) Maturation*

Maturation refers to progress operating within the subject as a function of time. It includes the physical and mental changes of subjects over a period of time.

Examples are: a subject may become tired, bored or wiser, etcetera leading to reduced or increased effect on final observation

### *iii) Instrumentation*

An instrument is valid for a particular purpose and group. Example: an interview schedule designed for CBD employees in a service industry cannot be valid for employees in a manufacturing concern.

Instrumentation is an effect due to inconsistent use of measuring instruments. For instance:

- A questionnaire may be changed between pre-test and post-test. This change is likely to result in an effect that is independent of the effect due to the research variables.
- In observation, observers may become tired, acquire a second dimension and behave as if they were 'only human'.

### *iv) Testing (effect of pre-testing)*

When a pre-test is given, it is possible that the initial experience with the test during the first assessment period can cause inflated (exaggerated) scores on the second measure. Subjects become "aware" after the first test, so that improved scores on the second tests threaten the internal validity.

### *v) Statistical regression*

This occurs when a sample which is extreme on some variable is selected, for example, poor readers, and remedial groups, etcetera.

The group is usually obtained by using some measurement in the first instance, if a second measure is administered with the purpose of variable. An extreme group, initially below the mean will, on second testing, seem to have improved even if it has no treatment whatsoever.

### *vi) Selection (maturation interaction)*

A combination of differential selection and maturation produce a joint (interaction) effect, either additional to or in the absence of any biases resulting from the two separately.

Example:

A group of delinquents treated over a period of some years might show substantially greater gains on behaviours rating compared to a 'normal' group solely because of selection bias' and maturation ( long period ) effects.

### *Factors affecting external validity*

#### *i) Interaction between testing and experimental variable*

Subjects may be extremely sensitized by the pre-tests, which may have serious effects on the influence of experimental variation.

Example:

Evaluation of fancy dietary scheme on group of fat girls

#### *ii) Interaction between selection and experimental variable*

#### *iii) Reactive effects of the experimental arrangements (Hawthorne effect).*

As soon as people realize they are guinea pigs, they change (usually, temporary) and thus produce changed effect. Any aspect of the experiment may produce this effect.

#### *iv) Multiple - treatment interactions*

These occur when the same groups of subjects are used for various treatment involved in the experimental design. This occurs because it is impossible to erase the effects of prior treatment before embarking on new ones.



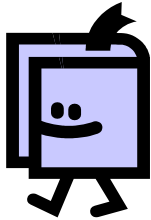
### **Activity**

*Give the meaning and purpose of research. Give an example to explain the difference between experimental research and predictive inquiry.*

### **Conclusion**

Research is an endless quest for knowledge or an unending search for truth that brings to light new knowledge or corrects previous errors and misconceptions and adds in an orderly way to the existing body of knowledge. It is a course of critical investigation and a systematic attempt to provide answers to questions.

It starts with questioning some idea or practice. The questioning is followed by the need to find answers. Research is thus a deliberate effort to collect data, to sift it, to analyze it, to put it together and to evaluate it.



### Further reading

1. Mugenda, O. M. and Mugenda, A.G. (1999): Research Methods. Quantitative and Qualitative Approaches. Nairobi. Acts.
2. Fraenkel, J. R. and Wallen, (V.E (2002). How to design and Evaluate Research in Education 4<sup>th</sup> ed. McGraw Hill.
3. Mwiria, K. and Wamahiu, S.P. (1995). Issues in Educational Research in Africa. Nairobi. East Africa Educational publishers.
4. Burns, R. B (2000). Introduction to Research Methods. London. Sage

## **SECTION 3**

### **THE RESEARCH PROCESS**

#### **Introduction**

In Section 3, you are introduced to the process of conducting research. Major steps are outlined that will guide you in this process. The research process begins from the time you identify the research problem to the time you develop your findings.

#### **TOPICS**

- How can we design a research study?
- What are the main steps in conducting research?
- Using the quantitative research and qualitative research process?
- Conclusion



#### **LEARNING OUTCOMES:**

By the end of this section, you will be able to:

- Explain how to design a research study
- Identify the main steps in conducting research
- Identify a viable research problem for your study
- Explain how to apply quantitative and qualitative research in developing your study

#### **TOPIC 1: How to design a research study**

Section 2 presented some of the options or methods used in doing research. Conducting research requires a logical sequence of related steps:

1. First, you will develop an interest to study something. There will be questions to be raised about the interest.

For example;

- Why do you want to study "students' discipline"

- What information is missing about it that must be sought?
  - What do you want to achieve at the end of the study?
  - The interest is then transformed into an idea. For example, is Guidance and Counselling related to discipline? Is A related to B?
  - Theory or previous research would help to explain or answer these questions. Theory explains why things happen and what makes them happen.
2. Conceptualize the problem (what is to be studied). Here you must specify the meaning of the concepts and variables to be studied. In this case;
    - What is discipline, as a concept?
    - Which variables represent discipline?
  3. Make a choice of the research method to use in that study. Find out which method is most appropriate. Is it descriptive research, or Correlational research etcetera?
  4. Determine whom you want to draw conclusions about. Who will be observed and measured to obtain the necessary data? Will they be teachers of G&C and students, only?
  5. Ask yourself how the variables will be measured to obtain data.
  6. Observation and measurement follows, that is, collecting data for analysis and interpretation. Will you use questionnaires or interviews?
  7. Data processing must then be done in order to transform the data collected into a form appropriate for analysis.
  8. Data analysis is then conducted to help you develop interpretations and draw conclusions.
  9. The results are then reported and their implications developed.



### Activity

*Assuming that you are required to carry out research study relating to your school programmes, such as the "Effects of Guidance and Counselling on students Discipline".*

- *What would be your first activity?*

- *What other activities would you carry out?*
- *Where would you go to search for information necessary to conduct the activities?*

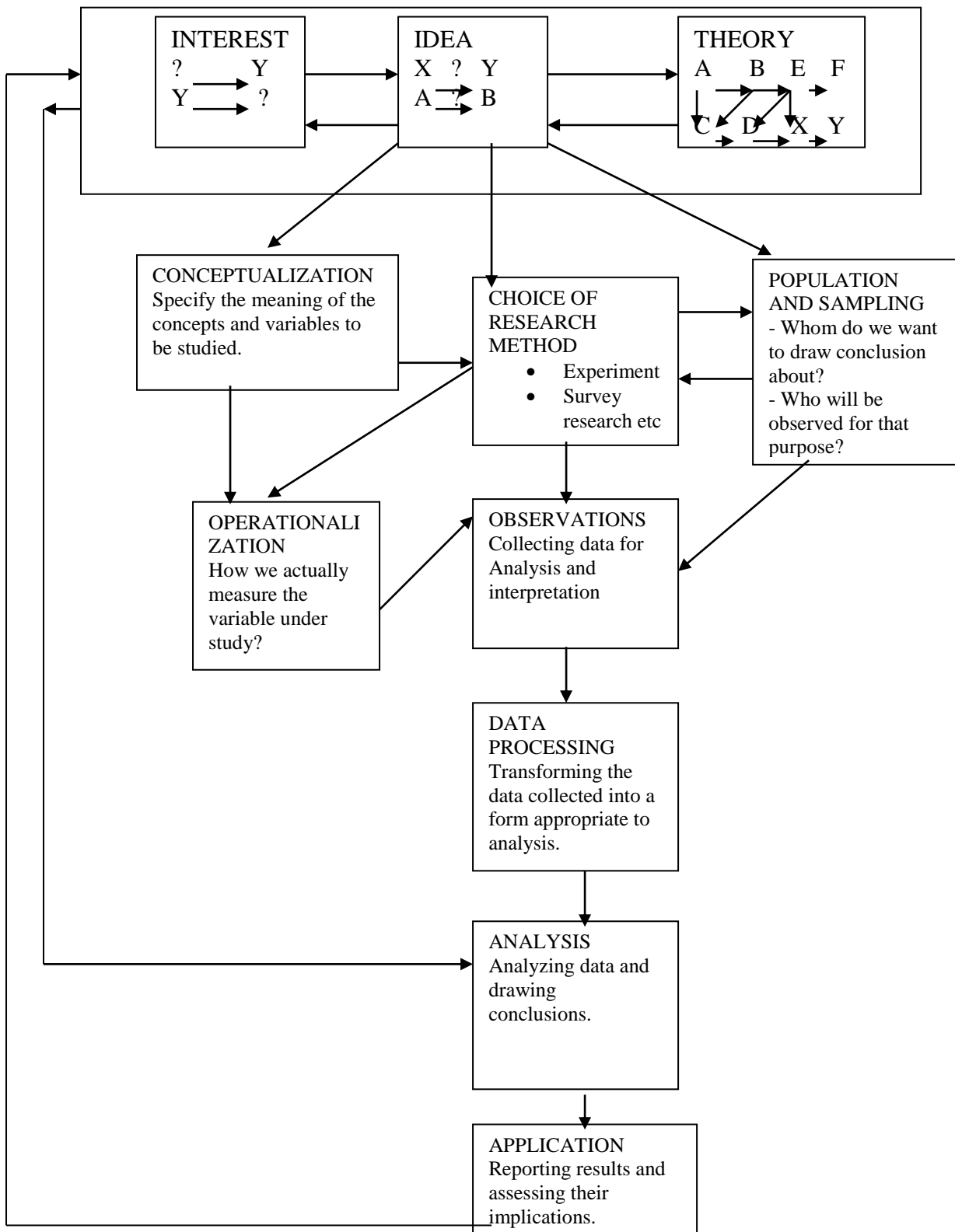


### **Activity**

*Think about the following topic which you may want to study and use the Figure 3.1 to develop the research process. Effects of E-learning on students' performance in mathematics in secondary schools"*



**Figure 3.1: The research process**



## TOPIC 2: The main steps in conducting research

Figure 3.2 below, illustrates the steps in conducting research.

Figure 3.2 Steps in Research.

- STEP 1: Identify and define a research problem.
- STEP 2: Review related literature.
- STEP 3: Formulate research hypothesis or research questions.
- STEP 4: Carry out data collection and data analysis.
- STEP 5: Verify the research hypothesis or determine answers to research questions.
- STEP 6: Compile and disseminate research findings / results.

These steps are further illustrated in a flow chart in Figure 3.3. As per Figure 3.2 the researcher needs to do the following:

In **step 1**, one needs to identify a suitable research problem for the study. This is explained in Section Four. You will then define the problem, clearly and precisely, specifying what is critical about it to warrant an investigation.

In **step 2**, through literature review, you will be able to develop your understanding about the problem. You will achieve this by exploring related information from publications. You need to seek information about previous studies on the same or similar areas to the problem. Theory may also be used to explain the problem.

In **step 3**, you will formulate research hypothesis or research questions. Your research hypothesis or questions will specify what you want to prove or answer about the problem. The literature review in the previous stage will improve your ability to formulate genuine questions or hypotheses.

In **step 4**, you will prepare yourself to collect and analyze data. First, you will decide on a suitable research design to use as a strategy for collecting and analyzing data to answer the research questions or test the hypotheses, for example, a descriptive survey design, co-relational survey design, qualitative (or explanatory) design and so on. Secondly, you will determine the target population for your study. You will then decide on a suitable sampling method to select a sample for your study. You will then design suitable data collection instruments for the study. Finally, you will collect and analyze the data. This will not mark the end of your study, until your research questions are answered or research hypothesis tested.

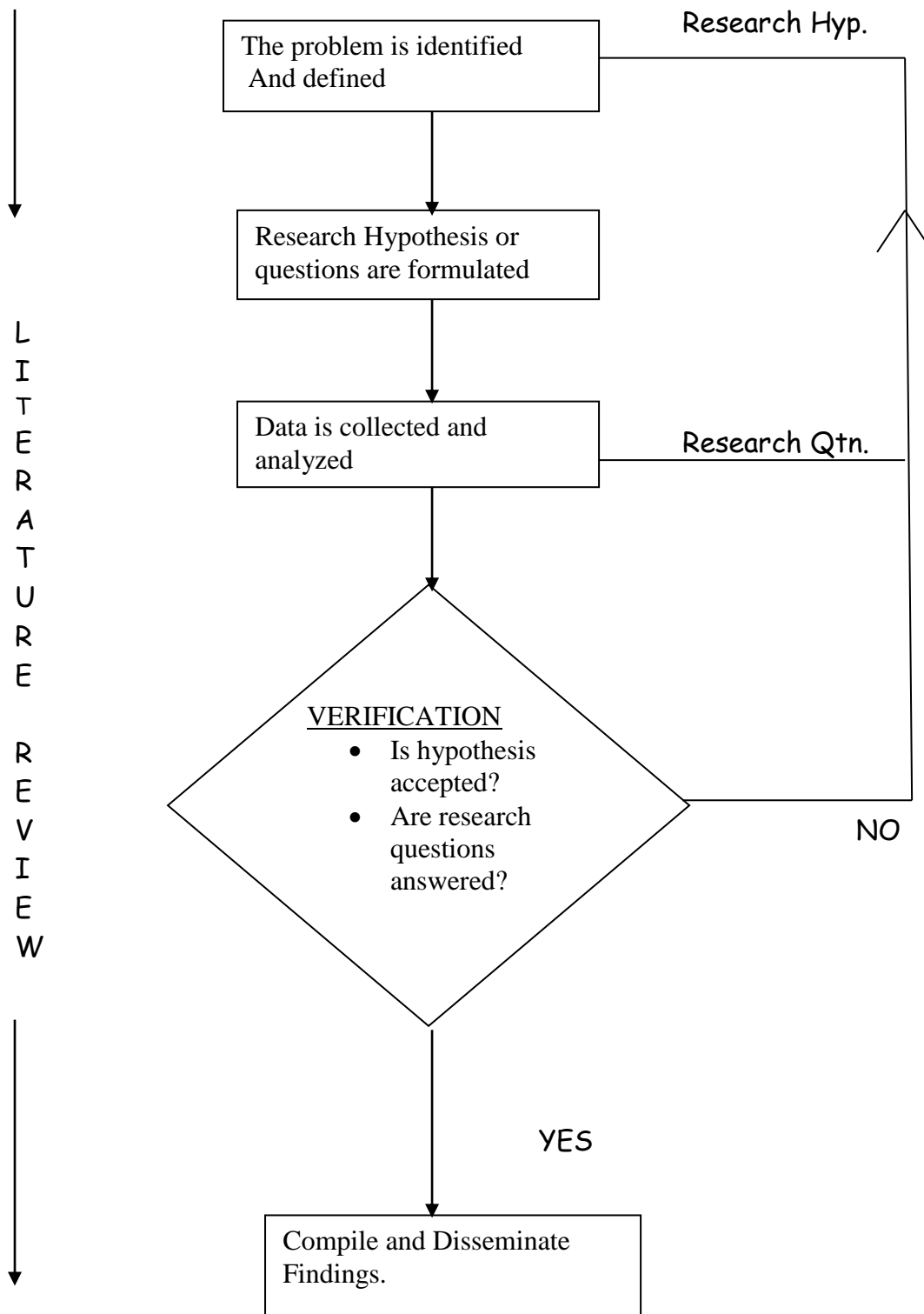
In **step 5**, you will check if the results of your data analysis have adequately answered the research questions. Alternatively, the research hypothesis will be

tested statistically. You will then decide whether to accept or reject the hypothesis.

In **step 6**, you will compile your research report for dissemination at this stage of the study. Other people will have the opportunity to evaluate your findings and the entire study as expressed in the research report.

Figure 3.3 below illustrates the steps in the research process.

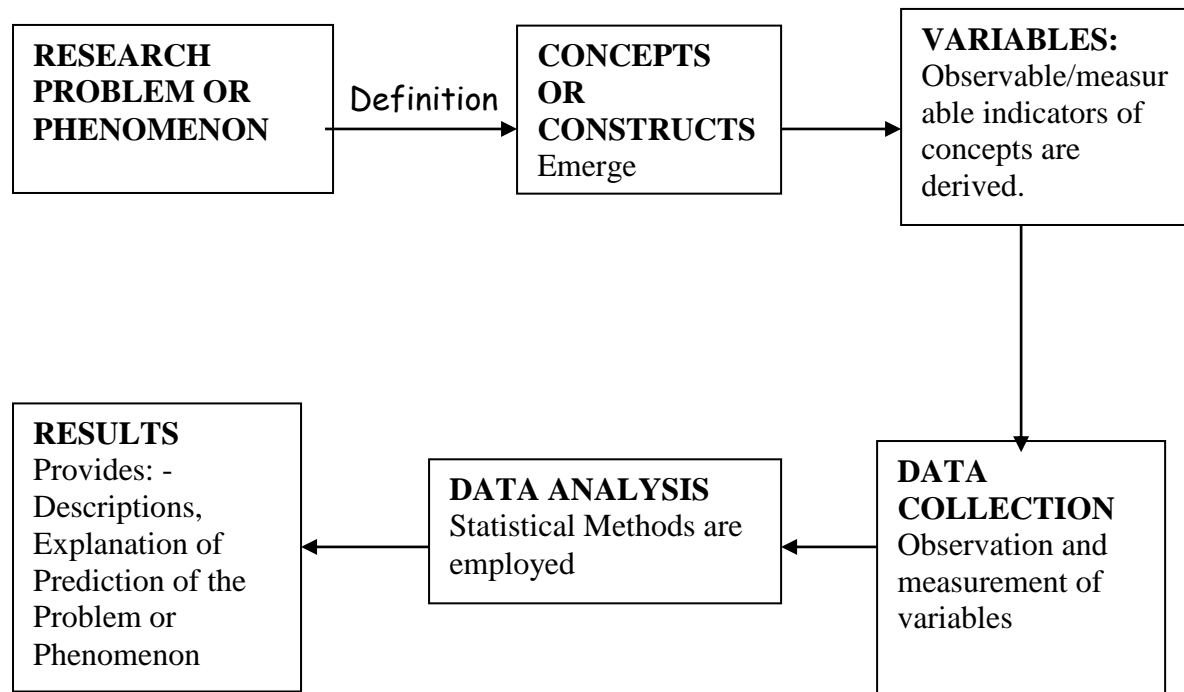
**Figure 3.3.: The research Process (steps)**



### TOPIC 3: Using the quantitative and the qualitative research processes

The quantitative research is a scientific method of investigation, which is based on the use of numeric data. Quantitative research is based on the use of numeric data. Qualitative research, on the other hand, uses textual data. Figure 3.4, here below, illustrates the process (methodology) of quantitative research.

**Figure 3.4 Quantitative Research Process**



#### **The quantitative research process**

The flow chart above identifies the following steps in the research process:

##### *Identification of a research problem or phenomena*

In the quantitative research, a research problem or phenomenon is identified. The problem is considered to represent a single, tangible (objective) reality, which must be broken down into smaller components called constructs (or concepts). In this case, a construct refers to an abstract concept, which can only be interpreted through observable behaviour /actions of people, objects or events.

For example, intelligence is a psychological construct that can only be observed through a student's performance in an I.Q. test. Student discipline can only be observed through his/her behaviour in response to say, school rules.



*How can the following constructs be observed or measured?*

- *Motivation*
- *Lifestyle*
- *Perceptions*

A concept is developed from similarities or commonalities among observed phenomena. The similarities in the observed behaviour, events or objects are then used to explain the concept. For example: the concept of drug-abuse is developed from a number of features;

- Existence of a substance.
- Misuse of the substance.

The substance could be varied. For example; cigarettes, alcohol, cocaine, mandrax and other have different chemical compositions.

Commonality is "the common observable characteristics, or attributes of people, objects, etcetera" For example existence and misuse of any of the substances such as alcohol is commonly referred to as "drug abuse"



### **Activity**

*The following represent commonly used concepts.*

*Indicate behaviours, activities, events or objects, which can be used to interpret them.*

- *Discipline*
- *Subject*
- *Skills*

### *Definition of the problem*

In the quantitative research study the problem must be defined to make it more focused and clear. In the process of its definition, constructs and concepts emerge. These concepts or constructs are abstract. It, therefore, means that they cannot be directly observed or measured to generate quantitative (numerical) data. For example, we cannot directly observe and measure motivation,

performance, and discipline. We must first specify their observable indicators in terms of behaviour or activities of people.

### *Specification of variables*

To enable us to observe and measure the concept or constructs, we must be able to define them further in more concrete terms. This is achieved by specifying activities, events, objects or behaviour that represents the concept or construct (which represent variables)

A variable can be defined as some characteristic, attribute or property which can take on different numeric values, or among people, objects or events.



### **Activity**

*Examine properties of physical objects, or events in the school environment and do the following:*

- *Find out the meaning of the terms; characteristic, attribute and property.*
- *Identify some common characteristics and attributes of students in your school.*



### **Activity**

*Identify possible categories, levels or numeric values which the following variables or factors represent:*

- *Gender*
- *Occupation*
- *Performance*

The following example illustrates how to observe and measure the categories, levels or values:

Gender is a concept, which represents people's attribute. This attribute can take on two categories among people, namely; male and female. We are able to observe

and measure the number of males and female students in a school, to study gender.

Gender thus, becomes a variable if we are able to specify the observable and measurable categories (that is, number of males and females in a school).



### Activity

*Using some research references, find out meanings of terms:*

1. *Description*
2. *Prediction*
3. *Explanation*

In a quantitative research study, the variables can be studied to describe, explain or predict a problem or some phenomenon.

### *Collection of data*

Description of a problem or phenomenon can be achieved by collecting quantifiable data through observation and measurement of each variable. The data is then subjected to statistical analysis. For example, descriptive statistics would help us in organizing, summarizing and describing numerical data to promote better interpretations of a problem. For instance, we can carry out a descriptive study on student discipline in selected secondary schools in Nairobi. First, discipline must be defined as a concept. The observable indicators of student behaviour, which represents discipline, are identified and defined. For example: 'obeying school rules' is an observable indicator of positive discipline.

Such indicators represent the variables. By use of questionnaires or interviews, we can find out how many students' obey school rules and how many do not. This information can be presented in a frequency table or bar chart to describe an aspect of discipline in the target school.





### Activity

*Explain how you would carry out a descriptive study on students' performance in mathematics.*

### Data analyses

Prediction of phenomenon, in quantitative research can be achieved by determining the relationship between or amongst variables. The measure of the relationship between variables can be accurately obtained through the application of statistics of correlation.



### Activity

*Correlation statistics examines how two or more variables change together or are associated. Find out about the following statistical measures:*

- *Correlation coefficient,  $r$*
- *Magnitude or strength of relationship.*
- *Direction of relationship.*

### Results

When we establish the relationship between variables, this tells us how a change in one variable would be associated with a change in another variable. For example, we can establish if a relationship exists between students' levels of performance in mathematics and the level of qualification of the mathematics teachers. The relationship may indicate that, the higher the teachers' qualification in mathematics, the higher is the students' level of performance. On the basis of this relationship, we can predict that the schools with a larger number of qualified mathematics teachers will perform better in mathematics than schools with a smaller number of qualified mathematics teachers.

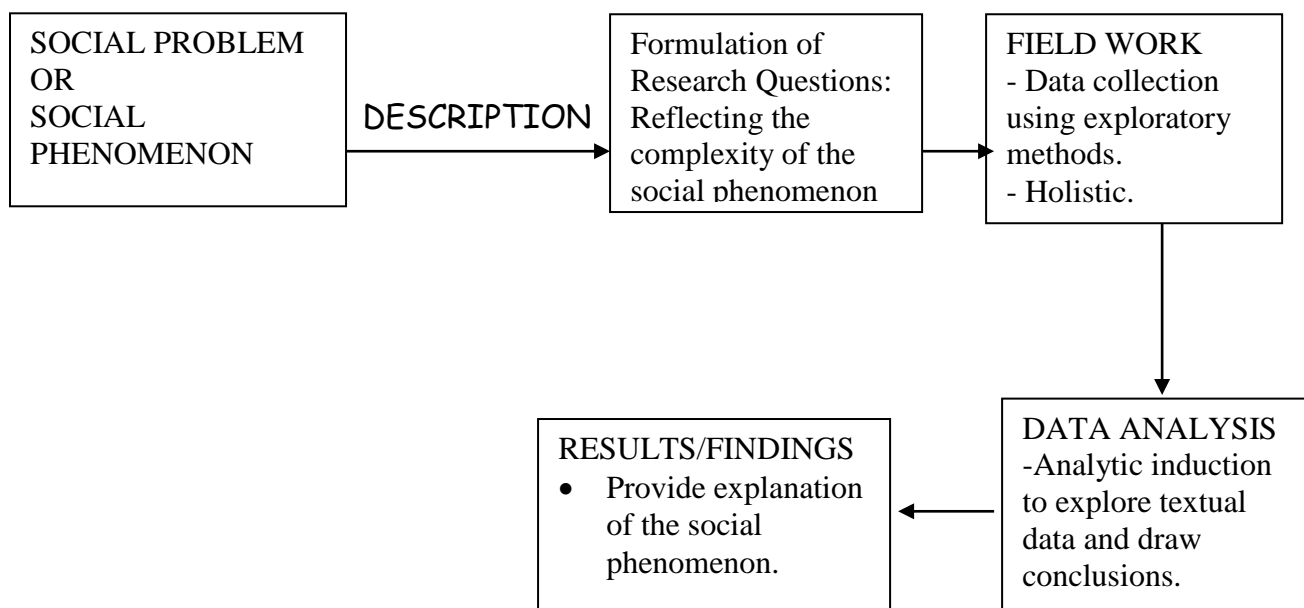
Establishing *cause-effect* relationship between variables can be used to develop the explanation of phenomenon or problem. It is possible to determine how a change in one variable (independent variable) can influence a change in another variable (dependent variable). For example, we can use an experimental study to find out if teaching methods can influence performance of students in Physics, as a subject.

The measures of cause-effect relationship provide explanations of phenomenon, which can enable us to control it. The explanation can further be generalized to formulate new theories, models and concepts.

### The qualitative research process

Researchers, in conducting qualitative research, have advanced various approaches. Figure 3.5 illustrates the general approach to the qualitative research process.

**Figure 3.5: Qualitative research process (A schematic Illustration)**



Qualitative research is primarily used to study social phenomena. The steps in the process are as follows:

1. In the qualitative research, a social problem or social phenomenon is viewed as something, which represents a complex system of integrated or encompassing factors. These factors cannot be broken down into separate components such as concepts or variables. Miles and Heberman (1994) explain that social phenomenon reflects everyday life of individuals, groups, societies and organizations.
2. The social problem must thus be investigated in a 'holistic' form. This means that the researcher must seek to determine a total of the complete

picture of the social situation at any given point in time. Questions are formulated that present an overview of the context under study: its logic, patterns, and internal and external situation.

The researcher identifies a 'field', which is specific to the context of the social problem.

3. Understanding of the problem, hence answers to research questions begin to emerge as data is collected using exploratory/discovery methods. Special open-ended data-collection techniques are used to generate rich and in depth textual data that provide multiple perspectives of the social problem.
4. The data collection process emphasizes the perspective of the social or local actors through researchers' empathetic understanding of their situations. This data reflects ones perceptions and interpretations of the research participants about their social environment.

In data analysis, inductive methods are used to examine emerging themes or patterns of meanings from the data. The researcher uses a thematic approach by clustering the patterns/themes into logical categories and relating various categories to extract explanations of the social problem or phenomenon. The result helps to improve researchers' understanding of the social problem.

### **Conclusion**

This section highlights that the research process is systematic. It begins from a clearly defined problem and sequentially develops the study until you achieve significant findings. Every research study must follow the steps specified in this section. Also, you must make an informed choice whether to use quantitative research process or qualitative research process. Sometimes you could use both processes.

## **SECTION 4**

### **THE RESEARCH PROBLEM**

#### **Introduction**

This section introduces you to what is meant by the term research problem. You will also be able to determine various sources which would be used to identify a suitable research problem for your study. Specific considerations on qualities of a viable research problem are highlighted. The concept of variables in research will assist you in defining the problem clearly and in developing the objectives, research questions/hypotheses for your study. The conceptual framework would provide a good foundation to your study.

#### **TOPICS**

- What is a research problem?
- How can we select a research problem?
- Problem identification?
- Characteristics/ criteria of good research problem?
- Variables in research
- Section Conclusion



#### **LEARNING OUTCOMES:**

By the end of this section, you should be able to:

- Define a research problem.
- Identify a suitable research problem for your study.
- Evaluate the practical viability of the problem you have selected using specific criteria.
- Develop a conceptual framework and specify key variables in your study.

## TOPIC 1: The research problem

Various authors define a research problem as follows:

- A research problem refers to some 'difficulty' which the researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same. (Kothari, 1984)
- It is an issue or area in any field (such as education) where the researcher would like to find an answer or solution. (Cohen and Manion; 1975)
- It could be a statement that asks: What relation exists between two or more variables? The answer is what is being sought in the research. (Kerlinger, 1986)

Usually, a problem exists. For instance, assume that you want to investigate "how guidance and counselling programmes have influenced students' change in behaviour." Once the problem is established the following conditions are to be met:

- (a) There must be an individual, group or organisation to which the problem can be attributed. (Let us call it, 'students and teachers')
- (b) There must be some environment (s) to which the problem pertains. (Say 'the school environment') which is defined by some uncontrolled variables, such as 'school administration'.
- (c) There must be some objective(s) to be attained. If one wants nothing, one cannot solve a problem (i.e. to determine how G&C programmes have influenced students' change in behaviour).
- (d) There must remain some doubt in the mind of a researcher with regard to the valid explanation of research problem.

This implies that the researcher must answer the question concerning the relative efficiency of the possible alternatives. In simple terms, the choices must have unequal efficiencies for the desired outcomes.

Thus, a research problem is one, which requires a researcher to find the best solution for a given problem. This implies, to find out by which course of action, the objective can be attained optionally in the context of a given environment. Sometimes, the problem may, represent a social situation, which is associated with peoples' perceptions or beliefs. In this case, exploring people's perceptions or interpretations about their social environment best solves the problem.

## TOPIC 2: Selecting a research problem

The research problem undertaken for a study must be carefully selected. A researcher when selecting a problem or a subject/topic for research may observe the following points:

1. The subjects/topic selected for research should be familiar and feasible so that related research materials or sources of research are within one's reach.
  - Consultation with an expert may be necessary.
  - Review of published current literature available on the subject may also be necessary.
2. The following factors/criteria must be considered when selecting a problem;
  - Importance of the subject /topic.
  - Qualifications and training of a researcher.
  - Costs involved in carrying out the research.
  - Time to be taken on the research process.

In the light of the above, the researcher must consider the following questions:

- (a) Is, he/she well equipped in terms of background knowledge/experience to carry out the research.
  - (b) Does the study fall within the budget he can afford?
  - (c) Will there be adequate co-operation from those who will participate in the research as subjects?
3. The selection of a problem must be preceded by a preliminary study. This is necessary when the problem is similar or related to a previous research already conducted.

For a relatively new field a brief feasibility study must always be undertaken.

4. Practices to be avoided:
  - (a) A subject/topic, which is overdone, should not normally be chosen. This is because it will be a difficult task to shed any new light in such a case.
  - (b) Too narrow or too vague problems should be avoided.
  - (c) Controversial subjects/topics should not become the choice of an average researcher.

### TOPIC 3: Problem identification

#### Sources of research problems

The most likely sources from which a researcher may identify a significant and genuine research problem are;

##### 1. Review of related literature

- A review of published literature such textbooks, journals, magazines, etcetera may shed some light on the most current areas/issues that require investigation.
- Other sources in this category include: research bulletins, research projects, journals of management research, dissertations, and the **Internet**: These sources often provide suggestions for further research.



#### Activity

*Explain which sources of literature you can use to identify a problem about curriculum development in schools*

##### 2. Personal experiences of the researcher

A researcher's education and professional experience, in terms of prevailing educational practices based on little or no research evidence may serve as a good source of a problem. This requires an inquisitive and imaginative mind to translate the practices/issues into practicable research studies. For example, how does the school transition or culture influence performance?



#### Activity

*Discuss some of your educational experiences that could be a source for your research*

### **3. Consultation with experts and research institutions**

Consultations with an expert, research supervisor, research consultant or a senior scholar in one's area of specialisation can be useful.

The most important function of the research expert is to help the average researcher clarify his/her thinking, achieve a sense of focus, and develop a manageable problem from one that may be vague and too complex.



#### **Activity**

*Name the research institutions and organisations in Kenya and specify the kind of research they do. Explore their websites to determine key issues or areas, which represent their current focus.*

### **4. Participation in professional discussion / forum**

Seminars, workshops and conferences provide forums for discussions and exchange of ideas with professional colleagues, which suggest many stimulating problems to be solved. Most of the fora are designed to sensitise or create awareness among professionals about new challenges, developments and problems that face their professions. For example HIV-AIDS awareness programmes are designed to sensitise people/ students about its negative implications. By participating in these forums, the researcher is likely to improve his/her problem awareness.



#### **Activity**

*Examine the forums you have attended in the recent past. What key issues were addressed? Can they represent the basis of your study?*

### **5. Social developments and technology changes**

Social changes and developments constantly bring forth new problems and new opportunities for research. For example, the development of computer applications in the operations of organizations has brought forth several issues that require investigation.





*Examine recent technological changes in education. How you could translate them into viable research studies?*

#### **6. A questioning attitude**

A questioning attitude towards prevailing practices and research-oriented academic experiences will effectively promote problem awareness.

### **TOPIC 4: Characteristics / criteria of a good research problem**

Before the proposed research problem can be finalized, several conditions and considerations must be satisfied. Among these are the characteristics of a good research problem. These are discussed herein:

#### **1. Relationship between variables**

A good research problem should express a relation between two or more variables. It asks, in effect, questions like: Is A related to B? How are A and B related to C? How is A related to B under conditions C and D?

The relationship between variables may, however, not apply to qualitative research.

#### **2. Theoretical and /or practical significance**

The problem should be significant enough and involve an important principle or practice. Its solution should add to knowledge or lead to an improvement in the current practices.

The problem should add to the development of a discipline and to previous findings in any way, for example, suggestions for further research.

#### **3. Feasibility and amenability**

Feasibility implies the suitability of the problem for a particular researcher. The researcher should be able to carry out the study through to its successful

conclusion. He/she should possess the required competence, knowledge and understanding, related to the selected area of study.

#### **4. Availability of data**

The researcher should ensure the availability of adequate valid reliable data. This is necessary because, it will be on the basis of this data that evidence will be drawn to support research findings or conclusions.

The researcher should ask - Can the problem be investigated through collection and analysis of adequate, reliable and valid data?

#### **5. Novelty**

The problem should be sufficiently original so that it does not involve objectionable duplication. The study should also employ the most recent data.

However, the fact that a problem has been investigated before does not mean that it does it is no longer fit for a study. There is need for verification of previous findings using newer and better devices and procedures. This represents a process called replication.

#### **6. Interesting**

The problem should be interesting to the investigator. The investigator should have a strong motivation for it. This will give her/him the courage and determination to pursue the study in spite of difficulties that may be involved. He/she should be willing to risk criticisms.

#### **7. Empirical testing**

We can decide whether to use quantitative or qualitative methodology. A problem and problem statement should be such as to imply possibilities of empirical testing, for quantitative research. As a scientific problem, it should contain implications for testing the stated relation (s). This implies that the variables of the relation can somehow be measured.

Philosophical or ethical questions cannot be tested empirically or quantitatively. Qualitative research approaches are preferred, in this case.

Example:  
How do we know?

Does democratic education improve the learning of youngsters?

The variables of the two questions are difficult to define and measure, hence, qualitative methods would be preferred.



### Activity

*Select a general area or issue of interest, for example: ICT IN LEARNING and do the following:*

*Explore the selected area by:*

- *Specifying and defining the key concepts*
- *Defining the key variables*
- *Determining possible relationships between the variables*
- *Determining which types of populations the study will be based, for example, secondary schools in Nairobi.*

*Where will the study be located?*

*Define the problem in specific and focused terms indicating:*

- *The main issue at stake to be addressed*
- *The independent and dependent variables*
- *The specific research title.*

## TOPIC 5: Variables in research

### What is a variable?

In Section 2 a variable is defined as: a characteristic, attribute or property that can take on different categories, levels or numeric values among people, events or objects. We revisit variables and concepts here below:

Variables are developed from concepts or constructs. A concept 'expresses an abstraction formed by generalization from particulars' (Kerlinger 1986). For example: 'Temperature' is a concept which expresses numerous observations of things that are more or less 'cold' or 'hot' likewise, 'achievement' in mathematics is an abstraction formed from the observable behaviour of children or students. The behaviour is associated with acquisition of knowledge and skills in mathematics which can be interpreted through activities like: Solving arithmetic problems or obtaining a given score.



### **Activity**

*Find out the various behaviour or activities are put together and expressed in these words (concepts) or constructs.*

- *Intelligence*
- *Aggressiveness*
- *Honesty*
- *Conformity*

### **The major types of variables**

Variables are classified in several ways. In this text, two important classification criteria are used:

- a) Classification by status of the variable in a given relationship.
- b) Classification of variables by suitable measurement techniques.

The purpose of the first classification is to enable the researcher to explain the 'problem' under investigation. The second classification is to enable the researcher to collect the right data, which will be analyzed using correct techniques.

#### ***Classification of variables by status in a relationship***

In this classification, the assumption here is that any problem that a researcher wishes to investigate represents a variable or a set of variables. As noted earlier, defining the problem will specify certain concepts or constructs, some of which are scientifically known from theory, principles, and models and so on. Every variable (or problem) does not exist in isolation. Whenever something occurs or changes it will trigger subsequent changes of related factors. Its occurrence or change is also triggered by some precedent factor(s), which relate to it. However, not all variables have a relationship. It is, therefore, necessary to be selective in your choice.

A construct is a concept, however, it has added meaning of being deliberately and consciously invented or adopted for special scientific purposes. For example: terms like intelligence and motivation have been used for scientific purposes.

Variables provide more observable and measurable indicators of concepts and constructs. Concepts and constructs are defined in operational terms by

specifying activities or operations necessary to measure them. These activities, events or observations provide concrete meanings to the concept or constructs.



### Activity

*Describe the activities, behaviour, or events that can be used to describe the following concepts:*

- *Gender*
- *Education*
- *Social class*
- *Organizational productivity*
- *Occupational Mobility*
- *Verbal aptitude*
- *Anxiety*
- *Religious Affiliation*
- *Political preference.*

It can be argued that: a research problem represents variables. **The variables are things that occur, change or are still changing and need to be explained or controlled.** It is our inability to explain and control them, which constitutes the problem. Constants rarely pose problems. It is necessary for the researcher to identify and determine only those variables that are genuinely related to the problem 'variable'. This information can be obtained from relevant theories, previous research, and models, known principles, among others. Information about the relationships provides a preliminary explanation of the problem, which can be confirmed through data collection and analysis.

In classifying variables in a relationship, you will use the following types:

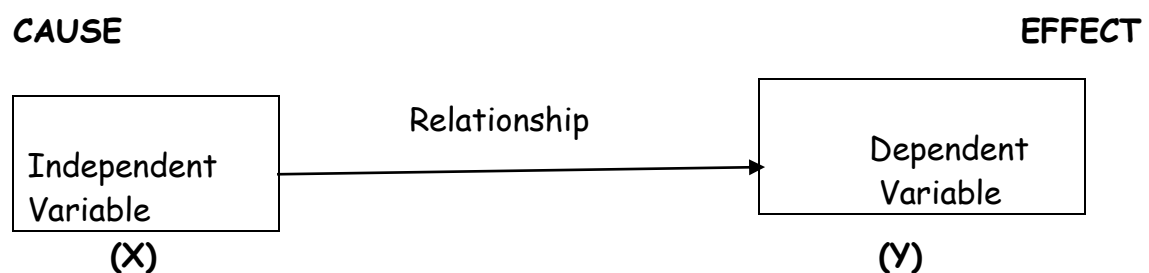
- 1) Independent variables
- 2) Dependent variables
- 3) Extraneous variables
- 4) Intervening variables

**Independent variables:** these are variables that influence or cause other variables to change. In this case, they are known as: 'CAUSAL FACTORS' in a given relationship. They are also referred to as the 'precedent' factors because they logically change or occur before other related variables can change.

**Dependent variables:** represent the variable that change or occur in response to previous changes or occurrences of independent variables. The dependent variables represent the **effects** in a given relationship. They are also known as the resultant factors in a relationship.

In research, explanations about phenomena represent the *cause - effect* relationship which is illustrated in Figure 4.1 below:

**Figure 4.1: Illustration of the cause- effect relationship**



You will notice that, this is a one-way process. The assumptions are that:

- If X caused Y then the two variables must have changed together. In this way they have a relationship.
- If Y changes or has changed we should observe the causal change in X
- If X changes, we should observe the resulting change in Y.
- If X is supposed to cause Y, then changes in X must precede changes in Y
- If X causes Y, then no other factor could have reasonably caused the change in Y at the moment. (This can only be determined if we hold other variables constant).



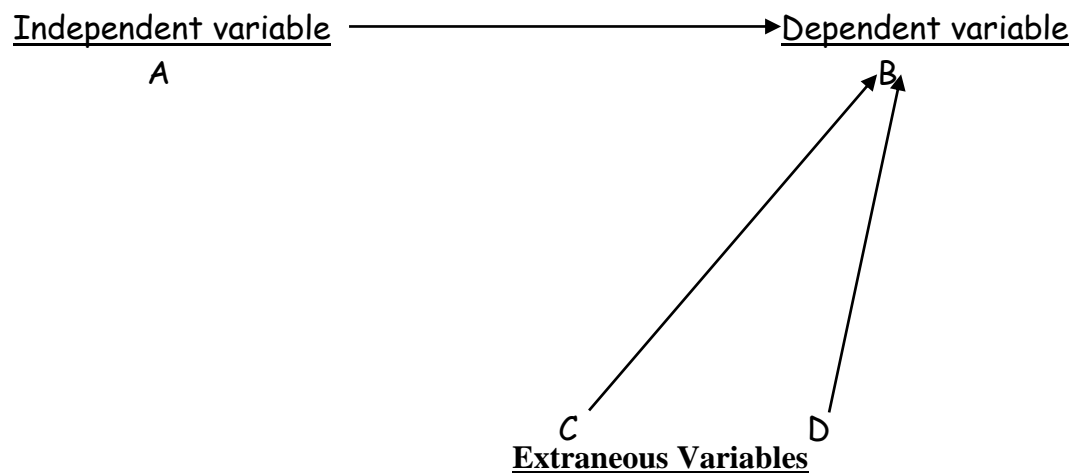
### Activity

*Examine the following sets of variables in the table here below. Determine if they have a Relationship with the other.*

Variable A	Independent or Dependent?	Variable B	Independent or Dependent?
1 Intelligence		Achievement	
2 Gender		Verbal aptitude	
3 Honesty		Social Status	
4 Aggressiveness		Religious Affiliation	
5 Achievement		Educational Level	
6 Age		Social Class	
7 Anxiety		Stress	
8 Political Preference		Religious Affiliation	

**Extraneous variables:** these are variables, which may influence the independent, and dependent variables yet do not constitute a major part of the research study. Extraneous variables are neither measured nor manipulated by the researcher. Unless they are controlled, by holding them constant, they may affect the validity of research findings.

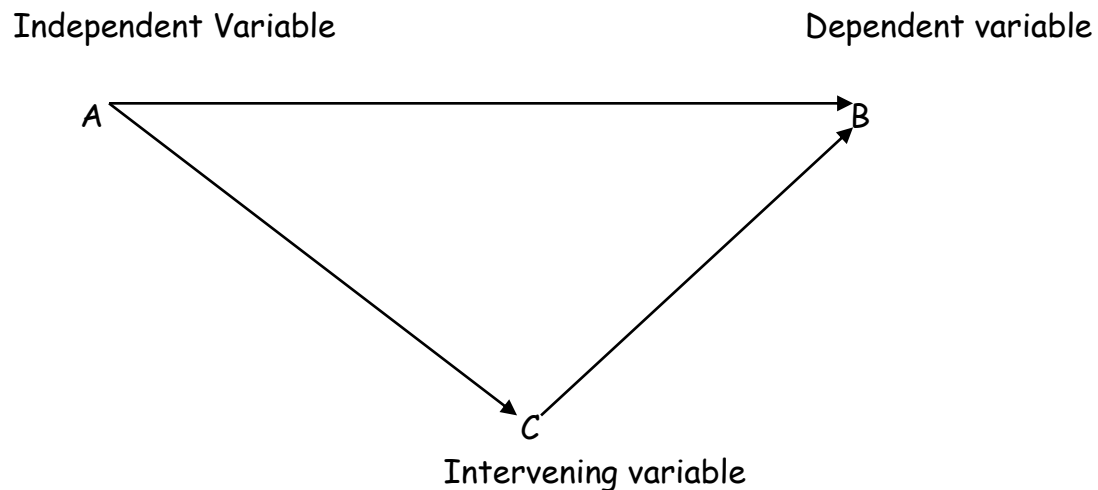
**Figure 4.2: Extraneous variables**



For example, in a study to determine the effects of teaching methods (A) on the performance (B) of students, in technical education subjects, the research may concentrate on data from the two variables only. It may happen that the performance (B), at the same time, is influenced by other factors such as Resources (C) and student Abilities (D). If these extraneous factors are not measured, then the result will be exaggerated or underestimated, thus affecting the validity of findings.

**Intervening variables:** sometimes variables exist in a cause - effect chain. For example, the relationship between A (an independent variable) and B (dependent variable) may not be obvious or direct unless some other variable, C (intervening) changes.

**Figure 4.3 Intervening variables**



For instance, we can introduce a method of teaching mathematics (A) to improve students' performance (B). However; unless students are motivated (C) when the new methods are employed, no significant change in B) will be realized. Majority of intervening variables represent psychological factors or constructs, which are difficult to observe or measure directly. Common examples include perceptions, attitude, motivation, morale and intelligence.

### ***Classification of variables by suitable measurement techniques***

Measurement is a process of collecting data. Variables are represented by numeric values, levels or categories with reference to a group of people, objects or events, according to their specific characteristics, attributes or property. Measurement is a means of comparing people, objects or events by assigning them numeric values, levels or categories. Measurement enables us to get data about their characteristics, attributes or properties. This gives these characteristics some meaning to enable us to describe people or explain their behaviour.

In terms of classification by measurement techniques, four types of variables are identified:

- a) Nominal variables
- b) Ordinal variables
- c) Interval Variables
- d) Ratio Variables



We must recognize, however, that some problems relating to social phenomena can be expressed in textual form. These are mainly developed in qualitative research. In this case, specific variables are not emphasized because of the complex nature of social phenomenon.

**Nominal variables:** these are variables which have categories that are arbitrary and sometimes mutually exclusive. The categories are arbitrary because there is no continuity or order between them. Also, they can be mutually exclusive because, in any given population, every unit belongs to one and only one category at any given point in time.

The variable that is measured in a nominal scale generates nominal data.



### **Activity**

*Specify categories of the subsequent variables.*

- a) Religious Affiliation
- b) Political Preference
- c) Occupation

Example:

Variable

Categories

a) Gender  
MALE

1.

2. FEMALE

**Ordinal variables:** nominal variables comprise categories or levels that can be arranged in a rank order sequence. In this way, it is possible to tell which level is higher or lower than the other. It is, however, not possible to determine the unit differences between the levels. We cannot tell, by what quantity one level is greater than another. This variable is measured on an ordinal scale.

Example:

Variable

## 1. Educational attainment

### Levels

1. Primary Education
2. Secondary education
3. University Education

Note that primary education is lower than secondary education, which in turn, is lower than university education. We cannot, however tell by how much secondary education is higher than primary education.

**Interval variables:** the interval variables comprise categories whose levels, can be arranged in an ordinal scale. At the same time, it is possible to establish unit differences between the levels. They are considered to be continuous variable. Each level of the variable contains a range of numeric values, from a specific minimum to a given maximum value.

Example:

<u>Variable</u>	<u>Levels</u>	<u>Value range</u>
Age - Group	1 Infant	0 - 2 Years
	2 Children	3 - 12 Years
	Adolescents	13 - 17 Years
	Young Adults	18 - 35 Years
	Adults	36 - 60 Years
	Aged	Over 60 Years

Note that the levels obey the order system. Each level has a range of numeric values.

**Ratio variables:** the ratio variable represents the highest level of all the variable types. In this sense, each variable comprises levels, which obey the rank - order sequence. It is also possible to determine unit differences between the levels of the variable. The variables are continuous, which means that they can take on any value along a continuous scale. Also, they generate absolute or exact values at the time of data collection.

Example:

### Variable

- Age
- Exam score



## **Activity**

*Examine the following variables, indicate whether and why they could be nominal, Ordinal, interval and ratio.*

- *Honesty*
- *Aggressiveness*
- *Education*
- *Social Class*
- *Anxiety*
- *Religious Affiliation*
- *Political Preference*

## **Applications of variables research study**

As noted earlier, the first step in research is to identify and define a problem. As the problem is defined certain abstract concepts emerge. These concepts must be defined in operational terms as variables. The purpose of this is to facilitate the data collection process. Evolving suitable measurement techniques for each variable develops their operational definitions. In this process, we must determine whether or not the variable is nominal, ordinal, interval or ratio. The observable and measurable indicators must be specified in terms of activities, behaviour or events that represent the variable or concept. These events, behaviour or objects can then be classified into relevant categories, levels or numeric values, to define each variable.

## ***Use of variables in formulating a conceptual framework***

In developing a research proposal, it is necessary to specify key variables in the study. Prior knowledge of the variable is necessary to enable the researcher formulate viable objectives, research questions or research hypothesis.

In majority of research studies, the dependent variable represents the research problem. We could, therefore, identify or determine possible causes (independent Variables) to the problem by examining relevant theories, models or principles as well as previous research. Theory is defined as: "A set of interrelated constructs (concepts), definitions and propositions that present a systematic view of phenomena by specifying relations among variables with the purpose of explaining and predicting the phenomena" (Kerlinger 1986: 9)

Miles and Huberman (1994) state that a conceptual framework explains the main things to be studied in a narrative form or sometimes graphically. The main things to be studied include concepts, constructs or variables. The explanation provides the presumed relationships among them.

Both theory and a conceptual framework can be used to specify the independent variables for a given research study. Once the problem is known, we then need to build a framework that relates it to independent variables. A conceptual framework can be rudimentary, elaborate, theory - driven, descriptive or casual. Conceptual frameworks are best done graphically rather than in text. This enables the researcher to map the likely relationship, to identify variables that are conceptually distinct and work with all information at once.

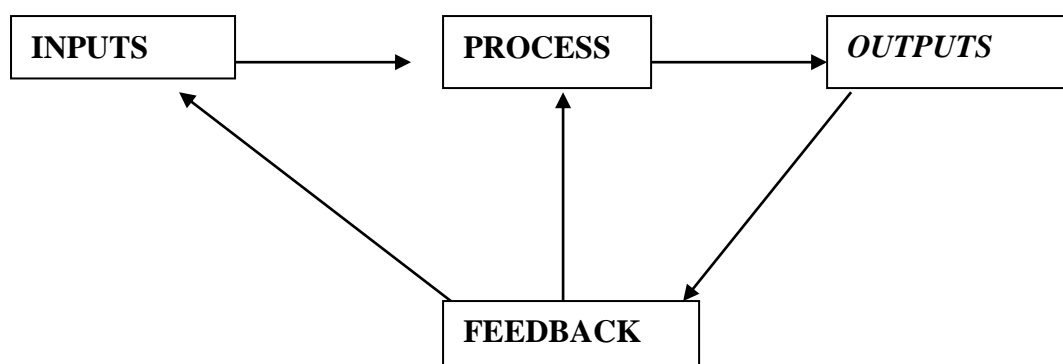
In studies relating educational programmes, a conceptual framework can be developed using a logical system of the relationship among variables. For instance, this could be built on a systems model.

In any system, four key components can be identified, namely:

- Inputs
- Process
- Output
- Feedback

For example, if we were to take Guidance and Counselling Programme as a sub-system in a school.

**Figure 4.4: A system model**



The *inputs* component represents the factors that should be put in place initially to enable the system to function. For example: Human resources, physical facilities, policy guidelines, and financial resources, among others.

The *process* component represents the techniques and methods that must be employed to reinforce the inputs towards the achievement of the desired

outcome in the system. For example, methods of training, motivating students/ employees, performance measures among others.

The *outputs* represent the desired outcomes or results that should derive from the system. For example: Achievement of institutional objectives, good student performance and other positive results.

The *feedback* component provides checks and balances in the system by revealing possible successes, achievements, weaknesses and limitations in the system. For example: Observed poor performance among students, indiscipline cases and others.

In relation to your research study, the feedback represents the indicators of the research problem, which in turn represents the dependent variables.

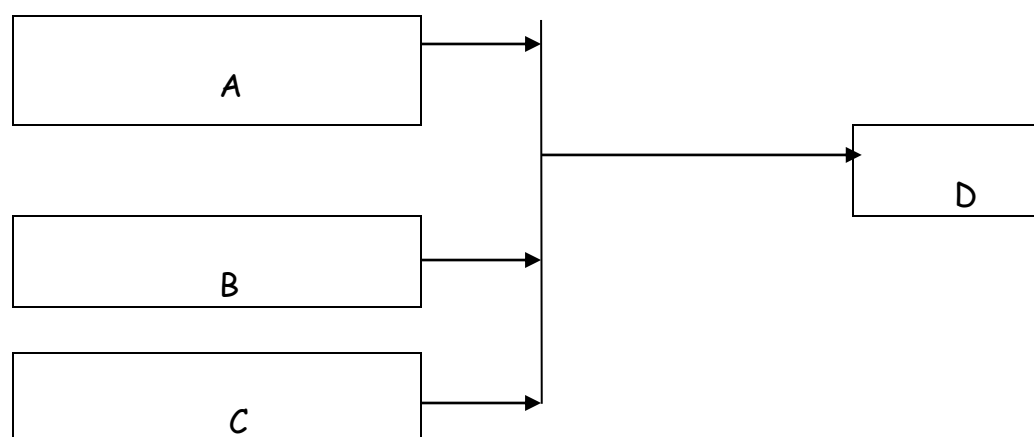
The problem can then be explained in terms of the possible causal factors within the inputs and Process Components of the system. These factors, in turn, represent the independent Variables.

A schematic illustration can be developed showing the independent and dependent variables as follows:

**Figure 4.5: A schematic presentation of relationships among variables**

Independent Variables

Dependent Variables



It is possible to explain the relationship between these variables conceptually. Objectives of the research study and research questions would then be formulated by evaluating each independent variable against the dependent variables

**Conclusion**

The first step in any research study is to identify and define a research problem. Before identifying a suitable problem for your study, explore suitable source of information relating to your area of interest. Literature review is one of the major sources. After defining the research problem, it is necessary to evaluate its viability before you begin the research process.

## **SECTION 5**

### **WRITING A RESEARCH PROPOSAL**

#### **Introduction**

This section gives you highlights of the relevance of a research proposal the types and the major components of a research proposal. It also explains the meaning and the significance of each component of a research proposal.

You should be able to prove that you can do independent research in the field of education. The research proposal requires thorough planning and reflection that must be substantiated by the literature sources you have consulted.

#### **TOPICS**

- Meaning and importance of a research proposal
- Types of proposals
- Format of a research proposal
- Conclusion



#### **LEARNING OUTCOMES:**

By the end of this section, you will be able to:

- Explain the importance of a research proposal
- Distinguish between various types of research proposals
- Write an appropriate research proposal

#### **TOPIC 1:    Meaning and importance of a research proposal**

Research is a major component in the modern technological world; however, did you know that those who embark on proposal writing would do so but only a few reach the target? We believe, you will plan, write and execute your research proposal writing in such a way that you will complete it.

Having worked through the first four sections, you may now begin to think about developing a research proposal, which must be approved before you start of collecting data because proposal writing is the first step in the research process, which helps the researcher to think through each step of the research project before embarking on it. You should consult literature relevant to the following:

- Educational research
- Research methods appropriate to the one you wish to undertake and
- The characteristics of a research report
- It is also important to study certain research theses/reports to determine what is expected of you
- Try to establish what has already been written on the subject/problem you have identified, what results and conclusions were made from it and which theories exist in the field that you can link to justify your research problem.



*What is a research proposal, in your own view?*

Look at a few suggested answers given here below and compare them with yours.

- A research proposal can be described as the way in which dependable and useful information about the education programme is obtained. The proposal is an integral part of the entire educational research process.
- A research proposal is a detailed description of a proposed study designed to investigate a given problem.
- It is a plan of action for fulfilling a need. It is a sales document that is honest, factual, and responsive to the needs of others.
- It is a written description of work to be performed that provides enough information for a customer to make a purchase decision.
- A proposal demonstrates the researcher's ability to think clearly about the intended research or project.

### **The importance of a research proposal**



#### **Activity**

*State at least four reasons for writing a research proposal.*



It has been noted that writing a good proposal has several merits that include the following:

- The proposal writing itself is a training ground for the actual performance of the work. It establishes:
  - ✓ The conceptual design
  - ✓ Initiates planning
  - ✓ Identifies needed equipment and facilities and hence the cost of the project
  - ✓ Formulates needed work methods and procedures.
  - ✓ Familiarizes the proposer (researcher/writer) with the scope, intent, and content of work.
- An error of design, planning or estimating found during proposal preparation creates less impact than if it is found during actual data collection. Unnecessary alterations in the process of research, which can be time-consuming and wasteful, can be avoided.
- A research proposal communicates the intentions of the researcher, the purpose of his intended study and its significance together with a logical plan for conducting the study.
- It is a written plan for a study spelling out in detail what the researcher intends to do.
- The budget outline, which is part of the proposal, enables the researcher to solicit funding for the project to establish issues such as the relevance, adequacy, clarity, usefulness, and appropriateness of methods used in the study.
- The overall achievement of the research objective is also easily evaluated, based on the proposal.
- A proposal compels you to state all your ideas in written form so that they can be evaluated and improved upon by you and others.
- It can also serve as a guide when you conduct the study so that you do not forget important procedural details.
- A neat, accurate, easily read, well-written and comprehensive proposal provides a head start on writing the thesis or dissertation.
- It permits others to learn about the intended research and to offer suggestions for improving the study. It helps the researcher clarify what needs to be done and avoid unknown problems.
- In a research proposal problems are identified, questions or hypotheses stated variables are identified and terms are defined. The subjects to be included in the sample, the instruments(s) to be used, the research design the procedures to be followed, how the data will be analyzed all are spelt out in some detail and some brief review of previous related literature is included.
- Allen (1975) in Mwiria and Wamahiu (1995:158) states that a proposal will assist delineate the specific area of research and in clarifying the purpose,

scope, methodology overall organization, limitations of the study and any special terms that may be unique to the study.

## **TOPIC 2: Types of proposals**

There are basically two main types of proposals:

- ✓ Research proposal
- ✓ Project proposal

We shall briefly focus on each type of proposal.

### **The Research proposal**

This is where a researcher proposes to undertake a piece of research on some pertinent issue. A research proposal may be an academic research proposal leading to a diploma, a Masters degree or a PhD. Most institutions require various components that generally go into an academic research proposal, however, there may be slight variations in format from one institution to another. The student should know the accepted format before embarking on writing a proposal. We shall do the same here so that you know right away the KTTC research proposal format.

Other research proposals too are aimed at undertaking research to solve a problem even though they may not be academic oriented; for example, action research.

A non-academic proposal would not be as detailed as the academic one in terms of components yet the quality should never be affected. For example, any hypothesis may not be necessary.

### **The project proposal**

This is the type of proposal, which is academic oriented but is action oriented and aimed at undertaking certain activities to solve specific problems.

It is possible to find a project proposal with a research component especially when conducting baseline survey [or SWOT Analysis]

A project proposal is aimed at solving a specific problem, for example. School feeding programmes, provision of health facilities and may others.



### Activity

*Think about problems in your community that may need to be included in a project proposal as illustrated above. State at least four project proposals.*

In a research proposal the outcome will be data that can be used as a basis for proposing a project or data, which will contribute to new knowledge. This also forms a basis for recommendations and action. Data collection and analysis is carried out and a research report is written.

While a project proposal focuses on implementation of proposed strategies and activities as well as on evaluation of the objectives, a research proposal is focused on expected outcomes on which recommendations are based for further action.

### TOPIC 3: Format of a research proposal

Since the format depends on the Institution and may differ even from one faculty to another. We shall give an outline for KTTC. Do not forget that the components are universal except for the sequence and purpose.

#### ***Components of a research proposal***

A list of the major elements or components of a research proposal is given as a guideline to you as you undertake the challenging task of proposal writing. This topic discusses important aspects of writing a research proposal for a thesis or dissertation toward a higher certificate or degree. It gives useful hints to ensure that a proposal meets the academic/faculty requirements. Bearing in mind that carrying out research is a very expensive and tedious venture, we feel it is important to ensure that you prepare a good, quality proposal.

Researchers in educational institutions have a wide range of opinions regarding what should go into a research proposal and what each component entails. The differences in opinion are due to:

- ✓ Varied interests
- ✓ Educational backgrounds
- ✓ Biases
- ✓ Expertise
- ✓ Experiences of researchers

As a student developing a research proposal, you may expect to encounter these differences from various lecturers at KTTC who may be your supervisors. Therefore, proposal guidelines are important for you even though having an acceptable standard may be difficult. In research, you can decide on which component to emphasize, depending on what you or the faculty considers being the major aspect of the proposed study.

The summary of the components of a research proposal preliminary is presented herein:

- The title
- Declaration
- Dedication
- Acknowledgements
- Abstract

*An Introduction section, which includes:*

- The background of the problem
- The statement of the problem
- Purpose (goal) and objectives of the research. Research questions or hypotheses.
- Limitations and assumptions
- Definition of concepts (Acronyms/Abbreviations)
- The theoretical and conceptual framework.

*A Literature Review section where:*

- The researcher reviews literature related to the topic under investigation.

*A Methodology section, which includes the description of:*

- The research design
- The population, sample and sampling techniques
- Data collection procedures
- Data analysis techniques.

*References/Bibliography*

*Appendices*

- Time schedule
- The budget

## Details of the research proposal components

### 1. The title

A research title should be **descriptive, short, clear, self explanatory and specific**

- **It should capture and reflect the content of the research proposal**
- **The title should clearly indicate the problem, the purpose of the research. The variables, methodology, the target population, outcome of the study, which is encompassing briefly the essential elements of the study.**
- **It should be well focused in terms of the problem of study.**

You need to start with a preliminary title because it may change as shifts in emphasis occur normally with progression of literature reviews.

Avoid any obscure technical terms within the title. You can explain them within the section including definition of terms/acronyms.



#### Activity

*Now that you have read about the title, think about an area of study that may be of interest to you. Write a title for your study. Does it have the qualities mentioned?*

### 2. The abstract

As you have just seen, the title of a research proposal is very important because it points to all the components including the outcome of the study. On the other hand, an abstract is a brief summary of the major parts of a proposal and provides a précis of the whole problem to be investigated.

It is a useful resume, particularly when a proposal is long, complex, elaborate and involves large sums of money. It should be concise and precise but informative.

- It should be a one paragraph summary of what you intend to do.
- Some researchers say that it should be a maximum of one page (300 - 500 words); this could surprise you but when you use words wisely, then it is possible.

## *Importance of an abstract*



*You now know what an abstract in a research proposal is. State three ways in which it is of use to the reader.*

Below are some of the suggestions we have given on the importance of an abstract.

- It provides busy executives and donors with a summary of what kind of research activities are envisaged, what is likely to be accomplished and the relevance of the findings
- It informs and lures colleagues to read your work.
- An abstract of the proposal portrays an on-going task.

An abstract should focus on and describe the following aspects:

- The title
- The purpose of the study
- The statement of the problem, objectives and hypotheses
- Methods to be used in investigating the problem
- The scope of the research
- Expected results and their significance
- Statement of the budget and when you expect to carry out the work.

What all this adds up to is that, an abstract should be complete enough to adequately give the reader an overview of the problem, the general plan of investigation and how the researcher intends to solve the problem through the proposed research without necessarily studying the proposal.

### **3. The introduction section**

This component compresses of several sub-section. We shall briefly outline what each entails.



### Activity

*Let us for a moment think of why we always wish to let someone know who we are, what we do, where we come from and in case of a teacher, the subjects and classes that we teach. You could list any idea that crosses your mind. Think of situations when you did introduce yourself to someone or to a group of people why was it necessary?*

Now we can turn to the introduction as a component of a research proposal. It states the problem and cites important previous research. The researcher justifies the importance of the problem, hence the need for the study and oft times may try fitting it into a theoretical context. The introductions thus;

- provides a basis for the study
- usually constitutes the first chapter of the proposal and is an important component, which if well written, tells a lot of what is to follow in the rest of the proposal.

An introduction should: stimulate the reader's interest in the research problem; create a good impression about the author and the research project as a whole; and acquaint the reader with the problem to be investigated by providing relevant background information.

An introduction section should include the following sub-section:

- The background of the problem
- The statement of the problem
- The objectives of the study
- Research questions or hypotheses (if any)
- The rationale or justification of the study
- The limitations and underlying assumptions (if any)
- The theoretical framework or conceptual model (wherever possible),
- Operational definition of terms.

***The background to the problem:*** The background to the problem is an essential part in any research proposal. It broadly introduces the background and theoretical framework of the study. It is a concise, descriptive, informative and climate building preamble culminating in a statement of the problem being addressed. It should be written in a logical and balanced way to portray the researcher's vision of topical issues to be investigated.

It is in the background to the problem that a global, regional and national overview of the research topic is briefly discussed. It should be relevant and help the reader to establish that there is need for investigation. It describes briefly prior studies in the same field and points out specific areas that have not been fully studied or areas that have doubtful facts and gaps in knowledge that remain to be investigated. For example; if we take the area :

"Female Education in Kenya"

Then you should give an overview of the status of female education globally, regionally (in Africa) and nationally (in Kenya). This will enable the reader have an idea of what is happening regarding the area under investigation. It should also show how the study relates to developing trends in educational thinking. The researcher is expected to justify why resources should be committed to the proposed work. You must indicate the benefits likely to accrue from the findings in relation to what has been done, in that, ultimately research findings are for the benefit of the people.

The background to the problem should indicate clearly how the proposed study departs from or adds to what exists in that educational discipline. You need to quote authoritative sources in order to establish a frame of reference. You will have a pretty clear idea on how to organize the introduction by addressing some questions outlined herein.

- What current and previous studies have been done on the issues to be studied?
- What is the available information on the magnitude, nature, and causes of the problem?
- What are the present gaps in knowledge and what makes the problem worth studying?
- What do you intend to do to solve the problem?
- What is the conceptual framework on which your study will be based and what are the tentative hypotheses to be employed in answering the questions?
- Does the solution to the problem have any practical or theoretical significance?
- Have you stated the assumptions relevant to the study?
- What are the social, economic, political, technical and environmental considerations involved?

You could now take note that when you have answered all these questions you will be able to state reasons why the proposed study must be undertaken.

**The statement of the problem:** the statement of the problem refers to an explicit statement of the specific research topic to be investigated. It should be



clear, specific and manageable identifying as far as possible all the variables in the study, outlining them in conceptual rather than operational form.

In much the same way, we can look at another example of a research problem.  
"Failure in mathematics among girls in secondary schools"

In this topic, you should describe factors that make the stated problem a critical issue to necessitate the study, thus, making a case for the research. So how would you go about it?

Example:

Topic: "Elaborate on the consequences of girls failing in mathematics.

Look at the Topic, List in the given Boxes as many factors as possible.

Here is a list of some of the consequences which we considered. Compare it with yours.

- Low enrolment of women in science and Engineering
- Gender inequality
- Few women in Management
- More women in social sciences
- Negative attitude towards mathematics by the girl child
- Lack of interest
- Lack of motivation

Now for something that may surprise you: The problem statement should range from half ( $\frac{1}{2}$ ) to two (2) pages, for you have to refer to relevant literature to describe the effects. What this all adds up to is that a short and uncomplicated problem statement is recommended.

### *Qualities of a good problem statement*

You need to evaluate your statement of the problem before you plunge deeper into the literature review. According to Best (1983), Borg and Gall (1989) and Mulusu (1990) cited in Mwiria and Wamahiu (1995), qualities of a good problem statement are:

- ✓ The ability to communicate to a sophisticated audience who do not necessarily have the technical knowledge of the researcher
- ✓ A clear fit within the broader context of current theory and relevant research, meaning that the problem addresses a significant issue both theoretically and practically.
- ✓ The research ability that is if it is feasible to collect the necessary data?

- ✓ Clarity and limited scope: if the problem is manageable with the resources and time available to the researcher.
- ✓ A logical and clear relationship to the hypotheses, the research questions or the specific objectives that follow the problem statement.

In summary, the statement of the problem justifies the research project especially when the problem is limited in scope and is well stated to facilitate the development of the purpose, objectives and hypotheses of the study. It is usually drawn from a brief review of the most important literature and the theoretical background, outlined in the preceding section [section 4].

The statement of the problem leads to the development of the purpose which is presented here below.

**The statement of purpose:** This is a broad statement indicating what the researcher intends to do about the problem being investigated. It identifies the goal of the study, emphasizing **mainly the practical outcomes**. It serves to elaborate upon the information implied in the title of the study. It should be brief but specific giving a quick overview of the study itself. It helps to focus the problem more clearly identifying the variables to be examined.

The purpose of the study can be written in two ways. One way is to state it at the end of the problem statement section as follows:

"The purpose of this study is to find out the consequences of girls failing in mathematics in secondary schools."

It is hoped that the study would provide information that could be used to develop policy recommendations for gender or creative procedures of teaching mathematics. Using this format, the researcher states the problem, and narrows down to the purpose statement towards the end of the section. The first part of the statement of purpose is stated in declarative form to describe the intended purpose. On the other hand, the second part shows how a statement of purpose can also include how the outcomes would be used to improve the subject or object of study.

Another way is for the researcher to have a separate subsection on the purpose statement and then follow it with a brief rationale of the stated purpose.

Whichever way it is presented, the purpose of the study should not exceed ONE paragraph.



### Activity

*Identify a research problem in Education and write the statement of purpose.*

**Objectives of the study:** An objective is a statement of purpose or the intended specific outcomes of the study with or without criteria of achievement; specified in long or short-term parameters.

Every study must have specific objectives to guide the investigation and they should be cohesive, precise, testable, brief and logically arranged. Objectives should be relevant to the problem statement and show the relations between variables.



*What purpose do objectives serve in a research study?*

Table 5.1 lists some purposes of objectives

**Table 5.1: Purposes of objectives**

They set the scope of the study
They determine the kind of research questions which will be asked.
They determine the data collection and analysis procedures to be used.
They help to further clarify focus and specify the problem more accurately.



### Activity

*Visit your nearest library and consult research reports, theses or journals to get an idea of how to state titles, purposes and objectives of the study.*

Here is an example to illustrate what you should do:

Title: The distribution of educational resources and opportunities in Kenya by location, sex and level.

General aim: Determine factors influencing the distribution of educational resources.

Objectives: (i) examine the factors determining the levels and nature of educational resources and opportunities  
(ii) analyze the socio-economic differences within regions and social groups in relation to organization and financing of educational system.

**Research questions or hypotheses:** Research questions and hypotheses are normally used alternatively. The questions are usually posed so that when answered, the responses will help in achieving the objectives of the study.

To set the research questions, you convert the objectives into questions. The only difference between research questions and objectives is that research questions are stated in question form while objectives are in statement form, hence when both are referring to the same phenomenon then one set becomes redundant. You, therefore, choose only one set either research questions or objectives to be included in the study. However, it is possible to have both in a proposal but only when the objectives are broader and the research questions more specific.

Look at this example of how the preceding first two objectives can be converted to research questions:

- What are the causes of failure in Mathematics by girls in secondary schools?
- What are the consequences of girls' failure in Mathematics at the secondary school level?



### Activity

Look at your research problem and the objectives and convert them into research questions. Compare your questions with the example we have given.

**Hypotheses:** The research proposal should contain a clear set of research hypotheses that are proposed to be tested. Hypotheses are educational or

intelligent guesses about possible solutions or explanations to the problem. A hypothesis is a proposition about the solution to a problem, the relationship between two or more variables or the nature of some phenomena. They are based on the research objectives. A hypothesis may be directional or non-directional. Verma and Beard (1981) elaborately define a hypothesis as a: A tentative proposition, which is subject to verification through subsequent investigation.

In many cases, hypotheses are hunches that the researcher has about the existence of relationship between the variables in the study [Mwiria & Wamahiu 1995].

Usually about 4 to 6 hypotheses are quite adequate for a study (Borg and Gall, 1984).

Both the research working hypothesis and null hypothesis can be tested statistically.

#### *How to state a hypothesis*

Once you have identified a research problem, you then formulate plausible solutions to the problem. Using your experience, intuition and consultations, then go through a variety of questions to come up with guiding hypotheses and techniques for verifying them.

For example:

- Is the hypothesis testable?
- Why is the hypothesis valid?
- To whom is the problem relevant?
- Will the results solve the problem?
- How much will it cost in terms of time and money to the study?
- What are the likely outcomes and impact?
- What are the constraints to carrying out the study?
- Are there alternative solutions to the problem?

(Keya, and Makau, 1989)

Many researchers experience problems in stating the hypotheses and the problem at hand. Yet it is extremely important to state the problem, hypotheses, themes, or arguments in the clearest terms for readers to follow the thrust of the argument.

Two examples of hypotheses are used, the directional hypotheses and the null hypotheses. Directional hypothesis state that "a relationship exists between the variables while a null hypothesis state that; no relationship exists between the variables or there is no difference between the experimental treatments.

### *Directional hypothesis*

#### Examples of directional hypotheses

- There is a positive and significant relationship between teaching style and girls' performance in Mathematics in Secondary school.
- There is a positive relationship between standard eight (8) pupils' attitudes towards science education and the level of achievement in science by the pupils in Kenya.

You can now easily state a directional hypothesis for your research problem.

### *Null hypotheses*

#### Examples of null hypotheses

- There is no relationship between teaching style and girls' poor performance in Mathematics in secondary school.
- There is no significant difference between achievement of class one (1) pupils with pre-school education and those without pre-school education.

Note that each hypothesis implicitly states the research problem since it gives the lines of investigation and the variables to be studied.

### *Qualities of a good hypothesis*

Assess your hypotheses by looking for the following: A hypothesis should

- State the relationship between two or more variables.
- Be reasonable and consistent with the existing body of knowledge.
- Be testable and verifiable.
- Be as clear and brief as possible.

However, whether directional or null hypotheses are stated, the differences or relationships guessed refer to population differences not sample differences. There are no hard and fast rules regarding when a researcher should use hypotheses, research questions or objectives. The choice depends on the academic disciplines and upon the nature of the study or problem.

**Significance of the study:** What do you imagine would go into this component? Some researchers refer to this subtopic as rationale or justification of the study. The words may be used synonymously to outline the reasons and importance for conducting the study.

- You should be fully convinced about the usefulness of the study before you begin.
- You should only investigate a research problem if it demonstrates value to the community school or country in general in terms of providing a solution to a particular problem.
- A research problem is also significant if its findings can contribute to the advancement of knowledge and theory or verification of theory.
- The results of the study should also be useful to professionals, planners, practitioners or the lay public.
- You should highlight what may be lost if the study is not done immediately. This will further strengthen the case for the study.

Keep in mind the questions that you should consider in writing the rationale for carrying out the study. Suggested questions are:

- (i) Why do you think the study is important?
- (ii) What is the study going to contribute to the extension and refining of existing knowledge both theoretically and practically?
- (iii) What contribution will the study make to the improvement of the related situation?
- (iv) What gaps in knowledge will the study address?
- (v) Is the study worth it?
- (vi) How will the results be used?

We will now conclude by stating that the researcher should explain why the study is meaningful, viable and worth spending time and other resources on. The practical significance can, for example, be described to point out issues such as who really needs the study and to whom the findings are likely to be useful.

The justification or rationale or significance must be strong enough to warrant the use of time, energy and money in carrying out the research.

Did you also realize that whether the researcher uses

- Significance
- Rationale or
- Justification of the Study;

depends mainly upon his choice and type of study and the target population?



### Activity

*Think of your research topic and give a justification for the study. Identify who will benefit from the results and briefly explain how.*

**Limitations and assumptions of the study:** Limitations refer to constraints both theoretical and practical, that the researcher has little or no control over. Limitations are an aspect of the study that the researcher knows may negatively affect the results or generality but over which he has no control.



### Activity

*Explain why stating limitations are important in a research study.*

We came up with the following reasons:

- They assist the researcher to avoid
  - Pitfalls
  - Over expectations
  - Under estimations
  - Frustrations in the course of the research project
- They show the scope of the study so as to enable an enthusiastic reader make tenable generalizations of the findings.
- They give the necessary precautions during data interpretation and generalization of the results.

Compare these reasons with the ones you gave in the Activity. Indeed, all of them help to explain why you need to state limitations of the study. How about looking at a few examples of the limitations?

- Financial
- Design of instruments
- Language use in questionnaires
- Sample size due to inadequate time, information funds etcetera.
- Length of the study
- Data collection procedures.





*When visualizing your study topic verses these limitations, what is likely to affect your findings? Give reasons why and explain how.*

You need to be very honest in stating the limitations so that readers can make intelligent deductions from the results. Never hesitate to state a limitation for there is no perfect study that lacks limitations.

**Assumptions of the study:** You have been making some assumptions in previous activities. Here we indicate what assumptions are:

- They are statements about what the researcher takes or believes to be true but cannot verify.
- The researcher makes assumptions concerning the conditions or important factors affecting the study.
- They are unique under the conditions, which the study is carried out.

Kathuri and Pal (1993:77) say that there is a multiplicity of variables in any research and so only a few variables are selected to be included in the study while the rest are controlled. The researcher may be aware of other variables, which can neither be included in the research nor be controlled. These could be stated as assumptions if the researcher is convinced that they may not influence the relationship of the variables selected for the study.

#### *Why and how you state assumptions*

Stating assumptions will help you to justify the study and consequently the findings. The results should be interpreted in the light of the stated underlying assumptions. You could either agree or disagree with the assumptions. The assumptions may either be convincing or not this will influence the acceptability of the findings.

Examples of assumptions/when given a research topic

Topic: *Poor performance of girls in Mathematics in secondary schools.*

Assumptions:

- All mathematics teachers are trained and qualified.
- Mathematics exercises are given regularly to the students.
- Girls have an interest in Mathematics

You can now state your assumptions based on your research problem. Keep in mind that even though assumptions are not a subject of investigation, they should be clearly stated in the proposal.

**Definition of terms:** It is worth mentioning that the researcher should define terminologies or concepts to be used in the context of the study. This will give an understanding of the sense in which the terms have been used.

Operationally define the dependent and independent variables, stating how the variables will be measured in your study. For example, poor performance can be defined as achievement below 50% out of 100% or being unable to calculate a given number of sums in an examination.

**Theoretical framework or conceptual model:** This is a really challenging part of the research proposal. If the researcher wants to test an existing theory, then he/she should show how the research question is related to the theoretical background. The theoretical framework should be clearly explained and we can describe it as a well-developed coherent (logical and consistent) explanation for an event: for example, Piaget's theory of child development.

The researcher may specify a theoretical framework for the following reasons:

- To locate their research
- To test a theory
- To apply a theory

Here is an example of an extract from a theoretical framework:

*This research is informed by Carl Roger's theory of person-centred which holds that the core conditions (empathy, genuineness and unconditional positive regard) are both necessary and sufficient in dealing with human beings (clients)*

*While working within Roger's framework, this research will also explore the validity of the use of core-conditions in schools set-ups and other intra as well as interpersonal relationships.*

*Using core conditions and verifying if and how it works. Look at the example and comment as to whether it is testing, applying or simply locating the proposed*



### Activity

Now try to describe a theoretical framework, which may apply in your study, and explain how it will be used in your research.

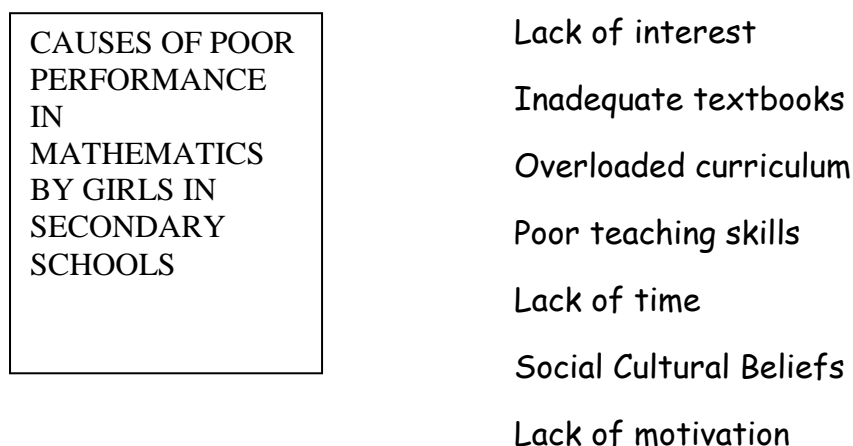
You may be wondering about the difference between a theoretical framework and a conceptual framework. A conceptual framework is a less well-developed explanation for events. For example, it might link two or three key concepts or principles without being developed into a full-blown theory.

The researcher should conceptualize the relationship between variables in the study and show it graphically and diagrammatically.

- It is a hypothesized model identifying the concepts under study and their relationships.
- The conceptual model helps the reader to see at a glance the proposed relationships and hence their importance.

The conceptual framework is illustrated in figure 5.1.

**Figure 5.1: A conceptual framework**



### Activity

Study the example illustrated above and develop a conceptual framework for your study.

It is important that you are aware that not all studies require explicit theoretical frameworks. For example, they may not be needed in explorations of new areas of research, which lack well-developed theories. However, considering the conceptual / theoretical framework in a study assists in making visible assumptions built into the research.

### **Literature review**

It would be of interest to note that: "Research starts in the library and ends in the library."

#### ***What is literature review?***

Visualize the term review and list all the words that cross your mind. According to Webster's Advanced Learners' Dictionary (1980) literature review means:

- See again
- Examine or study again
- To re-examine judicially
- To look back
- To take a retrospective view of
- To examine critically or deliberately
- To give a critical evaluation of.

Thus, in the context of research, literature review means:

- Locating literature in a variety of sources,
- Reading it carefully and thoroughly,
- Evaluating the content
- Breaking it down into themes
- Organizing it along the themes of the study.

In conclusion, the literature review is a systematic and critical analysis of existing literature relevant to the current research topic. It involves reading an appropriate proportion of the extensive literature that is available. It is basically a method of acquiring information.

#### ***Purposes of literature review***

The literature study serves several purposes in research. You will be able to do one or more of the following:

- **Define and limit the research problem (delineate the research problem).**

- Seek new approaches and recommendations for doing research and avoid sterile approaches.
- Gain understanding and insights into other methods of doing research and the trends that have occurred.
- Develop a clear research design. The researcher will be able to identify strengths and limitations of research methods used by others, in order to adopt or improve on them in his/her own research.
- Sharpen and deepen the theoretical framework of the study
- Share with the readers the results of other studies that are closely related to the study being reported.
- Relates a study to a larger, ongoing dialogue in the literature about a topic, filling in gaps and extending prior studies so that the researcher will be able to add to existing knowledge and introduce new ideas and perspectives.
- Clarify the relationship between the proposed study and previous work on the topic, this gives the researcher an idea of what has already been done. It also reveals the latest development in the area of study.
- Identify variables that must be considered in the research.
- Avoid unnecessary replication. You should conduct a thorough literature study to be able to select a problem that has not been exhausted by other research studies. However, deliberate replication of a study for verification or challenge is acceptable.

Literature in any field forms the foundation upon which all future research must be built. It helps avoid naivety and minimizes duplication of identical work already conducted and accomplished by other researchers. Indeed, all these reasons are helpful to a researcher. But, did you know that "Research' without theory is blind, and theory without practical focus is Empty". Keep in mind that you should make every effort to complete a thorough review before starting the research. This is because the insights and knowledge you have gained through the review almost inevitably lead to a better-designed project and greatly improve the chances of obtaining important and significant results.

Keya and Makau (1989) came up with these reasons for literature search as follows; that literature review is a continuous process that cuts across all stages of the research process in a dynamic way. As the researcher argues her/his case, she/he shows how the study will enlarge modify, depart from or compliment existing knowledge. Thus, the literature review helps to make the problem apparent when done comprehensively and critically.

To conclude the review of literature is the very first step in proposal writing and must be carried out well. A good literature review saves time later in the process of conducting research and forms the framework within which the research findings are to be interpreted. It demonstrates the researcher's familiarity with the existing body of knowledge which in turn increases the readers' confidence in

the researcher's professional ability. You can also source problems for further research from the suggestions and recommendations made by previous researchers as you review the literature.

### ***How to organize the literature review section***

Some suggestions include:

- You need to be clear on the headings and sub-headings of the whole study, which then become the lines upon which the literature review will be organized.
- It involves locating, reading and evaluating reports of research and those of casual observation and opinion that are related to the individual planned research project.
- A short introductory paragraph should be included at the beginning of the literature review section. You should then tie up the existing literature with objectives of the study - Finally, you should summarize main ideas and issues of the literature review towards the end of the section.

### ***Sources of information in locating and using educational research***



#### **Activity**

*List down some of the sources of information you would use to locate literature for your study. Compare your answer with the ones outlined here below.*

There are three major sources of information namely preliminary, primary and secondary.

*Preliminary sources:* these are used to locate books, articles and other educational documents related to the research problem. Most preliminary sources are indexes, which give the author, title and place of publication.

*Primary Sources:* these are the original research and writings of researchers. They include research articles in journals, abstracts, research reports, and scholarly books. Most primary sources are journals and they contain more up-to-date information than secondary sources.

An individual who actually observed or witnessed an occurrence could also describe it directly. More examples of primary sources are:

- Development plans
- District annual reports
- Court-case judgments

*Secondary sources:* these are publications written by an author who was not a direct observer or participant in the events described; but is reporting on research conducted by someone else. Examples are:

- Review papers
- Text books
- Encyclopaedias
- Summaries
- Citations of other works
- Journal articles

These sources can be used to track down references to primary sources. You need to develop a systematic approach to literature study from the very beginning.

- Be familiar with all the library facilities.
- Consult subject abstracts [which provide a summary of articles] reviews, indexes [which list the bibliographical details of articles by subject]
- Bibliographies
- Library catalogues, which come in various formats (, for example, hard copy, CD-ROM, on-line and microfiche).
- The Internet.

Ask the following questions when reviewing and selecting material:

- i) Is the literature relevant to my study?
- ii) Why am I including this study or reference?
- iii) How will the source contribute to my study?
- iv) Is it a primary source? If not, how can I access the primary sources?
- v) Is the source reliable?
- vi) Is the source up-to-date?

It is essential to begin with a clear idea of your research topic. A literature study should be purposeful and logical to avoid time wasting by wading through irrelevant literature.

- Keep an accurate and up-to-date list of all the sources you consult.
- Keep a record of where you found the material. You can use a card as illustrated herein:

Author, year, title, publisher, Town, page, location in the library. Some key words describing the nature and content of the source.

You could use a computer and develop your own system. Adopt a system to organize your material, for example, classifying material according to topics and or the chapters of your thesis. Keep a separate Box File for each chapter in which you place the material that pertains to specific chapters.

Literature review is an ongoing process that requires a great deal of:

- Self discipline
- Perseverance
- Persistence

You, therefore, need to remain focused and to use your time expediently and efficiently.

- Include only the necessary and relevant information.
- Avoid repetition of what has already been written
- Be open and challenge even the works of famous theorists (thus, adapting a constructive critical approach)
- Do not report everything you now know. Be selective and include only essential and valuable sources.
- Keep focused on your research problem avoiding time wasting on emerging issues.

To conclude, the key to completion of a research study is:

- Commitment
- Perseverance
- Consistent handwork

A lot more is given by Mugenda and Mugenda (1999) who have given some examples of sources of information (p.23) as:

- Scholarly journals
- Internet websites
- Theses dissertations
- Government documents
- Conference research papers
- Books
- References given at the back of the book
- International indices
- Abstracts
- Periodicals like magazines local dailies or journals published periodically



In brief, the preliminary sources are used to locate appropriate primary and secondary sources. While secondary sources give a quick overview of research related to the problem detailed in depth.

#### *The eight (8) steps in reviewing educational literature*

- Define the problem.
- Review secondary sources.
- Select the most appropriate preliminary sources.
- Translate the problem statement into key words.
- Search the preliminary sources.
- Read primary sources: Make the cards.
- Organize the notes.
- Write the report.



#### **Activity**

1. *Choose a topic of interest and write a three-page literature review based on this 8-step model.*
2. *Answer the following Review Questions:*
  - *Discuss the significance of literature review*
  - *Describe how a researcher can draw tentative hypotheses from a review of literature.*
  - *List four indicators of a good literature review.*

#### **Research design and methodology**

The third section of the research proposal explains the research design to be used in the study as well as methods of collecting and analyzing data.



#### **Activity**

*Find out the meaning of a research design in Section 2 and determine which design you will use in your study. Explain why you consider it to be relevant.*

**Research design:** This represents the first section of chapter three in your proposal. Here, you need to provide the following information:

- State the research design you intend to use.
- Explain its relevance to the proposed study.
- Describe the type of research to be used together with it e.g. descriptive research.

### **Target population**

In this section, you need to provide the following information.

- Describe the population characteristics
- Describe the location of the population
- Explain why you consider the population to be relevant to the study.
- Provide an estimate of the population size and its major components.

### **Sample design and procedures**

In this section, you need to explain the following:

- A suitable sampling method for the study E. g stratified random sampling (see section 7)
- Relevance of the method to your study.
- An adequate sample size E. g 25% of populations' size.
- Sample components.
- Description of sampling procedures.

### **Data collection methods**

This section should include:

- A description of data collection techniques , for example, questionnaires, interviews, etcetera
- Type of instruments stated E. g structured, semi- structured or unstructured.
- Relevance of the instruments to the study.

### **Data collection procedures**

Here, you need to describe how you will practically prepare for data collection instruments, actual fieldwork activities and data processing.

It is important to emphasize how the instruments will be validated, that is, through a pilot study.

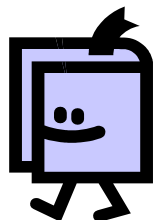
### **Data analysis procedures**

In this section, you will explain the following:

- Type of data expected ,that is, quantitative or qualitative data
- Methods to be used in the analysis in terms of research questions and hypothesis.

## Conclusion

A research proposal is an important guide to a research study. You must have a research plan before you implement the study. This will help you to develop your study in a more efficient and economical manner. You will also give others an opportunity to evaluate your proposed study before implementing it. Your research supervisors will play a significant role in directing you. You will also be able to communicate your intentions to conduct a specified study in a specified area to avoid duplication by other researchers.



## Suggested further reading

1. Study Guide 2: MEDEM2-R Research Methodology. Educational Management Edited by Hoberg, SM Pretoria UNISA. 1999.
2. Mwiria, K; and Wamahiu, P.S. (1995). Issues in Educational Research in Africa. Nairobi. EAEP.
3. Mugenda, O. M., and Mugenda, A.G.(1999). Research Methods. Quantitative and Qualitative Approaches. Nairobi. Acts.
4. Kathura, N. J; and Pals, D. A. (1993): Introduction to Educational Research. Nakuru, Egerton. Educational Media Centre.
5. Keya, S.O; Makau, B.Ff, etal. (1989). Guidelines for the Formulation of Research project proposals. NCST and IDRC. Oxford University press.

## **SECTION 6**

### **METHODS OF DATA COLLECTION**

#### **Introduction**

In this chapter, we explain the importance of research data, the various types of data, the major instruments used for data collection and the measurements scales.

Data collection is an important part of all research endeavours, because the conclusions of the study are based on what the data reveal? As a result, you should be able to do the following:

#### **TOPICS**

- Importance of research data
- Types of data
- Instruments and methods of data collection
- Types of measurement scales.
- Section conclusion



#### **LEARNING OUTCOMES:**

This section is intended to enable you to:

- Explain the importance of research data
- Discuss the various types of data
- Discuss the instruments for data collection and
- Explain types of measurements scales

## TOPIC 1: Importance of research data

You learnt about sampling designs in Section Five. Your work is not over yet if you are writing a research proposal. You are yet to develop data collection tools. But before you describe how you are going to collect the necessary information (data), we need to find out of what use data is in research. Why is the academic institution keen on you as a student of research, collecting data based on your research study?

### **Importance of research data**

We realized that this subtopic is subsumed in the entire research planning. No researcher has focused on the significance of data in research yet the whole essence in research is to collect data. We decided to ask our students who undertake research projects at diploma level and they came up with brilliant ideas as follows:

- Research data helps the researcher to have a full picture of the problem at hand.
- The researcher can establish the trend, the impact and the implications if no intervention is made.
- The researcher can make deductions based on data analysis.
- Without research data, we cannot proceed with further research since we cannot tell whether or not our initial perception of the situation was true or not.
- We would not talk of research if there were no data, thus, the core of any research study is to collect data, which is analyzed followed by conclusions and recommendations.
- Research data acts as supportive empirical evidence to our hypothesis hence; theory can be developed, modified or refuted.

We believe this gives you an insight into the importance of data and now you can add what seems to be left out. This will also motivate you to develop your own study so that you contribute towards the improvement of education in your country.

## TOPIC 2: Types of data

Previously, we defined data as all the information a researcher gathers for his study. We believe, you identified a research topic while working through Section 2 [Proposal writing], and you are at par with the text as we progress. It is interesting to note that we have different types of data, and you need to make an important decision during the planning phase of your investigation, about what

kind(s) of data you intend to collect. Both primary and secondary data are used in one study. Any of the data can be obtained in quantitative or qualitative form.

There are basically two types of data: primary data and secondary data.

### **Primary data**

Primary data refers to the information a researcher obtains for the first time from the field, that is, from the subjects in the sample specifically for the purpose at hand.

For example, consider students' responses to questionnaire items based on their satisfaction with leadership style.

The values may be obtained from the operational definitions of the variables (that is, leadership style) in the study to generate data. Leadership style may be operationalised by reference to the following indicators: communication, authority, power, listening, respect, role model, availability, transparency and many others. If several of these indicators are present, then we can imply that the leadership style is effective / satisfactory. The values derived from operational definitions are usually presented in the form of frequency distributions. Other sources of primary data are interviews, observation methods and content analysis.

### **Secondary data**

On the other hand, secondary data refers to the information the researcher obtains from books and research articles. Data may also be classified as quantitative or qualitative depending on the nature and objectives of the study.

## **TOPIC 3: Instruments for data collection**

The basis for obtaining useful research results is adequate, objective and reliable data. You need appropriate well-defined tools to collect the required data.

### **Procedures for data collection**

There are many methods of collecting data. A number of tools in social research can be used for collecting data. This topic discusses some of them but again you should consult other texts for details on each of the methods, as appropriate.

## **The questionnaire**

This is a set of questions or items that is drawn to meet the objectives of the survey and a research subject is expected to respond to. The questions must be relevant to the goals of the study and to the individual respondent. The questionnaire may consist of one or more sets of questions depending on the aspects of data to be collected. Sets of questions may also be determined by the categories of respondents.

Be sure on how answers will be analyzed before including an item in the questionnaire.

- Questions should be clear and categorical.
- Subsequent follow-up, open-ended questions should be treated separately.

The questionnaire can be administered orally as the researcher records the responses to each item or the research subject may be left to respond to the items independently. Items in the questionnaire may be closed-ended (structured) or open-ended response type.

In open-ended (unstructured) type of items the individual has more freedom of responding to the questions. They tend to be inconsistent in length and in content across respondents. The items require less effort to construct since you do not have to think and structure possible responses.

In closed-ended response type, (structured) there is consistency of responses across respondents; because responses have to be objective since they are already specified.

An example of a structured or closed ended question:

What is the most important factor in a stable marital relationship?

- A. Understanding
- B. Love
- C. Respect
- D. Care

An example of an open ended item is:

What made you decide to join the DEOL programme?

### ***Types of questionnaire items***

We have mentioned that there are several kinds of question and response methods in questionnaires. They include, for example, closed questions multiple-choice questions; rating scales and open-ended questions.



### Activity

*Differentiate between closed questions and open-ended questions.*

Generally, closed questions are quick to complete and straight forward to code. They do not discriminate on literacy levels of subjects because they prescribe the range of responses from which the respondent may choose. They do not allow any addition of information in terms of remarks or explanations. There is a risk that the response categories may not be exhaustive and that there may be bias in them. On the other hand, open-ended questions enable the respondents to write a free response in their own terms, to explain and qualify their responses and avoid limitations of pre-set categories of response. However, the responses are difficult to code and to classify.

### ***How to frame/design items in a questionnaire***

Cohen, Manion and Morrison (2000) have the following guidelines.

- a) Avoid leading questions, for example. Do you prefer tests based on facts when you have to memorize or application of knowledge?
- b) Avoid ambiguous language with all kinds of respondents.
- c) Avoid complex questions.
- d) Avoid irritating questions or instructions. For example: Have you ever facilitated any workshop in twenty years of teaching?
- e) Avoid questions that use negatives and double negatives. For example: How strongly do you feel that no technical teacher should enrol on the HDEM programme that has not completed at least five (5) years full-time teaching?
- f) Avoid too many open ended items on self-completion questionnaires

As one adheres to these guidelines, he has the following questionnaire items to choose from:

- (i) *Closed questions*: These can take several forms. An item that requires a 'yes' or 'no' response is called a dichotomous question. , for example, have you ever been late for class? Do you prefer theory or practical lessons?
- (ii) *Multiple - choice questions*: In these items the range of choices is designed to capture the likely range of responses to given statements. For example: The implementation of team-teaching is:



- a) An extra burden on lecturers
- b) Under use of manpower
- c) A waste of time
- d) Not appropriate for our college.

Note that in multiple-choice items, a statement is followed by a set of responses. The categories must have no overlaps and be mutually exclusive (that is, discrete). The possible range of responses has to be exhausted. The major problem of questionnaires is that different respondents interpret the same words differently.

- (iii) *Rank ordering*: It enables respondents to indicate their degree of preference, priority or intensity. A list of options is given from which respondents are required to rank order: For example:

Please indicate your priorities by numbering the statements given to show the order of your views.

- 1. Most important
- 2. Important
- 3. Undecided
- 4. Less important
- 5. Least important

The proposed implementation of DEOL at higher Diploma level might be successful if the following factors are addressed:

- Staff development in DEOL
- Availability of appropriate resource materials
- Government support.
- The lecturers understand and agree with it.
- The VVOB project continues for another 3 years
- There is an increase in students' motivation.
- There is approval by parents.
- Evaluation is conducted in a diversified manner.

Rankings are useful in indicating degrees of responses, thus, they are like rating scales. When the list is too long the respondents might be overwhelmed. Try to have at most five statements/ranks

- iv) *Rating scales*: give degrees and intensity of response. There are various types of rating scales. We will focus on the likert scales. You can read about the others in (Cohen, et al (2000) p 253). A likert scale provides a range of responses to a given question or statement, for example:

- How important do you consider industrial attachment to be for technical education students?

1 = not at all

3 = a little

2 = very little

4 = a lot

- All students should have access to free higher education

1 = strongly disagree

3 = Undecided

2 = disagree

4 = Agree

5 = Strongly agree

A rating scale is an attractive and widely used instrument in research. The categories should be discrete and exhaust the range of possible responses which respondents may wish to give but, the problems of interpretation exist in that one respondents 'agree' may be another's 'strongly agree'. Rating scales all the same are particularly useful for soliciting information about attitudes, perceptions and opinions of respondents?

- v) *Open-ended questions*: these can be included in the sections of a questionnaire that invite an honest, personal comment from the respondents in addition to taking the multiple choice parts thus, leading to a semi-structured questionnaire. The open ended question can be useful for a small scale research. An open-ended question can capture the authenticity, richness, depth of response, and honesty, which are the hallmark of qualitative data.

Look at this example: The major characteristics of HDEM students for the DEOL program are -----  
-----

OR

The reasons for unpopularity of Guidance and Counselling among college students are -----

Comparison of respondents is difficult and it is time consuming, with an assumption that all respondents can equally express their thoughts and commits them to paper.



### Activity

*With reference to the various examples given under each type of questionnaire items, identify a research problem and design a questionnaire that you would use to gather data.*

### **Characteristics of a good questionnaire**

How would you describe a good questionnaire? The suggestions given herein are not exhaustive and we expect that you will be able to make additions as you continue working through this manual. A questionnaire is good if:

- It deals with an important topic which entices the respondent to give response
- It seeks only data which cannot be obtained from secondary sources
- It is as short as possible and only long enough to get the essential data.
- It is as comprehensive as necessary to capture all relevant and crucial information.
- It is attractive in appearance, neatly arranged, and clearly printed.
- It has directions that are clear and complete. Each question deals with a single idea and the wording is simple giving opportunity for easy, accurate and unambiguous response.

### **Preparing and administering a questionnaire**

Perhaps you already have an idea reflecting on the issues we have discussed so far about questionnaires. You cannot get a ready-made questionnaire appropriate for your study. You have to prepare it yourself.

In the preparation of a questionnaire keep in mind the frame you outlined. Secure all the help you can in planning and constructing a questionnaire without suffering from an assumption that you know how to ask questions. Asking questions that will obtain the precise reliable data is no easy task. You will be amazed when respondents interpret items differently from questions that you thought were perfectly clear. As a teacher, you have always asked questions and hence this may appear odd nevertheless, give it a thought.

- Obtain a thorough grasp of the study area and a clear understanding of the objectives that you want the questionnaire to accomplish.
- Determine how you will analyze the information obtained from each item.
- Engage outsiders to read through your questionnaire because they are generally more objective and can see flaws that you are unable to see.

Hence, there is need for a pilot study on a few colleagues, who are reasonably competent to fill it out. This trial will help you realize the gaps and defects that can be corrected in time.

- Questions must be worded clearly to appear important and meaningful to the respondents.
- If the desired information is confidential in nature, then provide for anonymous responses.

It is your responsibility to convince the respondent that the data will be held in strict confidence and that the data will be used for no purpose other than research.

- Avoid negatively stated items, long winding questions and double-barrelled items.
- Avoid leading (biased) questions, personal and sensitive items, psychologically threatening questions and using difficult words.

### ***Sequencing the items***

Preparation of a questionnaire is incomplete without highlighting sequencing of items. To some extent, the order depends on how the sample population will respond to certain items, the purposes of the questionnaire, and the sensitivity of the research and the overall balance of the questionnaire. Items should be arranged in a logical sequence. Commence the questionnaire with non-threatening questions that they can be readily answered. After which you can move to more personalized questions. Initial questions should be simple, have high interest value and encourage participation. The respondent will have confidence as well as the motivation to continue. Midway through, the questionnaire could contain difficult questions; the last section should be of high interest in order to encourage respondents to return the completed schedule. Here is an example of a common sequence in most questionnaires.

The first items are focused on age, sex, occupation, educational level, years of experience, professional qualification and so on. The mid section would have closed questions through the use of multiple choice and rating scales. The statements or questions will try to elicit responses that require attitudes, opinions, views and perceptions. Then finally would be the last section, composed of more open-ended questions that seek responses on opinions, views, attitudes and perceptions, together with reasons for the responses given. The sequencing is from objective facts to subjective attitudes and opinions through justifications, followed by sensitive, personalized data. As you design the questionnaire, you have to anticipate the sensitivity of the topics (age, income, religion, etc.) in terms of the respondents, which has a wide socio-cultural dimension. The questionnaire has to be viewed through the eyes of the respondent and yours. Another acceptable sequence is arranging the questions according to themes. If you arrange the questionnaire into content sub-section then you should introduce each section, to help the respondent make sense of the

questionnaire without wasting time. Do not put important questions at the end of a long questionnaire because they might be overlooked or answered in a hurry. Finally, each questionnaire should be given an identification number (ID)

### ***Pre-testing the questionnaire***

What is pre-testing? Why would you need to pre-test your questionnaire? How do you pre-test? Pre-testing is crucial to the success of questionnaires because the wording is of great importance. Pre-testing refers to piloting or doing a trial. Piloting has several advantages although basically it is done to increase the reliability, validity and practicability of the questionnaire. Cohen, Manion & Morrison (2000) and; Mugenda and Mugenda (1999) give the following as the reasons for pre-testing questionnaires:

- To check on the clarity of the questionnaire items, instructions, and the layout.
- To eliminate any ambiguous or difficult wording.
- To gain feedback on the type of question and its format
- To identify redundant questions with very little discriminations
- To identify commonly misunderstood or non-completed items.
- To gain feedback on the attractiveness and appearance of the questionnaire.
- To check the time taken to complete the questionnaire
- To check the length of the questionnaire, whether too difficult or too easy; too threatening, too intrusive, too offensive.
- To consider and incorporate comments and suggestions made by respondents during pre-testing that improves the questionnaire.
- Pre-testing reveals deficiencies in the questionnaire. For example, unclear directions, insufficient space to write the response, cluttered questions and wrong numbering can be revealed and corrected, to improve the questionnaire.
- To try out the coding/classification system for data analysis. Researchers should analyze the few questionnaires to see if the methods of analysis are appropriate, especially when dealing with a large study and resources (time and money) allow. The results could generate suggestions on how suitable the proposed methods of analysis are.



*Have you ever tried out something for yourself to see if it works or not? What was it? What were the results? Feel free to write it down. What you did was pre-test?*

## How to pre-test the questionnaire

Pre-testing should be carried out on a selected sample, which is similar to the actual sample that the researcher plans to use in the study. DO NOT use subjects in the actual sample in the pre-test. The number of subjects in the pre-test sample should be small that is, between 1% and 10% depending on the sample size. For example, consider a study on performance of pupils in Kiswahili KCPE in Nairobi Province. The researcher will identify the sample schools then use those schools left out of the sample for pre-testing. The subjects should be encouraged to make comments and suggestions concerning instruction, clarity of items and relevance.



### Activity

*Imagine you are to conduct your own pilot study and describe the pre-testing procedures and the results.*

## Administration of questionnaires

Suppose you were to conduct a research study, how would you ensure that your questionnaires reach the subjects? There are three main methods of administering questionnaires.

### (a) Self administered questionnaires

In this method, the respondents are asked to complete the questionnaires themselves. The questionnaires can be posted or, that is, hand-delivered. Have you ever filled any questionnaire?

### (b) Researcher administered questionnaires

This is where the researcher uses the questionnaire to interview the respondents. The researcher reads the items and the categories to the subjects and then writes down the responses. It may happen due to low educational level of the subjects, and inability to understand and interpret the items.

### (c) The Internet

This is mostly used in developed countries to collect data. The sample group for the research receives and responds to the questionnaires through their web sites/home pages and through their e-mail accounts. In developing countries like Kenya, this technology is currently available to a few individuals

and institutions. KTTC is one of the few through the VVOB support. It is costly to conduct research on the Internet.

We wish to bring to your attention that there is so much written about questionnaires. You will have to read more on your own from the list of books given under further reading. You will discover a lot of material, which will be helpful to you.

During your intensive study, we recommend that you find out the merits and demerits of questionnaires. They are numerous and are covered in every Research Methods Textbook

## **Interviews**



*Have you ever attended an interview?*

*Share with us your experience at the interview?*

*How did you feel during and after the interview?*

*What would you say an interview is?*

Most people are familiar with the word interview but they are not able to precisely say what it means. An interview is an oral administration of a questionnaire or an interview schedule that guides the interviewing process. It is conducted face to face or by telephone. For you to obtain accurate information through interviews, you need to obtain the maximum cooperation from respondents. Therefore, you must establish rapport with the respondent prior to conducting the interview. Interviewing is one of the older and most widely used methods or approaches used in survey research for collecting data in social science. To ensure that the interviewing is done systematically, consistently and as objectively as possible, the tool normally used is the interviewing schedule (Coleman and Briggs, 2002).

The interviewer asks questions tailored to the achievement of the study objectives. Some interviews may be structured and some can be unstructured, depending on the focus of the study. An interview provides the option of elaborating or clarifying items after they are presented to the respondent.

### *The strengths and limitations of interviews*

The strengths of an interview are in its flexibility, ensuring a high rate of response control of the interview situation. It allows recording of spontaneous and unintended responses and one can prevail upon the respondent to complete all questions. However, interviews can be expensive, reach only a few cases, they are time-consuming, inconvenient to the respondents, the researcher may be biased and with many interviewers, standardization of the stimuli is difficult. Respondents may not give the information recorded because the researcher merely confirms prejudice.

During the interview, data can be recorded using a tape recorder or a video recorder. The respondent should be well informed to avoid any suspicions of hidden motives in data collection.



• *How would you react if the interviewer were to record your exchange?*

Avoid extensive writing during an interview to allow yourself more time and attention to the respondent.

### *Types of biases*

In research, the researcher should be aware of the different types of biases that could influence the data collected. The biases include the following:

#### *i. Interview bias*

This can arise out of the interviewer's reaction to sex, social class, age or even dress. Questions may also be worded so as to lead the respondent towards the expression of certain beliefs by the researcher. For example the following questions are biased:

Is there too much autocracy in this institution?

Are men more respected than women in this area?

#### *ii. Sample bias*

This is where a researcher interviews a few people at say, a market place or a dispensary and concludes about a few parents understanding much about the education of their children.



Interviews may be less standardized due to involvement of many hired interviewers. Some questions will not be asked in a standardized way while some interviewers may fake answers when subjects are uncooperative or for other reasons.

Here are some suggestions for using an interviewing schedule [Kathuri and Pals 1993]

- The interviewer should be well aware of the problem or variables under investigation.
- The questions on the interview schedule should be clear to both the interviewer and the interviewee
- Avoid excessive informality or being emotionally involved during the interview
- Avoid any unrealistic argument as much as possible
- When more than one interviewer is used, they should be trained to enhance consistency.
- Avoid ambiguity by specifically and clearly stating the items or questions.
- DO NOT embarrass or offend the respondent, handle any such questions with care.



### Activity

*Suppose you have been asked to carry out an investigation into the quality of the Higher Diploma in Educational Management.*

- a) Identify your target group*
- b) Identify four key questions that you would include in your interview schedule*

Did you come up with items more or less similar to the one listed here below?

- a) How relevant is the HDEM curriculum to the work of an Educational Manager?
- b) What is the relationship between theory and practice?
- c) How effectively is the course being handled?
- d) What would you say about the overall quality of the HDEM programme?

Our target group for interviewing is the students of HDEM and the lecturers. Keep on asking yourself this question: What am I trying to find out? It will help to focus you on the main purpose of the study so that you come up with relevant items and also determine the right target and accessible populations.

## Observation

Observation is a tool for gathering data. It is used in the collection of data and it is often confused with the use of questionnaires.

What are you observing right now? What have you seen? Look at the table or the environment where you are as you work through this topic, note down all the things you have observed. How is observation different from questionnaires or interviews? We observed the following items in our working office as we did the writing of this manual,

**Table 6.1: Observation form**

Piles of books
Heaps of exam scripts
Cartons of manila papers
Racks of pens
Dusty seats and tables
Worn out Carpet
Cobwebs on the ceiling (roof)
Papers stuck on the wall

Table 6.1 can be referred to as an observation form, schedule or checklist depending on how it is designed and what is being observed.

We can, therefore, say that observation is a procedure by which the researcher (an observer) notes and records what is occurring in some situation. For example, observing the behaviour pattern of students and staff of KTTC during sports day or observing interaction pattern of teachers during recess/tea break, unlike self-reports, observation minimizes or eliminates the bias that may result from people offering information about themselves. Observation as a data gathering tool should be as objective and systematic as possible. It is necessary to have an observation schedule which specifies the behaviour to be observed. To have uniform data, observe each behaviour or episode of behaviour for a specified period. Record behaviour as it occurs and record the situation in which the behaviour is demonstrated. Obviously, the presence and behaviour of the researcher will influence the respondent's behaviour.

The researcher should wait until the respondent gets familiar with him as part of the environment. Like in questionnaires and interviews, research assistants should be trained, if any is used in data collection to ensure consistency in observing and recording.

At times, an observation checklist may be used to record what the researcher observes during data collection.



### Activity

Think of a situation/event at your work place or in your village. Identify and define the behaviour you will observe at a given interval, for example, every two minutes (2 minutes). List them in an observation form similar to Table 6.2 presented here below:

**Table 6.2: Observation Form**

Behaviour	Occurrence
• -----	
• -----	
• -----	
• -----	
• -----	
• -----	

Well done! You have developed an observation checklist. You can now use it to check the behaviour as they occur during your data collection. The accuracy of the study is enhanced because you have adequate time to think about what is occurring as opposed to how to record the behaviour.

Remember that we do not only observe behaviour, but we also observe, cover and record items such as books, equipments and facilities in an institution, evaluating their state and relevance. Such an observation form must be tested in similar situations to those expected during the data collection to help correct only mistakes that may be detected.

Other types of observations are also described. They are participant observation and experimental observation.

#### *Participant observation*

This method requires the investigator to be involved in the respondents' activities in order to gain insight and be able to observe certain factors required for the investigation. For example, if you wish to find out about students' behaviour

patterns after classes, then you could decide to live among them for a specified period of time in order to gather the data.

### *Experimental observation*



#### **Activity**

*Recall your science lessons in high school particularly in the Biology and Chemistry lessons. Choose one experiment that caught your attention and describe what you observed.*

You must have a number of experiments rushing through your mind and you are wondering which one to describe. We can say that an experimental observation involves the manipulation of certain factors and variables in the environment until an observable effect is produced. Experimental observation is a method mostly applied in the physical and natural sciences, in laboratory situations. Such experiments are also quite common in fields such as psychology, law, sociology, agriculture and history.

### **Tests**

What is a test? Are you wondering how a test can be a tool for collecting research data? A test can broadly be defined as any instrument for assessing individual differences along a specified dimension of behaviour. It is an instrument used for data collection through measurement, which is objective and is quantifiable. There are variety of test types, such as written and oral, norm-referenced, domain-referenced, criterion-referenced, individual and group. However, most tests used in behavioural sciences are norm-referenced, that is, they have scores that indicate how an individual's performance compares with that of others.

If you intend to use a test as a measuring instrument, then it should be standardized to make it both reliable and valid in relation to what it is supposed to measure.

Of course, teachers use tests all the time, but classroom tests are not standardized tests, that is why they are full of errors and cannot be used in replicating studies. For a test to be an appropriate and effective tool it should:

- be valid in all ways, that is, content, predictive, etcetera. depending on the purpose of the test;
- be closely relevant to the purpose and objectives of the research;
- be reliable
- be clearly and correctly written;
- have questions precisely stated
- have complete and clear directors.

Besides these, the environment may influence the test results. Both social and psychological environments should be appropriate for the best test performance.

You may need to know what the standardized test is. It is a test that has consistency and uniform procedures for administering, scoring and interpreting the behaviour of subjects (Mugenda and Mugenda, 1999). Standardized tests are available in education, psychology and sociology. Have you ever heard about GRE, GMAT or TOEFEL? These are standardized tests usually taken by foreign students wishing to pursue further studies in American Universities.



### Activity

*With all information you have gone through, list down other methods/tools of data collection.*

### Other methods of data collection

Sometimes information is obtained from documentary sources such as:

- diaries
- published statistical bulletins
- medical records
- remote sensing
- textbooks in libraries
- slides and tapes.
- computer and the internet.

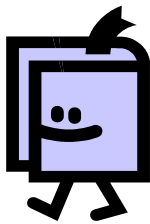
### Conclusion

In this section, you have observed various techniques of data collection. This stage is crucial in your study because it provides the evidence on which your findings and conclusions will be based. It is, therefore, important to ensure that

you collect data that is adequate, reliable, valid and current. These are the qualities of good data and they will enrich your findings.

### Review questions

- 1a) Distinguish between Questionnaires and Interviews.
- b) State the advantages and disadvantages of questionnaires and interviews.
2. Design an item under each of the four major data collection tools discussed in this chapter.
3. Discuss the significance of observations as a tool in data collection.
4. Explain why tests are not commonly used for data collection by researchers.



### Suggested further reading

1. Mugenda, O. M. and Mugenda, A.G. (1999)  
Research Methods. Quantitative and Qualitative Approaches  
Nairobi. ACTS.
2. Fraenkel, J. R. and Wallen, N.E. (2000)  
How to Design and Evaluate Research in Education. 4<sup>th</sup> ed. Boston.  
McGraw Hill.
3. Coleman, M. and Briggs, A.R (2002)  
Research Methods in Educational leadership and Management.  
London Sage

## SECTION 7 SAMPLING AND SAMPLING TECHNIQUES

### Introduction

Various procedures are used in determining the sample of respondents in any research. The procedures are presented in this section. The term sample is defined and different types of samples discussed. The term sample is differentiated from the term population, with it is often confused.

Knowledge of sampling is useful since one cannot study the entire population that would give the requisite data.

### TOPICS

- What is sampling?
- Sampling methods
- Conclusion



### LEARNING OUTCOMES:

By the end of this section, you will be able to:

- Define the term "sampling".
- Distinguish between a sample and population.
- Explain the criteria for a good sample.
- State advantages of sampling.
- Select a suitable sampling method for your study

### TOPIC 1: What is sampling?

Sampling is a procedure used in the selection of sample units from the population. A sample represents a small section of the population that has been selected for observation and analysis. The purpose of sampling is to study a population.

A population represents all cases of people, objects or events that possess certain common characteristics relevant to the purpose of a study. The target population for a research study depends on what kind of information is required and who can provide it. For example, a study on "effects of Management styles on school performance in Examinations" would target a population of:

- Head teachers
- Deputy head teachers
- Assistant teachers
- Students
- Sub - ordinate staff.

The various categories of people mentioned here have certain common characteristics. They are all members of the school environment where the various management styles' prevail. Also, their behaviour or actions contribute directly or indirectly to school performance.



### Activity

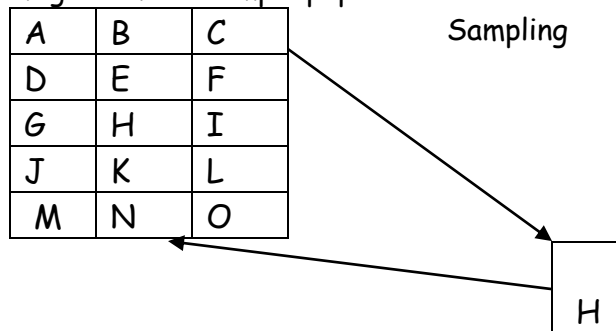
*Describe the target population for the following research study: **Determinants of Effective Financial Management Practices in Secondary schools in Nairobi.***

The target population represents the universe in which the results of the study are generalized. This implies that the sample measures (or statistics) are used to interpret or estimate the population parameters (or characteristics).

The purpose of sampling is to study some population by selecting a representative sample. In this case: "A sample is a set of cases drawn from the specified population for purposes of generalizing or making inferences about that population" (Kohout, 1974:247). Look at Figure 7.1 here below which illustrates a sample population.



Figure 7.1: A sample population



### Sample

.Sample statistics are obtained

#### Example:

- . Sample mean,  $\bar{X}$
- . Sample Standard Deviation  $S$

Used to estimate or

Interpret the population Parameters

Example: pop. Mean  $\mu$ : Pop. S.D:  $\sigma$

In this case the sample mean,  $\bar{x}$ , is used to estimate the population mean,  $\mu$ . Likewise, the sample standard deviation,  $s$ , is used to estimate the population standard deviation,  $\sigma$ .

A parameter is a measure that summarizes or describes a characteristic of a population. A statistic is a corresponding measure that describes a sample characteristic. The sample statistic can provide a close or accurate estimate of the true population parameter. However, the two can be widely varied. This difference represents the sampling error.

Sampling error: Is the difference between the true population measure (Parameter) and the statistic used to estimate it. A good sample must fulfil the following criteria in order to minimize sampling error.

### ***Criteria for a good sample***

#### ***a) Adequacy of the sample size***

The sample size should be large enough to adequately represent the true population characteristics. The smaller the sample size the greater the sampling error and vice versa.

*b) Reliability of the sample*

The selected sample should be reliable to minimize errors or bias in interpretation of research results.

*c) Independence of sample units*

The sample units should be independent of each other. This means that the selection of one population unit should not influence the selection of another unit. Each population unit should be given equal chance of being drawn for the sample.

*d) Homogeneity of sample units*

The sample units should be homogeneous. This is to say that they must possess similar characteristics which reflect the true population characteristics.

***Reasons for sampling***

What are the advantages of using a sample in a research study?

*a) Cost factor*

Sampling reduces the costs of the study, what would otherwise be high if the whole population is used.

*b) Time factor*

Less time is spent in the study with a sample than with a total population. This enables the researcher to meet specific time for research projects.

*c) Accuracy*

Handling fewer population cases enables the researcher to conduct a thorough evaluation and analysis of data. This improves reliability of results.

*d) Efficiency*

It is possible to carry out several studies simultaneously in a single population when samples are used. This increases efficiency in allocation of research resources.



### Activity

*Explain why sampling is preferred to a census study.*

### **Designing a sample**

The following steps are suggested in sample design:

- Step 1: Re-examine the objectives of the study. The objectives indicate the relevant population characteristics required in the study.
- Step 2: Define the population characteristics, that is, categories of people, institutions, or organizations.
- Step 3: Determine the population size (N) and obtain a suitable sampling frame: A list of all population units from which the sample will be drawn.
- Step 4: Determine an adequate sample size (n). This could be at least 25% of the population size (N).
- Step 5: Select the sample units, using a suitable sampling method.

### **TOPIC 2: Sampling methods**

Sampling methods can be classified into two major categories, namely:

- a) Random/ Probability sampling methods
- b) Non - Random (Non - Probability) sampling methods.

**Random sampling:** Refers to a procedure for selecting cases from a population in such a way that every member of the population has an equal chance of being drawn for the sample.

**Non - random sampling:** Refers to a procedure for selecting cases from a population in such a way that members of the population have an unequal chance of being drawn for the sample.

The differences between the two methods are summarized in Table 7.1.

**Table 7.1: The differences between random sampling and non-random sampling methods**

<b>RANDOM SAMPLING METHODS</b>	<b>NON - RANDOM SAMPLING METHODS</b>
a) Selection is based on chance or probability	a) Selection is judgmental or purposive
b) Generates an accurate sample	b) Generates a biased sample
c) Mainly used in quantitative research	c) Mainly used in qualitative research

### **Random methods of sampling**

Random sampling techniques include:

1. Simple random sampling
2. Systematic random sampling
3. Stratified random sampling
4. Cluster or area sampling.

Table 7.2 summaries the contexts in which one can use each of the methods of sampling

**Table 7.2: How and when to use random sampling methods in research**

<b>Sampling Method</b>	<b>When Used</b>	<b>Selection Procedure</b>
1. Simple random Sampling	<ul style="list-style-type: none"> <li>• Target population must be <u>Homogeneous</u>.</li> <li>• Population size is known</li> <li>• A sampling frame is available.</li> <li>• Population is relatively small.</li> </ul>	<ol style="list-style-type: none"> <li>1. The population is defined, that is, (homogeneous).</li> <li>2. A sampling frame is obtained.</li> <li>3. An adequate sample size is the determined.</li> <li>4. Population size is determined</li> <li>5. Sample units are selected using <u>random numbers</u> or the lottery technique.</li> </ol>
2. Systematic Random	<ul style="list-style-type: none"> <li>• Target population is <u>Homogeneous</u>.</li> </ul>	<ol style="list-style-type: none"> <li>1. Define the target population</li> </ol>

Sampling.	<ul style="list-style-type: none"> <li>Population size is known.</li> <li>Sampling frame is available.</li> <li>Population size is large.</li> </ul>	<ol style="list-style-type: none"> <li>Obtain a suitable sample.</li> <li>Determine the population size.</li> <li>Determine an adequate sample size.</li> <li>Divide the population into a number of equal - interval, where each <u>Interval</u> = Population size over Sample size.</li> <li>Select the first unit from the first interval at random, and note its position in the interval ( that is, <math>r^{th}</math> units from the rest of the intervals).</li> </ol>
3. Stratified Random Sampling.	<ul style="list-style-type: none"> <li>The target population is <u>heterogeneous</u></li> <li>Population size is known.</li> <li>Sampling frame is available.</li> </ul>	<ol style="list-style-type: none"> <li>Define the target population.</li> <li>Obtain a sampling frame.</li> <li>Determine the population size.</li> <li>Divide the population into logical components or strata.</li> <li>Determine the number of units in each stratum.</li> <li>Select the sample units each stratum at random and ensure that the sample components reflect the population strata,</li> </ol>

		proportionately.
4. Cluster or Area Sampling	<ul style="list-style-type: none"> <li>Population size is known.</li> <li>Population is distributed into wide geographic areas/locations.</li> <li>Population units are grouped into clusters.</li> </ul>	<ol style="list-style-type: none"> <li>1. Define the target population.</li> <li>2. Determine the population size.</li> <li>3. Determine the sample size required</li> <li>4. Determine the number of logical cluster in the population and the size of the smallest cluster.</li> <li>5. Select one or more clusters at random to represent the sample.</li> </ol>

**Methods of sampling are non - random / non - probability.**

**Non -random sampling techniques include:**

- Quota sampling
- Chain sampling (snowball)
- Maximum variation sampling
- Critical case sampling
- Extreme/deviant sampling
- Typical case sampling
- Intensity sampling
- Criterion sampling
- Homogeneous sampling

**When and for what purpose the non - random sampling methods used**

Table 7.3 explains the contexts in which the non-random sampling methods are used.

Table 7.3: Use of non-random sampling methods

Sampling Method	Purpose and Use	Selection Procedure
1. Quota Sampling (Stratified purposive sampling)	Used to illustrate sub groups and facilitate comparisons. - Used when the population heterogeneous but the population size is not known.	<ul style="list-style-type: none"> <li>• Identify the population strata.</li> <li>• Estimate relative sizes of population strata.</li> <li>• Design a sample by allocating quotas to the population strata by size or importance to the study.</li> </ul>
2. Chain sampling (snowball method)	<ul style="list-style-type: none"> <li>• Used to identify cases of interest from the people who can identify others that are familiar with population cases that are information rich.</li> </ul>	<ul style="list-style-type: none"> <li>• The target population is defined.</li> <li>• A few population units are identified.</li> <li>• A referral network system is used to identify other sample units until an adequate sample size is achieved.</li> </ul>



### Activity

Identify a research topic and

- Describe the kind of data you will need
- Indicate the method of sampling you will use to collect the data

### Conclusion

The reliability of the research results will depend on the careful choice of a relevant sampling method. It is important to ensure that the researcher selects a sample that fulfils the major criteria for a good sample.



## SECTION 8

### DATA ANALYSIS

#### Introduction

Once you have collected your data you need to process it into information that is accessible to other readers. You probably have asked yourself this question: ***What on earth am I going to do with this data?*** First, you will need to manage this data by processing it. You will then decide on suitable data analysis techniques. There are a variety of data analysis methods. Your choice depends on what you intended earlier to find out in your study. These are expressed in your research objectives. Alternatively, you could base your data analysis on the research questions or research hypotheses.

In this section, focus is on understanding and applying tasks in data analyses. Types of data analysis techniques are presented and their use illustrated. Analyses are also reviewed in relation to drawing of relevant conclusions.

#### TOPICS

- How can we design a research study?
- Introduction to Data Analysis
- Data Processing
- What is data analysis?
- Quantitative Analysis
- Quantitative Analysis
- Summary



#### LEARNING OUTCOMES:

By the end of this section you will be able to:

- Understand and apply the tasks in data Analysis
- Explain purpose of data processing and analysis
- Distinguish between quantitative and qualitative data analysis techniques
- Analyze data, interpret data analysis results and draw relevant conclusions

## **TOPIC 1:           Introduction to data analysis**

At this stage, you should have prepared a research proposal and designed the instruments for collecting your data. You may have checked if you designed the instruments that provide the kind of data you needed. Perhaps you went ahead and collected the data.

First, you will need to manage this data by processing it. You will then decide on suitable data analysis techniques. There are a variety of data analysis methods. Your choice depends on what you intended earlier to find out in your study. These are expressed in your research objectives. Alternatively, you could base your data analysis on the research questions or research hypotheses.

The main challenge is to take control of the tools of analyses, user-friendly computer programmes are available which can help you to manage and analyze both quantitative and qualitative data. However, your common sense, tact and understanding will take you through this process. It is the researcher who needs the right strategy, creativity and the wit to handle the data through the analysis. In this way, correct interpretations will be drawn. These interpretations will be compared to theory and previous research in order to build useful findings. Figure 8.1 provides a mind map about your path to research findings

Figure 8.1: A mind map for data analysis.

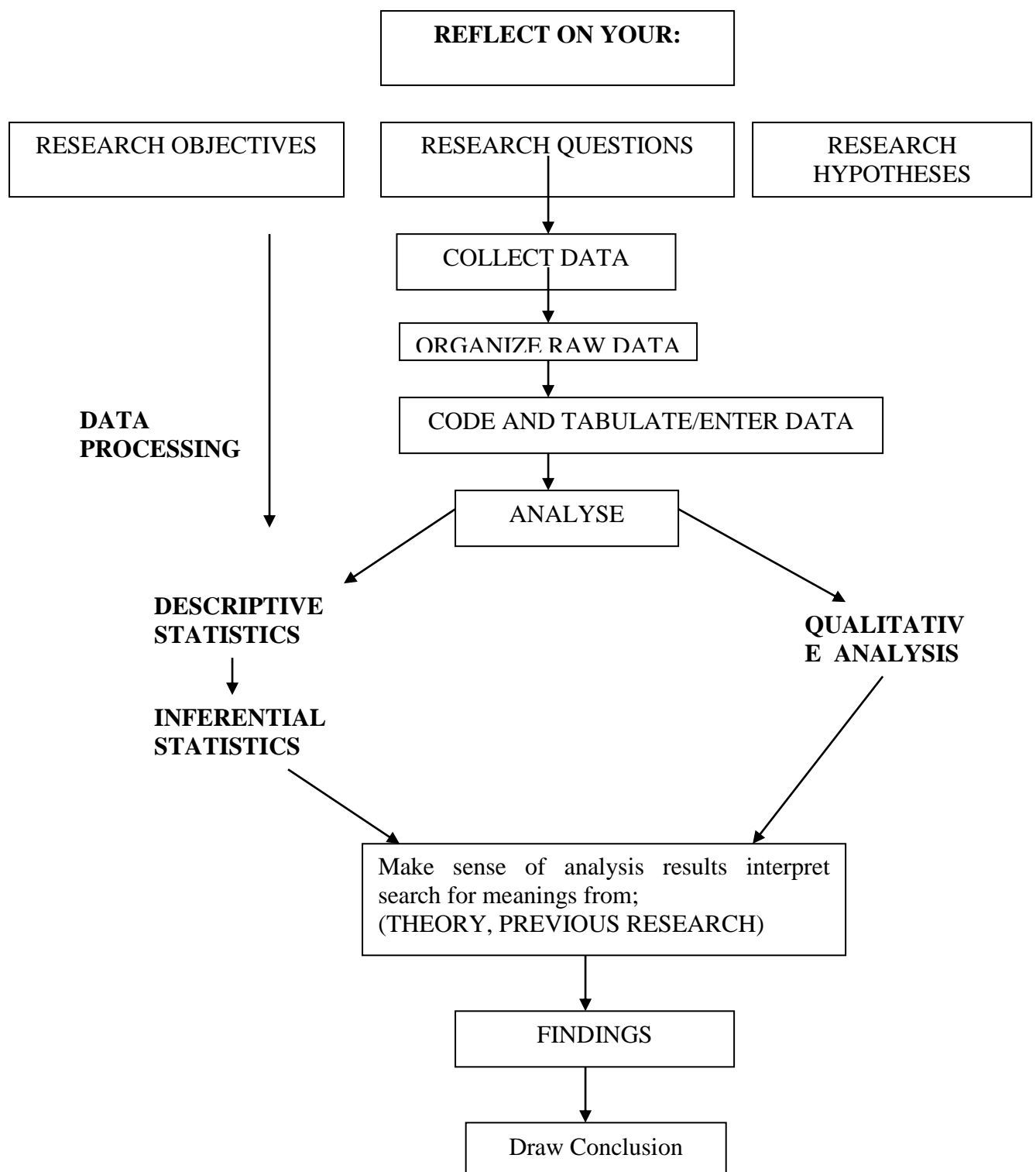


Figure 8.1 gives you a strategy for planning and organizing your data analysis



### Activity

*Assuming that your research title was: Factors affecting Quality of Teaching Mathematics in Secondary Schools in Nairobi'*

- a) *State two objectives you would like to achieve through the study*
- b) *Formulate two research questions for the study*
- c) *Describe the kind of data you will need to answer the research questions.*
- d) *Explain how you will analyze this data.*

## TOPIC 2: Data processing

Before you begin analyzing the data from the field, you will need to process this data. Data processing enables you to organize both quantitative and qualitative data to make the analysis easier and faster.

*Data processing:* is a procedure for validating, editing, coding and tabulating raw data from the instruments

Data Processing will enable you to manage the data you have collected. You will then be able to decide on the best way of analyzing the data to answer your research questions well. Also, it will be easier for you to select the data you need from the one that you do not need. Table 8.1 illustrates the four steps in data processing.

**Table 8.1: Four steps in data processing**

1. Data Validation	Is the data relevant?
2. Data Editing	Are there irregularities in the data?
3. Data Coding	What will each category of data represent? (Variables)
4. Data Tabulation	What types of data represent each variable?

## Data validation

You will need to ascertain whether or not the data you collected is right for your study. Make an attempt to determine if the questionnaires, interviews and observations were conducted correctly and were free from error.

As a researcher, you will need to establish the following:

- Was the data collection process falsified?
- Was the data collected from the right respondents?
- Was the data collection process carried out in the proper procedural setting?
- How accurately was the process completed?
- Was the process done in a courteous manner?

If your answer to most of the questions is YES, it means that you managed to secure good data for your study.

## Data editing

To edit means "to remove chaff from wheat after harvesting" or "to remove weeds if you want your plants to grow well".

What is data editing?

**Data editing** in research, means a procedure for manual scanning and cleaning of data to reduce inconsistencies in the questionnaires or interview responses.

Sometimes you may wonder what to do with so many of the questionnaires you have received from respondents. Also, the interview schedules you completed or filled after fieldwork could be bulky. It is a tedious task to begin analyzing your data straight from the questionnaires or interview schedules. You could end up getting disorganized or confused.



## Activity

The following are items in selected questionnaires, which were returned by respondents to a researcher after data collection. Examine each question and identify any irregularities about the responses given.

### Question 10:

To what extent do you feel satisfied with your current working conditions?

Respondent I:

COMPLETELY SATISFIED	SATISFIED /	INDIFFERENT	DISSATISFIE D /	COMPLETELY DISSATISFIE D
5	4 \	3	2 \	1

Respondent II:

COMPLETELY SATISFIED	SATISFIED	INDIFFERENT	DISSATISFIED	COMPLETELY DISSATISFIED
5	4	3	2	1

### Question 12:

How long have you worked in your current teaching position before getting promoted to the next job group?

**Respondent I:** promotions are very rare.

**Respondent II:** Six years

You realise that in question 10, respondent I provided double responses where only one was required. Likewise, respondent II never gave any response.

In question 12, respondent I gave an irrelevant answer, while respondent II provided a relevant answer.



### Activity

*How would the response in the above Activity affect your data analysis results?*

You now realise that some responses could be misleading and can negatively affect the accuracy of your data analysis results. It is not necessary, therefore, to include such data in your analysis, unless you are pretty sure of how to correct them.

### *The importance of data editing*

#### **Note I**

Data editing will assist you in ensuring that;

- Proper questions were asked
- The respondent recorded proper answers.
- Proper screening questions were employed, to stimulate respondent to clarify their answers.
- Open-ended responses were recorded accurately.

#### **Note II**

Editing checks on and corrects the following;

- Wrong - entries / responses
- Errors in response
- Omissions in response
- Possible outliers (extreme values)
- Any other inconsistency



### Activity

*Explain how you could correct the inconsistencies in Note II*

**Wrong entries** are committed when a respondent records an answer in a space meant for a different question. This can easily be corrected by checking which

question/items are relevant to the answer given. The mismatch can then be corrected.

**Errors in responses** are made when numerical answers are either exaggerated or understated. For example, a respondent may record work experience as 400 years when the correct value is 40 years. Most of the errors can be corrected through common sense.

**Omissions in responses** sometimes affect the accuracy in statistical analysis. For example, if the total number of respondents for a study was 200 and only 150 of them responded to a question/item, this could affect results.

Supposing the question required a YES or NO response, and 50 respondents indicated YES while 100 indicated NO. The percentage for YES may be computed erroneously as  $(50/200 \times 100)$  instead of  $(50/150 \times 100)$ . The number of omissions should, therefore, be checked to avoid inaccurate data analysis results.

**Outliers** are extreme values, which differ significantly from a set of responses given for an item/question. They often distort the true picture that the statistical analysis results would otherwise give. Consider the following case, in activity 5.



*A researcher in an interview posed the question below to selected small business operators.*

*Question: What is your monthly average income after taxation?  
Five responses were given as follows.*

Income (in Kshs.)	
Respondent 1	25,000
Respondent 2	30,000
Respondent 3	15,000
Respondent 4	2,500,000
Respondent 5	18,000

*Compute the mean income for the small businesses.*



*Does the mean income represent the five cases accurately?  
How well does it represent the majority of the respondents' income?*

### **Data coding**

After editing the data, it is necessary to prepare for the next stage of coding and tabulating the data.

**Data coding** is a procedure for assigning numeric values or symbols to all the variables (or items) as well as of providing numeric labels or symbols to data so that they can be tabulated for subsequent statistical analysis.



*How is data coding carried out?*

Imagine you are developing a questionnaire to be administered in collecting data from your students in a class. Questions you included in the instruments are shown below:

Questionnaire Item 1:

What is your gender?

☐

Male

☐

Female

Questionnaire Item 2:

What is your age-group?

☐

Less than 15 years

☐

16 - 20 years

☐

21 - 25 years

☐

Over 25 years

Questionnaire Item 3:

How was your performance in mathematics in the last end-term examinations?

☐

Excellent

☐

Very Good

☐

Fair

☐

Poor

In coding the data for the items, you need to assign numeric values or symbols to each question as well as to each response category provided. In this process, you need to compile a coding scheme. The Table 8.2 provides an example of a coding scheme for the questionnaire items expressed earlier in this section.

**Table 8.2: Data coding scheme**

	Description of variable	Variable Code	Response Labels	Labels Codes	Type of Variable/Data
Var. 1	GENDER OF STUDENTS	01	Male Female	1 2	NOMINAL
Var. 2	AGE OF STUDENT	02	<ul style="list-style-type: none"> <li>• Less than 15 years</li> <li>• 16 - 20 years</li> <li>• 21 - 25 years</li> <li>• Over 25 years</li> </ul>	1 2 3 4	INTERVAL
Var. 3	STUDENTS PERFORMANCE IN MATHEMATICS	03	<ul style="list-style-type: none"> <li>• Poor</li> <li>• Fair</li> <li>• Good</li> <li>• Very good</li> <li>• Excellent</li> </ul>	1 2 3 4 5	ORDINAL

The process of coding will make it easy for you to tabulate the data in the preparation for data analysis. It will also make it easy for you to store the data in a computer using spreadsheet software or data analysis software's such as SPSS (Statistical Package for Social Sciences).



### Activity

*Design a questionnaire intended for collecting data for your study. Develop a coding scheme for the instrument.*

### Data Tabulation

Data tabulation is a process for organising data to fit into a tabular framework to facilitate subsequent analysis.

- Data tabulation indicates the number of respondents who gave each possible answer to each question on a questionnaire or interview schedule.
- It generates a cross tabulation which provides categorization of respondents by treating several variables simultaneously.
- It organises data into Columns and Rows to create an array of Variable Values against the units of analysis, thus generating a data matrix.
- The columns represent the coded variables, while the rows represent the units of analysis, who are the respondents.

Based on the previous coding scheme developed earlier in Table 8.2, you will need to specify the following:

- a) The Units of Analysis: This represents those who responded by filling in the questionnaires. Each questionnaire represents a unit of analysis. You need to provide a number for each questionnaire as they come back to you. Indicate on top of the first questionnaire, the number 1, second questionnaire, the number 2, and so on.
- b) Specify the variable codes as shown in the data-coding scheme. These are; 01 for "Gender of Students", 02 for "age of students" and 03 for "Students performance in mathematics".
- c) Draw up the table as shown in Table 8.3.

**Table 8.3: Data matrix: Example variable codes**

Units of Analysis (Respondents)		01	02	03	04	05	06	07	---
Respondent	No. 1	1	3	4					
Respondent	No. 2	2	2	4					
"	" 3	2	2	5					
"	" 4	2	4	3					
"	" 5	1	3	3					

Note that respondent No. 1 represented by the first questionnaire (1) is

- "Male" represented by 1
- Age -group "21 -25 years " represented by 3
- Recorded "very good performance" represented by 4.

This is why the first row for respondent No. 1 has values: 1, 3 and 4



### Activity

*Explain the entries for respondent No. 2 and No. 3 as indicated in the data matrix.*

Let us make an analysis of variable 01 for the 5 entries, in column 2. In this case, we draw up a frequency table as shown in Table 8.4.

**Table 8.4: Analysis of students by gender**

Gender of Student	Frequency	Percent of Total
1. Male	3	60
2. Female	2	40
<b>TOTAL</b>	<b>5</b>	<b>100%</b>

You will notice that the title of the first column in Table 8.4, "Gender of Student" is similar to description of the variable in the coding scheme. You will also notice that in the frequency column in the table, male students are 3 and female students are 2. These frequencies are obtained by counting the number of 1's in the Data Matrix for **Variable 01** and the number of 2's, for males and females respectively. This is necessary because 1 represents "male" and 2 in the coding scheme represent female category.



### Activity

*Draw up a frequency table for var. 02 (Age of Students) and variable 03 (Students performance), using the coding-scheme and the data-matrix.*

After processing your data, the next step is to analyse the data. This process is explored in the next topic, which will familiarise you with various techniques for quantitative analysis and qualitative analysis.

### Types of quantitative data

Before we begin to examine statistical analysis techniques, it is worthwhile to specify the type of quantitative data to use. When you understand the type of data to use, you will be able to select a suitable statistical analysis technique. In Section 4, of this manual we specified four types of variables. These are nominal, ordinal, interval and ratio variables. Each of these variables generates the same kind of data. Examine the summary in Table 8.5.

**Table 8.5: Types of quantitative data**

Type of Data	Purpose/Function
NOMINAL	Classifies data into categories only. Example: male and female
ORDINAL	Represents order of number, say from highest to lowest level. Example: Grade A, B, C, etcetera.
INTERVAL	Regular intervals between the data exist. They have arithmetical significance.
RATIO	Data provide exact measures. Example: Time, temperature, etcetera.



### Activity

Study the data here below and specify which of the following represents nominal, ordinal, interval or ratio data.

- Concentration of sugar in tea  
Type: \_\_\_\_\_ Why? \_\_\_\_\_
- Students' scores in English test.  
Type: \_\_\_\_\_ Why? \_\_\_\_\_
- Position of staff in school.  
Type: \_\_\_\_\_ Why? \_\_\_\_\_
- Likert Scale.  
Type: \_\_\_\_\_ Why? \_\_\_\_\_

### TOPIC 3: What data analysis means

Data analysis involves classifying, ordering, manipulating and summarizing data in order to obtain answers to research questions or to test research hypothesis. The purpose of analysis is to reduce data to a form that makes interpretation possible. It is always difficult or impossible to interpret raw data. It is first necessary to analyze the data then make interpretation of results.

#### Meaning and purpose of data analysis

Data in research means:

- Research results from which inferences are drawn
- Usually numerical or textual results
- The results of systematic measurement and observation used to make inference to arrive at conclusions.
- Other examples include;
  - Newspapers and magazines or articles

- Biographical materials
- Diaries, transcriptions

Scientists/researchers make observations, assign symbols and numbers to observations, manipulate the symbols and numbers to put them into interpretable form and then make inferences about the relations among various types of research problems.

Data analysis involves the categorizing, ordering, manipulating and summarizing of data to obtain answers to research questions to test research hypotheses. The purpose of data analysis is to reduce data to intelligible and interpretable form so that the relations of research problems can be studied and tested.

### **Interpretation of data**

The analyses of research data, however, does not in and of itself provide the answer to research questions. Interpretation of data is necessary.

To interpret is to explain, to find meaning. It is difficult or impossible to explain raw data. One must first analyze the data and then interpret the results of analysis.

Interpretation takes the results of analysis, makes inferences pertinent to the research results, and searches them for their meanings and implications. This is done in two ways:

- a) The relations within the research study and its data are interpreted. This is the narrow and the more frequent use of the term interpretation. Here interpretation and analysis are closely intertwined. Example: When one calculates, say, a coefficient of correlation, one almost immediately infers the existence of a relation.
- b) The broader meaning of research data is then sought. One compares the results and the inferences drawn from data to theory and other research results. One seeks the meaning and implications of research results within the study results.

### **Quantitative data analysis**

Quantitative data analysis focuses on numeric data. This is data expressed in the form of numbers, levels or categories of things. Analysis of quantitative data

involves the application of statistical methods. Two branches of statistics are employed in the analysis of numeric data.

*Descriptive statistics:* Is concerned with statistical procedures used in organizing, summarizing and describing numeric data so that meaningful interpretations can be developed about the research findings.

*Inferential statistics:* Is concerned with statistical procedures used in estimating or interpreting true population parameters or measures on the basis of sample statistics. Inferential statistics is based on probability theory.

#### **TOPIC 4: Descriptive statistical methods**

Preliminary analysis of quantitative data commonly involves the application of descriptive statistics. A variety of technique can be employed, depending on the research questions or objectives. The main types include:

*Descriptive methods:* These techniques are mainly used in the presentation of raw data. They help in organizing or classifying the data. In this presentation, the following techniques are used:

- Frequency tables
- Bar charts or bar graphs
- Histograms
- Pie-charts
- Frequency polygons
- Cumulative frequency curve (Ogive)
- Line graphs

Frequency tables represent the most commonly used method in presenting data in descriptive research.

*Measures of central tendency:* These are mainly used to summaries raw numerical data to facilitate interpretations and communication of findings to others. The measures include: **mean, mode and median**)



## Presentation of data

Your ability to present data in the research report will enhance data interpretation. The use of computer software such as Excel, SPSS, SAS and others will help you to present your data faster. If you use manual presentation, take care to avoid errors and exaggerations.

### *Frequency tables*

Many students use frequency tables to organize a large amount of data and display the data in their reports. You may not be an exception. To present a good frequency table, you must observe some simple, but important requirements.



*Examine the frequency Table, 8.6 below. What is wrong or missing Table 8.6?*

**Table 8.6**

Age on leaving secondary school	Employment	Unemployment
Less than 16	20	80
16 - 18	27	73
19 - 20	10	90
21 - 25	5	95
Over 25	0	100

You probably have noticed some criticisms about the table. You may have noted the main problems with it are: -

- A missing title
- No indication of what the numbers mean.
- No indication of how the data on employment was measured.
- No indication of the source of the data

Take a look at the corrected version of Table 8.6 (see Table 8.7) in spite of the corrections there are still a few issues to be raised.



*Find out the things that are missing from the Table 8.7*

**Table 8.7: Employment Trends: 2004**

Employment rates of 30 year olds: by age on leaving full-time schooling, 2002		
Kenya: Percentage		
Age on leaving school	Employment <sup>1</sup>	Unemployment <sup>2</sup>
Less than 16	20	80
16 - 18	27	73
19 - 20	10	90
21 - 25	5	95
Over 25	0	100
1. People generally employed in full time jobs.		
2. People generally employed in part-time jobs or completely not employed.		
<b>Source:</b> Statistical Abstract		

Looking at Table 8.7, you will still notice that the actual totals are not given. This should be immediately obvious. The source of the table does not indicate the year of publication.

Take a look at some guidelines that you need to follow when presenting a table. Opie (2004) specifies some things to remember.

*Simplicity:* The table should be as simple as possible, highlighting of the main issue.

*Labels:* Should be clear, comprehensive and explanatory. For example, there should be a title, units of measurements, column headings and year of collection indicated.

*Totals:* Should be presented, especially where percentages are given.

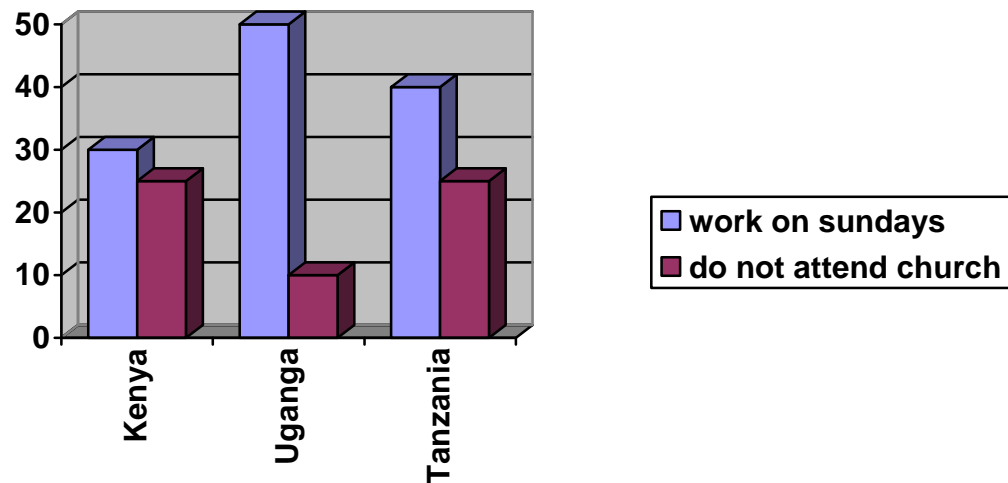
### **Charts and graphs**

It is easier to see spatial relationships than numerical relationships. However, we may distort the value of presentation by using colour or by use of overcrowded bars.

#### **(a) Bar chart and pie charts**

We use bar charts to present frequency data. They are suitable for presenting nominal and ordinal data.

Figure 8.2: Example of bar chart



Note that, to ensure ease of interpretation limit the number of bars in any graph. There are other forms of bar charts.



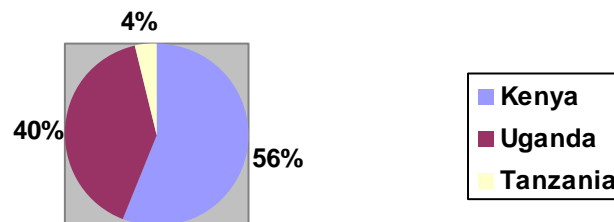
### Activity

*Research on other forms of bar charts and list them down.*

You probably found out that other bar charts include; stacked bar chart, 3-dimensional bar chart, and Horizontal bar charts.

Fig. 8.3: Example of pie chart

### Working



## **Graphs**

The main consideration in presenting a graph includes.

**Labels:** these should be clear, comprehensive and explanatory. Include a title, variables and unit.

**Variables:** Independent variable should be placed in the horizontal X- axis while the dependent variable is presented in the Y- axis.

**Vertical axis:** Should start at zero, and the variable should be evenly spaced.

**Impression:** It is important to ensure that the graph is accurate and not distorted.

## **TOPIC 5: Measures of central tendency**

The main types of central tendency that will be considered are the mean, median and mode.

**The mean  $\bar{X}$**  is the sum of all scores ( $\Sigma X$ ) divided by the number of scores ( $N$ ) the mean reflects the influence of all scores in a distribution; this means that a score larger than all the others will significantly affect the size of the mean.

$$\bar{X} = \Sigma X / N$$



### **Activity**

*Calculate the mean for the distribution of scores*

(a) 2,4,6,8,10

(b) 10,9,8,7,6,5,4,3,2

(c) 2,6,12,50

Statistically, the mean has wider application than the measure of central tendency. This is because it is much easier to manipulate, and it has application in more complex analyses in inferential statistics.

**The median** means the middle number. To find the median of a distribution, one should rank the scores in order of increasing magnitude, and then pick the middle score. For example in the following distribution: 16, 6, 11, 24, 17, 4, 19, 9, 20

When arranged on order of magnitude: 4 6 9 11 17 16 19 20 24 the median is 16, it is the central number. If there are two central numbers, in the case where the distribution is even, the median is calculated by averaging these two numbers. For example, 16, 29, 20, 9, 34, 10, 23, 12, 15, 22 when ranked is as follows: 9 10 12 15 16 20 22 23 29 34. The two numbers in the middle are 16 and 20. The median is  $(16+20) / 2 = 18$

The median is limited in application because it is at the ordinary level of measurements. It, however, has an advantage over the mean in that it is not affected by extreme scores, and is, therefore, more useful in cases where the distribution contains more extreme measures.

**The mode** is the most frequently occurring value in a set or distribution of score. For example, in the following distribution, 23, 28, 20, 24, 9, 24, 24, 21, 18, 19, 24 the highest occurring number is 24 (three times). In the case where there is a tie, then both numbers will share the mode. For example, the distribution 3, 4, 5, 8, 4, 9, 11, 3, 8 is bimodal (two modes, 8 and 3)

The mode lacks the precision of the other measures of central tendency and can be misleading. It is, therefore, rarely used in research.

The information obtained from measures of central tendency is not sufficient, since they do not tell us the extent to which the scores vary. Measures of variability, therefore, provide us with that information.

## **Topic 6: Measures of variability**

The main types of measures to be considered here are the range, variance and standard deviation. The range refers to the difference between the highest and lowest score. For example, in the following distribution; 35, 75, 86, 23, 92, 47, 65, 67, 38, 48, the range is  $92-23=69$  the range is a limited application in data analysis since it reflects values of only two scores. The following measures have incorporated all scores in the computation on variability. The

variances tells us how much all the scores vary from the mean. It is computed using the formula.

$$V = \sum (X - \bar{X})^2 / N$$

Note that the unit's measure will be squared. In order to remove the square, we need to calculate the square root of the variances. This will give us a measure known as the standard deviation. The formula for the standard deviation (SD) is as follows.

$$SD = \sqrt{V} = \sqrt{\sum (X - \bar{X})^2 / N - 1}$$

Where N-1 represents the degrees of freedom of the distribution

### The degree of freedom

Opie (2005) defines degree of freedom as: "number of values from a total number (N), which are free to vary. These are the numbers that are not fixed by some restriction placed upon them. Let us think of some four (4) numbers. If we place no restriction on them, then the degrees of freedom,  $df = 4$ . Suppose we place some restrictions on them by imposing a mean value of 8 for them. Let us first take three values to total 8, and then last number,  $n$  is fixed.

$$\text{This means: } 8 = \frac{5 + 6 + 7 + n}{4}$$

Given the value of 14, the number, 14, is therefore fixed. The other three numbers are free to vary,  $(N - 1)$



### Activity

a) Calculate the mean, range, variances and standard deviation for the following set of scores. 5, 16, 13, 18, 19, 9

b) Below are three sets of data. Find out the one with the largest SD, and give a reason why.

- i) 2, 4, 6, 8, 10
- ii) 10, 9, 8, 7, 6, 5, 4, 3, 2
- iii) 2, 6, 12, 50

c) You are told that one of the scores in a distribution is 8. The standard deviation of that distribution is 0. Which of the following statements is true?

- i) The mean can be calculated
- ii) All the scores are identical

## TOPIC 6: Measures of association / relationships

In your research study, you may be intending to determine relationships between variables. This could be in an attempt to fulfil the objectives of your study or answer research questions. Sometimes, you may have formulated research hypothesis.

In this section, we examine statistical methods, for determining relationships between variables. Also, methods of establishing differences between groups of selected sample are examined.

### (a) Spearman's Rank Order Correlation Coefficient

This method will be useful to you when you intend to determine relationship between two sets of ordinal variables. It involves arranging the sets of values of each variable in a rank order. The formula used here is: -

$$r_s = 1 - \frac{6 \sum d^2}{n(n-1)(n-1)}$$

Where:  $r_s$  is the correlation coefficient

$d$  is the difference in rank between the items in a pair

$n$  is the number of items.



### Activity

The following, Table 8.8, shows ranking by two classes of students of various characteristics of effective teaching. Complete the columns for (d) and ( $d^2$ ) to compute the correct coefficient.

**Table 8.8: Students' ranking**

	Characteristics	Class A Ranking	Class B Ranking	d	$d^2$
1	a	1	1	0	0
2	b	2	3	-1	1
3	c	3	2	01	1
4	d	4	4	0	0
5	e	5	6		
6	f	10	5		
7	g	6.5	9		
8	h	6.5	11.5		
9	i	8	13.5		
10	j	15.5	7.5		
11	k	12.5	7.5		
12	l	12.5	10		
13	m	9	11.5		
14	n	11	13.5		
15	o	14	19		
16	p	15.5	15		
17	q	15.5	18		
18	r	20.5	20.5		
19	s	18	16.5		
20	t	19	16.5		
21	u	20.5	20.5		
					$\Sigma d^2 = ?$



Note that, the sum of difference in ranking between paired items squared  $\sum d^2$  is 237.25. Using the equation;

$$r_s = 1 - \frac{6\sum d^2}{n(n-1)(n+1)} = \frac{1 - 6(237.5)}{21(20)(22)}$$

$$r_s = 0.846$$

This is relatively a strong correlation between the two - classes' rating of the characteristics of effective teaching. The statistical significance of this value can be determined using statistical tests, such as t-test, Kruskal-wallis test. These are discussed, later

### (b) Pearson's Product Moment Correlation Coefficient

You will find this method relatively straightforward in computing correlations. It is however only used where the variables are interval or ratio.

The formula for this method is indicated.

$$r = \frac{n \sum XY - (\sum X)(\sum Y)}{(n \sum X^2 - (\sum X)^2)(n \sum Y^2 - (\sum Y)^2)}$$

Where:

- n - The number in the sample
- X - Values of one variable
- Y - Values of the other variable



#### Activity

You intend to determine the relationship between form Four students' scores on mock and final exam, (KNEC) in English. Their results in both exams are shown in Table 8.9.

Complete the calculations in the table to complete the correlation coefficient,  $r$ .

Table 8.9: Values of scores in English

	Students	Score in Mock exam (X)	Score in KNEC (Y)	(XY)	(X <sup>2</sup> )	(Y <sup>2</sup> )
1	A	30	34	1020	900	1156
2	B	38	36	1368	1444	1296
3	C	60	42			
4	D	65	60			
5	E	43	42			
6	F	50	48			
7	G	58	52			
8	H	72	66			
9	I	64	48			
10	J	80	72			
		<u><math>\Sigma X = ?</math></u>	<u><math>\Sigma Y = ?</math></u>	<u><math>\Sigma XY = ?</math></u>	<u><math>\Sigma X^2 = ?</math></u>	<u><math>\Sigma Y^2 = ?</math></u>

You will notice that:  $\Sigma X = 560$ ,  $\Sigma Y = 500$ ,  $\Sigma XY = 29164$ ,  $\Sigma X^2 = 33562$ ,  $\Sigma Y^2 = 26432$ ,  $(\Sigma X)^2 = 313600$  and  $(\Sigma Y)^2 = 250000$ .

Using these values in the equation:

$$r = \frac{10 (29164) - (560) (500)}{[10(560) - (313600)] [10(500) - (250000)]}$$

$$r = 0.91$$

### The relationships between ordinal and nominal variables (cross tabulations)

In this section data from variables, such as gender, occupation, social economic status, teaching methods, among others are considered. These variables generate *non-continuous* data (sometimes referred to as discrete data). This kind of data is also known as *non-parametric*. Hence, non-parametric statistics are used.

These terms may not be very familiar to you. What matters is how you can use them to achieve good results for your study.

## The contingency table

This is a cross-tabulation of two variables. In this table you will use columns to represent categories of the independent variable and rows to represent categories of dependent variable. This is merely a convention. Take a look at Table 8.10. This table has two rows and two columns.

**Table 8.10: A contingency Table**

Dependent Variable	Independent variable		Totals
	Low	High	
High	146	88	<b>234</b>
Low	90	134	<b>224</b>
<b>Totals</b>	<b>236</b>	<b>222</b>	<b>458</b>

Note: The cut-off point between low and high should be equivalent to the median value, of the variable.

Note that the columns are ordered so that they go from low to high as you move to the right. Likewise, the rows increase from low to high as you move from bottom to top. This is used when the variable is ordinal. For nominal variables, ordering does not matter.

Observe that the four blocks containing frequencies; 146, 88, 90 and 134 are called cells and the frequencies are called cell frequencies. Also; 234, 224, 236 and 222 are called the marginal frequencies. The samples size (n) is represented by 458.

### a) Using percentage differences to estimate correlation



#### Activity

*Develop a percentage table from the frequencies.*

Table 8.11 represents a percentage table. The percentages are computed by dividing each cell frequency by the marginal frequency in the corresponding column then multiplying by 100%. For example, 61.9% is obtained by dividing 146 by 236 (in table 8.10), then multiplying the result by 100.

**Table 8.11: Percentage table**

Dependent	Independent	
Variable	Variable	
Variable	Low	High
High	61.9%	39.6%
Low	38.1%	60.4%
<b>Totals</b>	<b>100%</b>	<b>100%</b>

***Estimating Correlation Coefficient using percentage differences***

You can estimate the correlation coefficient,  $r$ , between the independent and the dependent variable, by determining their percentage differences here; use only the percentages in each row. In this case subtract the lower percentage from the higher percentage in each row. What do you note?

- Percentage difference in 1<sup>st</sup> row = 61.9% - 39.6%  
= **22.3%**
- Percentage difference in 2<sup>nd</sup> row = 60.4% - 38.1%  
= **22.3%**

22.3% is an estimate of the correlation coefficient  $r$  (equivalent to  $r = 0.223$ ) hence the coefficient of correlation is represented by the; %  $d = 22.3\%$



**Activity**

The Table 8.11a represents percentage of people employed by educational levels. Using the % difference, estimate the correlation coefficient.

**Table 8.11a: Employment by educational level**

Employment	Educational Level		
Status	Less than O - Level	O - Level and above	Total
Employed	164 (82%)	182 (91%)	346
Unemployed	36 (18%)	18 (9%)	54
<b>Total</b>	<b>200 (100%)</b>	<b>200 (100%)</b>	<b>400</b>

**(b) The phi - coefficient ( $\Phi$ )**

This method is used in computing the relationship between variables whose values have been dichotomized. This means that the values are divided into two categories of high and low. For example student scores in mathematics can be dichotomised into high and low scores, where low score is below 50% and high score is 50% and above. Normally, the median value is used to create the cut off point. You will note that certain variables such as gender are naturally dichotomised into "males" and "females"

To compute the phi-coefficient only a 2 x 2 contingency table is used. This is illustrated in Table 8.12

**Table 8.12: 2 x 2 contingency table**

Dependent variable	Independent variable		
	Low	High	Total
High	A	B	(a+b)
Low	C	D	(c+d)
Total	(a+c)	(b+d)	N

The phi-coefficient  $\Phi = \frac{bc - ad}{\sqrt{(a+b)(c+d)(a+c)(b+d)}}$



### Activity

A researcher intended to establish whether student's performance in mathematics was related to their performance in physics. As shown in Table 8.13 .10, 15 students obtained high scores in physics, but low scores in mathematics. 40 students scored low scores in mathematics and physics. 18 students obtained high scores in mathematics but low scores in physics.

Compute the correlation, using the phi-coefficient. Interpret the results.

**Table 8.13: Comparative Scores in Physics and Mathematics.**

Physics	Mathematics		Total
	Low	High	
High	15	35	50
Low	40	18	58
Total	55	53	108

### Using Tau, Gamma, and Somer's d

These methods are used to compute correlation coefficient for partially ordered data. The variables must be ordinal. Before we present the formula for calculating the coefficient of correlation, it is necessary for you to conceptualize the procedure used here.

Take a look at the contingency Table 8.14 here below.

Table 8.14: A contingency table

X-Variable

		X- Variable	
		→	
		Low	High
High ↑  Low			c
			b
	A		d

We need to make comparisons between pairs of values on variable - X and on variable - Y. This is illustrated in Table 8.15

Table 8.15 Pair Wise Comparisons

Pairwise Comparison	Order of pairs on X	Order of pairs on Y	Agreement or Disagreement.
a vs b	$a < b$	$a < b$	Agreement
a vs c	$a < c$	$a < c$	Agreement
a vs d	$a < d$	$a < d$	Agreement
b vs c	$b = c$	$b < c$	Tie on X
b vs d	$b < d$	$b = d$	Tie on Y
c vs d	$c < d$	$d < c$	Disagreement

Note that along the X-Variable, a is less than b, b=d, and so on. Similarly along the y-variable, a is less than b and so on. Between X and Y variable, there are 3 agreements and two ties. The tie on X is only one. The tie on Y is also only one.

These counts are useful in your calculations.

(i) *Goodman and Kruskal's Gamma*

Based on our discussion on agreements (A) and Disagreement (D), we can obtain a measure of correlation between two **ordinal** variables.

This is called the Gamma Coefficient of correlation, =  $\gamma$

$$\text{Where, } \gamma = \frac{A - D}{A + D}$$

Where  $\gamma$  is the coefficient of correlation and  
 A is the number of agreements  
 B is the number of disagreements



### Activity

In our contingency table below; determine the correlation coefficient.

	Low	Moderates	High
High		C	
Moderate		D	d
Low	a		

In the above activity, note that the number of agreements (A) in pair wise comparisons of the frequencies equals 3 and number of disagreements (D) is only 1.

The **gamma coefficient** is given by:

$$\gamma = \frac{A - D}{A + D} = \frac{3 - 1}{3 + 1} = \frac{2}{4} = 0.5$$

The gamma indicates the proportional reduction in error of 50%, when all ties are ignored.

### (ii) Somer's (d) coefficient of correlation

Somer's  $d_{yx}$  indicates the proportional reduction in error, when only ties in the **dependent variable** are taken into account.



$$\text{Somer's } d_{yx} = \frac{A - D}{A + D + T_y}$$

The  $T_y$  in the formula indicates ties in only  $Y$  - variable levels.

Using the case in gamma ( $\gamma$ ), we can determine Somer's ( $d$ ) coefficient as;

$$\text{Somer's } d_{yx} = \frac{3 - 1}{3 + 1 + 1} = 0.40$$

### (iii) Kendall's Tau coefficient of correlation

Kendall's Tau ( $T_b$ ), provides the proportional reduction of error, when ties in both independent and dependent variables are considered.

$$T_b = \frac{A - D}{\sqrt{(A + D + T_x)(A + D + T_y)}}$$

In the previous example, we can compute Kendall Tau correlation coefficient as follows:

$$T_b = \frac{3 - 1}{\sqrt{(3+1+1)(3+1+1)}} = \frac{2}{\sqrt{25}} = \frac{2}{5} = 0.4$$



### Activity

Table 8.16 indicates a summary of students' performance grades obtained in the o-level results for a secondary school in Nairobi. This is compared with their previous performance in K C P E exams.

Compute the Somer's ( $d$ ), Gamma and Kendall's Tau, coefficient of correlation.

**Table 8.16: Correlation of KCPE and O - level exams**

O-level	KCPE EXAMS GRADES			
GRADES	C	B	A	TOTAL
A	5	5	30	40
B	10	10	10	30
C	20	20	20	60
<b>TOTAL</b>	<b>35</b>	<b>35</b>	<b>60</b>	<b>130</b>

**Step 1: Obtain Agreements (A).** Examine pairs that indicate agreement between O' level and KCPE grades. The agreement is located on a diagonal that increases from left to right. In the table, multiply the frequency in each cell by cases that fall above and to the right of the cell.

**Step 2: Obtain Disagreements (D).** These are located in the diagonal that decreases from left to right. In the table, multiply the frequency in each cell by the number of cases falling below and to the right of it.

**Step 3: Obtain ties on X ( $T_x$ ).** We know that  $T_x$  indicates all pairs that are tied on X but not on Y. In the table, variable X is KCPE (grades) while variable Y is O-level grades. These are cells in the columns. So, take each cell and multiply it by all the cases falling above it in the same column.

**Step 4: Obtain Ties on Y ( $T_y$ ).** This represents ties on Y but not on X. These cells are located in the rows, representing O-level grades. Multiply each cell, in turn, with all the cases that fall to its right in the same row.

Compare your results with the following:

Fill in the spaces and questions marks (?) to complete the table.



## Guttman's Lambda Coefficient

This provides a measure of association for nominal variables.

- a) You should be able to compute Lambda ( $\lambda$ ) coefficient to determine relationships between nominal variables.
- b) You should be aware that Guttman's Lambda is a Proportional Reduction in Error statistic. This means that it reflects the degree to which knowledge of the independent variable reduces errors in predicting where the cases will fall on the dependent variable.
- c) You should, also be aware that as a Proportional Reduction in Error Statistic, Lambda is an estimate of the coefficient of Determination,  $r^2$
- d) There could be an asymmetrical and symmetrical form of Lambda (find out).

The formula for computing Lambda is:

$$\lambda_{xy} = \frac{\sum LYX - LY}{N - LY}$$

**Where:** *N is the total number of cases in the table.*

*LY is the number of cases in the modal Y - Category, ignoring X.*

*LXY is the number of cases in the largest cell within X - Category.*

*$\sum LX$  indicates summation of all X - Categories.*

*LYX is an asymmetric measure because it indicates the amount of error reduced when guessing Y - categories from the knowledge of X, but not vice versa*

Now attempt this example:



### Activity

*Table 8.17 indicates a cross-tabulation of two nominal variables X and Y. Compute the Lambda Coefficient for the variable relationship.*

Table 8.17: Cross tabulation

Y - Variable Categories	X - Variable Categories				
		X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	TOTAL
	Y <sub>1</sub>	200	60	40	300
	Y <sub>2</sub>	50	90	10	150
	Y <sub>3</sub>	0	0	50	50
	TOTAL	250	150	100	N = 500

You notice that  $\lambda_{xy} = \frac{\sum LYX - LY}{N - LY}$

$$= \frac{(200 + 90 + 50) - 300}{500 - 300}$$

$$= \frac{40}{200} = 0.20$$

**Symmetrical Lambda:** This is denoted by

$$\lambda = \frac{\sum LYX + \sum LYX - LY - LX}{2N - LY - LX}$$

Where: LY is the number of cases in the modal Y category

LX is the number of cases in the modal X category

LXY is the number of cases in the largest cell in a given X - Category

LXY is the number of cases in the largest cell in a given Y - Category.



### Activity

Using values in table 8.16 determine the value of the Lambda coefficient (X) - symmetrical.

## TOPIC 7: Inferential statistics

In this topic, we shall confine our discussions on inferential statistics to methods that will facilitate completion of your research project. One area of interest concerns hypothesis testing.

### The research hypothesis

It was explained earlier that a research hypothesis is "a tentative explanation of a research problem or phenomenon". It refers to a declarative statement that provides a tentative explanation about a given research problem.

When you are planning for a research study, for example: "*The impact of guidance and counselling programmes on behaviour change of secondary school students*"

Your research hypothesis would be framed as follows:

H<sub>1</sub>: There is a significant relationship between students' exposure to guidance and counselling programmes and their observed behaviour change.

Or

H<sub>1</sub>: There is a significant difference in behaviour change between students exposed to guidance and counselling programmes and those not exposed.

This hypothesis predicts the expected outcome of the research study. It is, however, subject to statistical verification at the time of data analysis.

In formulating the research hypothesis, you need to observe the following considerations:

- The hypothesis must express a relationship between two or more variables. Alternatively, it could express a difference between two or more levels of a dependent variable in relation to an independent variable.
- Secondly, the hypothesis is expressed in such a way that it conforms to known theories, principles or models.
- Thirdly, the statement of the hypothesis must imply possible measurement and statistical analysis of the variables.

### Types of hypothesis

In your research study, you may need to consider the following types of hypothesis:

- The alternative hypothesis ( $H_1$  or  $H_0$ )
- The null hypothesis ( $H_0$ )

In most research studies, the alternative hypothesis is stated at the beginning of the research study. It specifies what we intend to prove in the course of the study. The alternative hypothesis emphasizes that there is a relationship between two or more variables. It may also emphasize that there is a difference between two categories or levels of a variable as a result of the influence of another variable (see the example) at the beginning of the section/Unit).

The alternative hypothesis can be expressed in two forms, namely:

- In non-directional form
- In directional form

The alternative hypothesis expressed in non-directional form only emphasizes the existence of a relationship or a difference. It, however, does not indicate the nature of the relationship. For example, it does not express whether the relationship anticipated is direct or inverse.

Example 1:

There is a relationship between a student's participation in guidance and counselling programmes and his/her change in behaviour (non-directional).

Example 2:

Students exposed to longer guidance and counselling programmes experiences greater positive behaviour change than those exposed to shorter GUIDANCE AND COUNSELLING programmes, (directional hypothesis).

The second hypothesis is expressed in directional form. It indicates that change in period of exposure to the GUIDANCE AND COUNSELLING programme is directly related to level of behaviour improvement.

In verifying the non-directional hypothesis, a two-tailed test is used, whereas in verifying the directional hypothesis, a one-tailed test is used. These concepts are explained in the next section/unit.

### ***The Null-Hypothesis ( $H_0$ )***

This hypothesis represents the statistical hypothesis because it is the hypothesis tested using inferential statistics. At the beginning of the research study you will state the alternative hypothesis to be proved during the course of your study. However, at the time of data analysis, the alternative hypothesis is re-stated in null form, that is, in the negative or opposite form to the alternative hypothesis. In this case, it is the null hypothesis, which is tested to determine the probability that the alternative hypothesis will be accepted or rejected.

The null-hypothesis helps to minimize researcher bias. The null-hypothesis emphasizes that the relationship or difference expressed in the research hypothesis is **not** statistically significant. It stresses that the presumed relationship or difference in variables is merely due to random chance (coincidence) or error.

Take a look at the previous hypothesis

**H<sub>1</sub>:** There is a relationship between participation in guidance and counselling programme and student behaviour change.

**H<sub>0</sub>:** There is no significant relationship between participation in guidance and counselling programmes and students' behaviour change.

Before we explore the concept of hypothesis testing, it is necessary to examine the basis of inferential statistics. One of this is the concept of the normal distribution

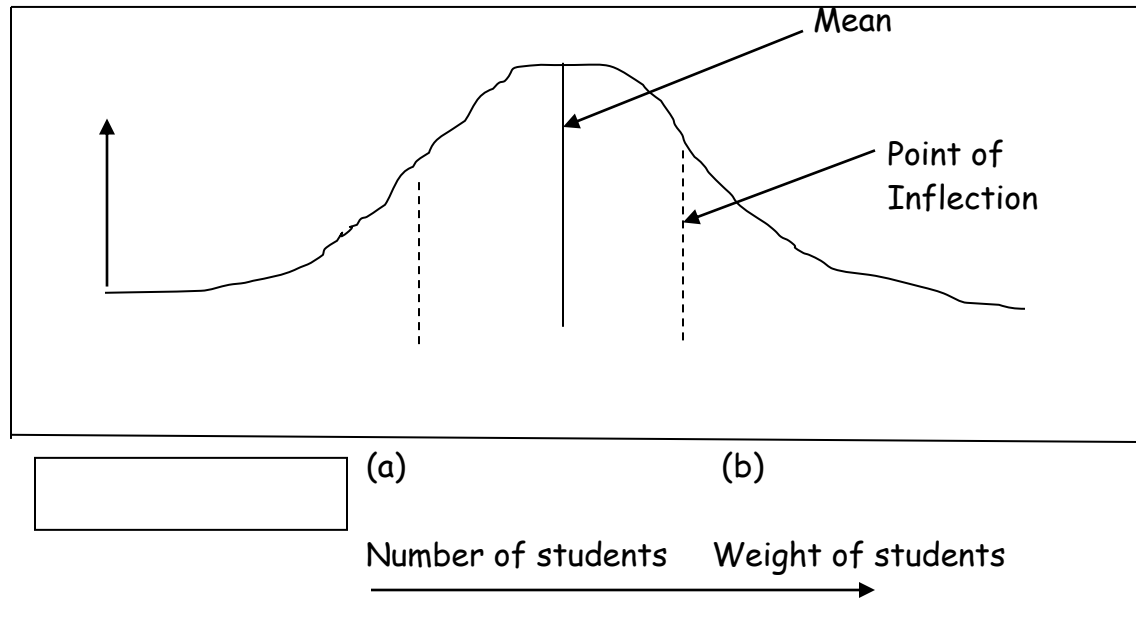
### **A normal distribution**

Suppose we take a large sample of measurable data and plot this data on a frequency distribution, we will derive a smooth bell-shaped curve. Population variables or measures are expected to initiate a normal distribution. This is because the number of cases in a population is very large.

For example; if we take about 1000 samples of students' weights in all secondary schools in Kenya, then calculate the mean weight of each sample and plot the mean values in a frequency distribution, we shall derive a normal distribution curve as shown in Figure 8.4



Figure 8.4: Normal distribution curve



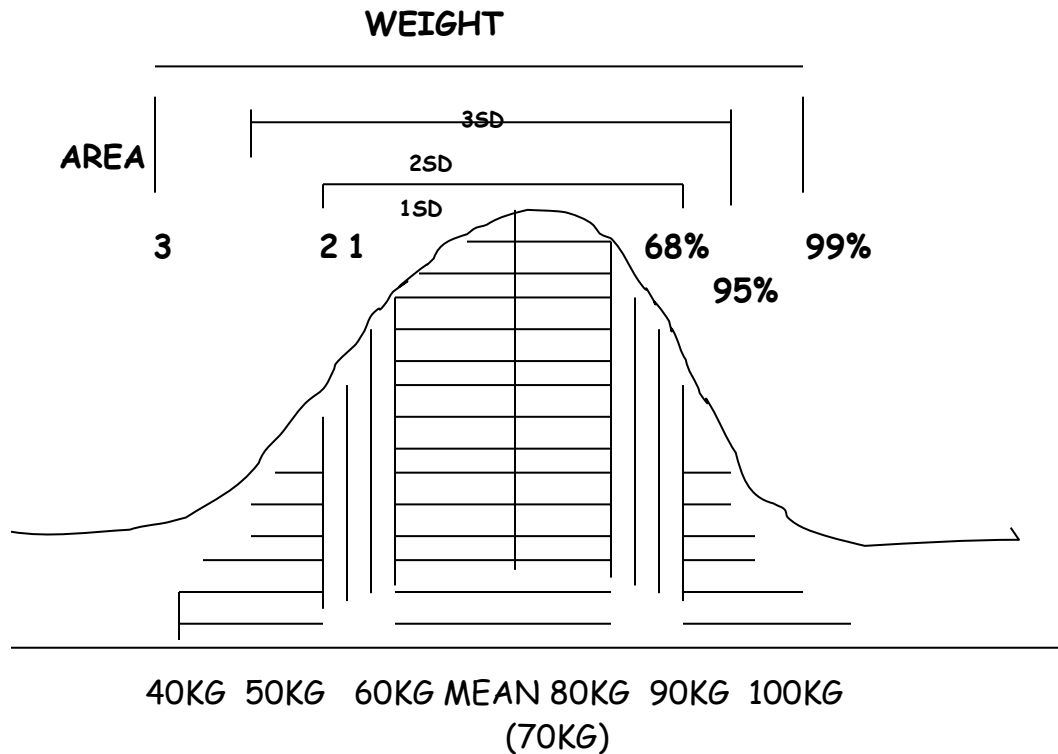
The curve in Figure 8.4 is called a **normal distribution curve**. The distribution of values of weight is called a normal distribution. In this analysis, we shall consider the mathematical properties of the normal curve. The curve has a point of inflection.

### The point of inflection

This is where the curve begins to fall off less steeply on either side of the mean (Opie, 2005). Take a look at the perpendicular lines drawn from the point of inflection, to the base of the graph. The standard unit of distance from the mean point to the point at the base (a) is called the standard deviation. When you know the mean and the standard deviation, we can describe any specific normal curve.

Examine Figure 8.5, which represents the same normal curve with values of mean weight and standard deviations. Let us assume that the mean weight for students in Kenya is 70kg, with a standard deviation of 10kg.

Figure 8.5: Normal distribution of student population



In Figure 8.5, you will notice that:

- a) Area 1: Between 60 kg and 80 kg; is one standard deviation away from the population mean (m) of 70kg. This area, in the normal curve, represents about 68 % of the total population of students.
- b) Area 2: Between 50kg and 90kg; is two standard deviations away from the mean. This area, in the normal curve, represents about 95% of the population of students.
- c) Area 3: Between 40kg and 100kg; is three standard deviations from the population mean. This area, in the normal curve, represents about 99% of the population of students.



### Activity

*Suppose that the population of teachers in Kenya is estimated to have a mean of 80kg with a standard deviation of 15 kg. Explain the distribution of weight of teachers using a normal curve.*

### The confidence level

The confidence level in a normal curve/distribution: is the term related to the standard deviation and a normal distribution. The confidence level relates to the confidence we have that a particular result in research, lies a certain distance (confidence interval) either side of the mean of a sample taken or target population (Opie, 2005). The most commonly used confidence levels in research studies are 92% and 99%.



### Activity

*Examine Figure 8.4 and determine at what standard deviation away from the mean is 95% and 99% of the population represented?*

You may have noted 95% confidence level represents + 2 standard deviations from the mean. Likewise 99% represent + 3 standard deviation from the mean.

1. A confidence level of 95% is the same as saying that the result has a 0.95% probability of occurring inside the confidence interval.
2. A confident level of 95% is the same as saying that the result has a 0.05% probability of occurring outside the confident intervals. This is the same as 5% or 0.05 level of significance.

### Level significance

The term level of significance is used in inferential statistics to represent the pre-determined probability (p) with which the researcher is willing to reject or accept a null- hypothesis. The value of p is often used in most research papers.

At what level should probability (p) be set? This level is set depending on the nature of the research problem. Many researchers are cautious and therefore set p at 0.05. This indicates that only 5 times out of 100 is the result likely to have occurred by chance.

### Testing the research hypothesis

It was explained that testing the research hypothesis is concerned with the need to confirm whether or not the presumed relationship or differences are significant. Where significance means, how the true population situation is.

The key steps in testing the research hypothesis are listed on Fig.8.5 below.

**Figure 8.5: Steps in testing the research hypothesis**

Step 1: re-state the research hypothesis. This is referred to as the alternative hypothesis ( $H_A$  OR  $H_1$ ).

Step 2: state the Null - hypothesis ( $H_0$ )

Step 3: determine the level of significance at, which you will accept, or reject the null- hypothesis ( $H_0$ )

Example: a) 5% level of significance at  $p = 0.05$ .  
b) 1% level of significance at  $p = 0.01$

Step 4: identify suitable test - statistic to use in verifying the null- hypothesis ( $H_0$ )  
Example: z-test t-test, chi-square test ( $\chi^2$ - test), etcetera.

Step 5 : establish the probability value for the competed relationship or difference using the test - statistic stipulated in step 4.  
Example: computed t- value = 2.027

Step 6: compare the critical -value at the stated level of significance in step 3 with the critical value  
Example:

- i) Critical value for t-test at  $p = 0.05$  is 2.086 at degree of freedom,
- ii) Computed t- value is less than the critical value.

Step 7: accept or reject the Null- hypothesis  
Decision: we accept the null-hypothesis ( $H_0$ )

**IMPLICATIONS:** the result presented here above indicates that the alternative hypothesis ( $H_A$  or  $H_1$ ) is not significant. This means that the presumed relationship or differences stated in the research hypothesis ( $H_A$  or  $H_1$ ) can be attributed to error, random chance (confidence) or researcher bias.

## Test statistics

The most frequent **test- statistics** in educational research are:

- a) the z - test
- b) the t - test
- c) the chi-square test (x<sup>2</sup>-test)
- d) the f - test
- e) Kruskal's - Wallis test.

### a) The z - test

The z - test can be used when the researcher intends to test hypothesis about relationship between **interval variables** and **ratio- variables**. These are continuous variables whose values can take on any level along a continuous scale.

*How to compute the z - value*

You noticed either that the z- value indicates the number of standard deviations that any score falls on either side of the mean on the horizontal axis of a normal distribution.

For example:

The mean weight of pupils in Kenya is 57.5 kg with a standard deviation of 6.6 kg. If we had children in a school whose mean weight is 64.1kg, this would be one standard deviation away from the mean. This has a z - score of + 1

To calculate the z - score or value use the formula:

$$Z = \frac{x - \mu}{SD}$$

Where, **z** is the z - value

**x** is any result

**$\mu$**  is the mean

**SD** is the standard deviation

Example: if we had children who weighed  
49.25 kg on average then,  
$$z = \frac{49.25 - 57.5}{6.6} = - 1.25$$

This means that the value is 1.25 SD below the mean.

Note: Z - score of + 1.96 corresponds to 95% of total area under the curve.

### b) The Chi-square ( $X^2$ ) test

This is non-parametric test, which is used to verify if there is a significant difference between observed frequencies and expected frequencies for nominal data.



#### Activity

Examine the contingency Table 8.18 here below: Identify the observed frequencies and expected frequencies.

**Table 8.18: Gender and perception about mathematics**

Perceptions about Mathematics	GENDER		
	MALE	FEMALE	
Like	20	30	50
Dislike	40	10	50
Total	60	40	100

In Table 8.18, we can see a cross-tabulation of Gender and Perception about Mathematics by O-level students. In this analysis, the research hypothesis was:

H1: There is a significant difference between male and female students in their perception of mathematics.

H<sub>0</sub>: there is no significant difference in perceptions of mathematics between male and female students.

Observed and expected frequencies are compared through the chi-square test statistics. The statistics, symbolized by  $X^2$  is defined as:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where, **O** represents the observed frequency in any given cell.

**E** represents the expected frequency in that cell.

Take a look at this, while examining

**Table: 8.19: Computation of expected values**

Observed Frequency (O)	Computation of (E)	Expected Frequency (E)
20	(50 × 60)/100	30
30	(50 × 40)/100	20
40	(50 × 60)/100	30
10	(50 × 40)/100	20

Therefore, the computed chi-square value is:

$$\chi^2 = \frac{(-10)^2}{30} + \frac{(10)^2}{20} + \frac{(10)^2}{30} + \frac{(-10)^2}{20}$$

$$\chi^2 = \underline{16.667}$$

**Further:**

1. At  $p = 0.05$ , degrees of freedom = 1, the critical value of chi-square = 3.841 (**from tables**).

Note: Degrees of freedom, d.f. = **(c-1) (r-1)**

Where **c** is the number of columns and **r** is the number of rows i.e.

$$(2-1) (2-1) = 1$$

Decision: **Reject**  $H_0$  and **accept**  $H_1$  because **critical value** is less than the computed value.



**Activity**

Compute  $\chi^2$  for the data below. This time use  $p = 0.01$  (level of significance, 1%)

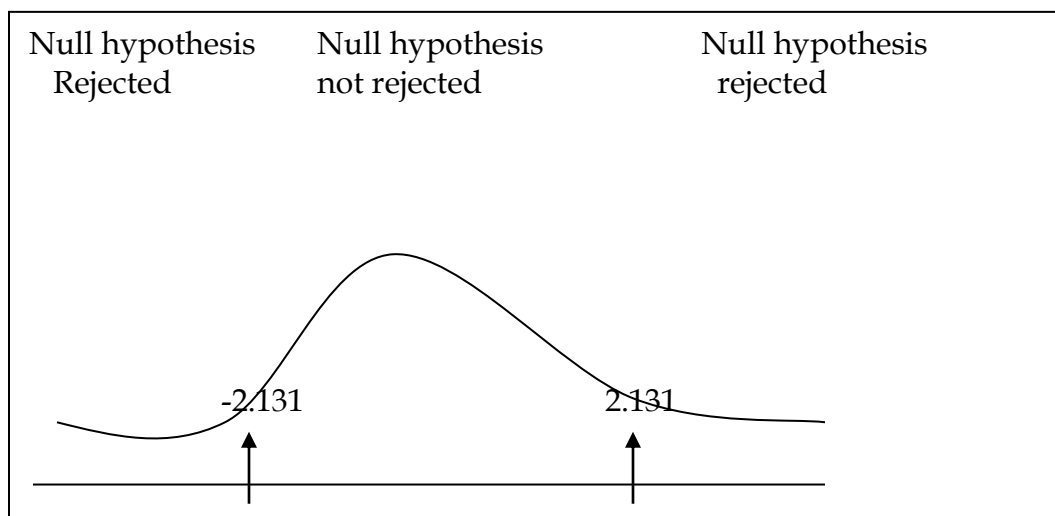
Family Size	Area of Residence			Total
	Central city	Suburban	Rural	
3 or more	20	20	40	80
2 children	20	35	20	75
1 or no child	30	25	20	75
<b>TOTAL</b>	<b>70</b>	<b>80</b>	<b>80</b>	<b>230</b>

### c) One-tailed and Two-tailed tests

We noted earlier that, in order to find the significance in any statistical test, you need to set the level of significance ( $p$ ) you will be prepared to work towards. For example, if  $p=0.05$ , you are stating the result that is likely to occur no more than 5 times out of 100 by chance. If you compare this to the normal distribution curve, it means that the result will occur at the extremities of the curve. That is, in a total area under the curve corresponding to 5%.

Supposing you undertake a t-test with 15 degrees of freedom and you do not know whether the result will be below or above the mean value. Looking at the diagram in Figure 8.6, the area corresponding to  $p=0.05$  is indicated. From a t-distribution table, you will obtain a critical value of 2.131. The diagram shows two areas (or tails) where the significant result would be obtained. This analysis is called a two-tailed test, which is applicable for a non-directional hypothesis.

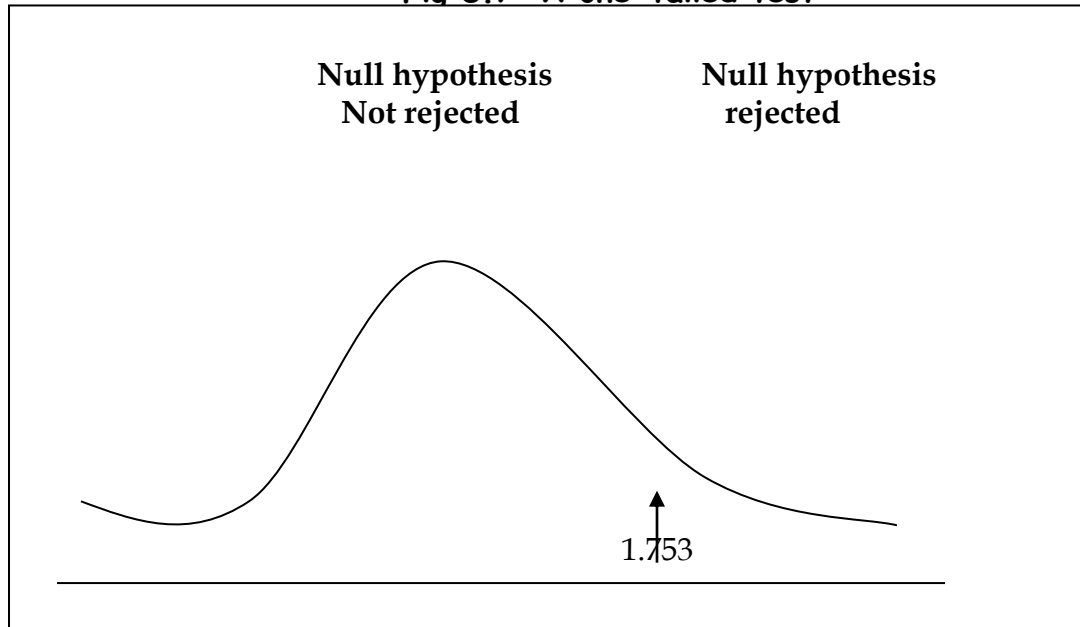
**Figure 8.6: A two-tailed test**





For a directional hypothesis, we are certain, in which direction the result will go. In this case, we do not have to consider the lower half of the graph in Figure 8.6. Hence, for  $p = 0.05$  we shall use Figure 8.7. In this case, a value of 1.753 is obtained from the initial values table, for a t-distribution. There is only one area (or tail) where the significant result can be obtained. This is a one-tailed analysis.

**Fig 8.7: A one-tailed test**



### Critical values table

Figure 8.7 depicts a section of a critical values table for a t-distribution.

Statistical tables: these are tables which indicate the value that a test has to reach (or to be greater than) for any particular level of significance (Opie, 2003)

Take a look at Figure 8.7. Assume that you are looking for a particular t-test, where the level of significance was set at  $p = 0.05$  for a two-tailed test and the degrees of freedom (d.f.) were 20. The critical value for t would be determined by checking the table along the row corresponding to d.f. = 20. Now check the columns until you reach  $p = 0.05$  for a two-tailed test.

The critical value is  $z = 2.086$  (highlighted)

**Figure 8.8: Critical Volume for t-distribution and t-tests**

d.f	Level of significance for one tailed test			
	0.05	0.025	0.01	0.005
	Level of significance for two tailed test			
	0.1	0.05	0.02	0.01
1	6.314	12.706	31.821	63.657
5	2.015	2.571	3.365	4.032
10	1.771	2.160	2.650	3.012
15	1.753	2.131	2.602	2.947
18	1.734	2.101	2.552	2.878
20	1.725	2.086	2.528	2.845
40	1.684	2.021	2.423	2.704
60	1.671	2.000	2.390	2.660
120	1.658	1.980	2.358	2.617
	1.645	1.96	2.326	2.576

See one-tailed and two-tailed test for explanation

See one-tailed and two-tailed test

See t-test

See Z-scores

## Qualitative analysis

Qualitative data analysis refers to textual data. This is non-numeric data that is expressed in the forms of:

- Discussions
- Explanations
- Documentations
- Reports
- Conversations
- Transcriptions.

Qualitative analysis involves evaluating, classifying, or coding, summarizing and interrelating categories of textual data in order to derive explanations about specific social-oriented issues.

The basic considerations in qualitative data analysis are that:

- It is conducted via prolonged and intensive interaction with a 'field' or real life situation. The situation specifies natural settings of individuals, groups, societies and organizations or institutions.
- The researcher makes an attempt to secure a holistic overview of the context of the study.
- The data is detailed and reflects the perceptions of the actors', which emphasizes empathy. To carry out Qualitative Analysis based on the above consideration you need to:
  - Read through the textual data.
  - Isolate certain themes and expressions that the original form of the data is contained in.

The critical test is to determine how the participants understand, account for, act and manage their day-to-day situations (Miles and Huberman, 1994).

In simpler terms the analysis is textual. In this way, words are put together, classified into logical thematic categories and coded. The researcher compares and contrasts the patterns of emerging themes in order to develop conclusions or interpretations: This involves Thematic Analysis.

**Figure: 8.9: Components of Qualitative Data Analysis.**

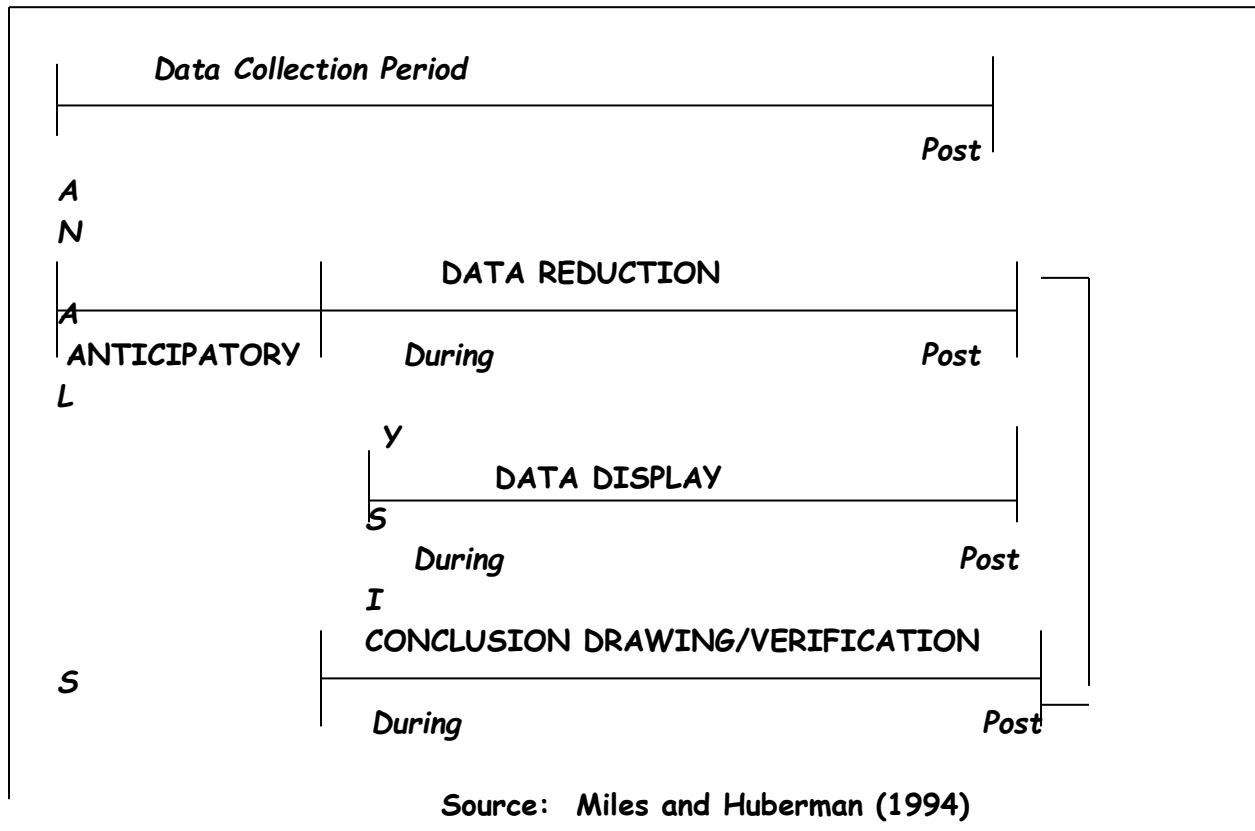


Figure 8.9 illustrates the three simultaneous flows of operations that are compared in thematic analyses, namely:

- Data Reduction
- Data Display
- Conclusion Drawing/Verification

In Data reduction; your activity involves selecting, focusing and simplifying the data from the field. This helps in developing themes. You begin to sharpen, sort, and organize data to permit conclusions and verifications.

*Data display:* In this activity, you will need to display a systematic summary of textual information that facilitates conclusion drawing and the necessary action. This may involve matrices, graphs, charts or networks.

## Conclusion drawing and verification

At this stage, you will need to develop:

- Patterns, explanations, causal flows and propositions,
- Relations to research questions or theories are made.
- Results that are grounded on questions or theory.



### Activity

*This exercise is designed to give you an opportunity to experience data categorization for data reduction and data display. The data was obtained from an interview. The responses are transcribed in Table 8.19.*

*Do not take more than 30 minutes to complete the exercise.*

The statements are responses obtained from interviews of a sample of staff and students on a one-year initial teacher training PGCE course.

The item examined "staff and students attitudes towards the way they acquired knowledge on the course offered".

The responses were recorded in one common sheet of paper as follows: This transfer of data from the instruments to the common record sheet is called *transcriptions*.

**Table 8.19: Transcribed textual data (data display)**

Respondents No.

(Responses)

1. I wanted them to get into the library.
2. We give you assignments because we need to assess you.
3. I went into school and told the teacher that I was doing these lesson plans and he said, 'Hey, see mine!' And in fact his was three words – Teach physiology, afternoon', So they're not really that useful.
4. We give you work because we think it will do you some good.
5. My journal's awful. I pity who's got to read it. I just wrote down what happened at school.
6. Quite frankly, I don't think we've been given that much time for reading at all, I think that's a real problem.
7. Using the library is a bit like a Harrod's Sale – there's a rush and I arrive after all the bargains have gone.
8. I was suffering from complete exhaustion after my teaching practice. And then I had to write!
9. They've given us so many of these tasks to do. You just end up feeling swamped.
10. What I'm going to tell you about my course and the tutors is confidential.
11. The only reason I read the TES is for the jobs. I don't think I've ever read an article in it.
12. I'd certainly want to go on reading when I've left the course, because there's so many ways you can go on improving.
13. The whole process of writing a journal has made me think.
14. They get a reading list beforehand and they get some guidance during the course.
15. Teaching practice was the most valuable bit of the course.
16. Just doing the teaching is the best preparation for the job, not reading.
17. Are you from the government?
18. To be quite honest, by the time I've got to the library there aren't any books left,, so I've found it all a bit of waste of time.
19. I don't want an external to read something so private and personal.
20. Oh, well you learn to be very careful about saying anything you hear in lectures in the staffroom because it doesn't go down too well.
21. I can't imagine reading educational literature for pleasure, although it may happen with me.
22. I think if you don't watch out you end up being like a teacher – they've got all the ideas they could possibly want and that's if, full stop.
23. The course should be whether you're teaching or not and you're still getting the impression that the way to pass it well is to do quite a lot of written material.
24. I started off thinking who's going to read this – am I offending anyone, especially the person marking it?

Source: Opie (2004)

Table 8.20 demonstrates the data reduction process. It shows the categorization indicating the constructions the researcher arrived at.

**Table 8.20: Data reduction (categorization)**

My own categorization is here to show you what constructions I came to. I broke it first into staff and students, which gave me:

STAFF - 1,2,4, 14  
STUDENTS - 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 23, 24  
NOT SURE - 22 (and I couldn't in fact fit it in)

Then putting STAFF and STUDENTS into various categories gave me

Categories	Staff	Students
Assessment	2, 4, 14	9.23
Teaching practice (journals)	-	3, 5, 13, 19, 24
Teaching practice (work)	-	8, 15, 16
Reading (library)	1	6, 7, 18
Reading (general)	-	11, 12, 21
Confidentiality	-	10, 17, 20

**Source: Opie (2004)**

The categories in column one represent the major themes that the researcher found to emerge from the data. Column two and three represent the units of analysis who were the staff and students, respectively. This is associated with the information they gave, as shown in Table 8.19.



### Activity

*Examine carefully the categorized data in Table 8.20. Using information in Table 8.19, develop your interpretations and conclusions by answering the following questions.*

**Interpretations:** the following questions would assist in developing interpretations.

- a) What are the attitudes of teachers and students towards assessment?
- b) What were students' attitudes towards teaching practice?
- c) What were students' attitudes towards reading?
- d) What do students perception about confidentiality?

**Conclusions:** Can be drawn by determining possible relationships between themes/categories. Some useful questions to ask are:

Are there any relationships between?

- a) Assessment and teaching practice?
- b) Assessment and reading?
- c) Teaching practice and reading?
- d) Confidentiality and assessment?



### **Activity**

*Discuss the relationship between the themes to draw conclusions.*

After developing your interpretations and conclusions, you then need to establish how they address your research questions.

### **Conclusion**

You have to note that data analysis is the bridge between data collected and the results generated in the study. If your data analysis is flawed then your interpretations and findings will be inaccurate or not valid.

Data analysis, however, is not a sufficient condition for development of results or findings. Interpretation of this data must be done objectively and carefully to provide useful meanings of the results of the analysis.



## **SECTION 9**

### **REPORT WRITTING**

#### **Introduction**

This section will enable you to be conversant with the format of writing a research report, how to disseminate the research findings and to identify some of the challenges in educational research.

The focus is the research report format. The dissemination of research findings is explained. Lastly, the challenges of educational research are presented.

#### **TOPICS**

- Research report format
- Dissemination of research findings
- Challenges in Educational research
- Summary



#### **LEARNING OUTCOMES:**

This section is intended to enable you to:

- Define a research report
- Prepare a report following the stipulated format
- Discuss ways of dissemination of research findings
- Discuss challenges in educational research.

## TOPIC 1: Research report format

We begin by briefly stating what a research report is all about? We could say that a research report is a document that informs you of the problem the researcher initially set out to investigate, the method of investigation used and the researcher's findings.

The Report should present data fully and adequately including accurate interpretation of the analyses of such data relating findings back to the objectives, hypotheses or research questions. A report must therefore be formal, precise and economical. It must be consistent with an orderly flow of ideas from the beginning of the document to the end.



### Activity

*Come up with your own definition of a research report? Compare your version with the previous discussion.*

You will need to remember that the organization of the research report essentially follows the format used in developing the research proposal. Do you recall the major components of proposal writing in section two? A well-written research report comprises a number of distinct sections or components.

You can have a look at this suggested outline of parts of a Research report

### I. Preliminary pages

- Title page
- Dedication page
- Acknowledgement
- Abstract
- Table of contents
- List of tables (if any)
- List of figures (if any)

## **II Main body of the report**

### **IIA Introduction**

- Statement of the problem
- Literature review
- Statement of hypotheses/research questions,
- Definition of key terms
- Scope and plan of development [organization]

### **IIB Research methods**

- Research design and Methodology
- The sample
- Research Instruments
- Procedure

### **IIC Research findings**

### **III Summary, discussion and recommendations**

- Summary
- Discussion
- Recommendations

## **IV References**

## **V Appendices**

Each component of a research report is described briefly. You can greatly improve on the quality of your report if you follow the guidelines.

### **The preliminary pages**

The preliminary pages introduce the research report; so that you can get some idea of what the report is about, who has helped in its making and how it is organized. It indicates where tables, figures and illustrations (if any) are located within the body of the research.

### ***Title page***

This should be as it was designed in the proposal. The title page should give the title of the report, and bear the author's name, institutional affiliation and the date the report was finalized. The title, which should be brief and simple yet informative (15 words or less is recommended). It should be self-explanatory to give readers what the article is all about. The title should identify the major variable of the research, the target population and if possible, the geographical location of the research.

### ***Dedication***

Dedications are especially common in academic research reports [thesis, dissertations]. Some researchers dedicate their work, to a person(s) they consider special in their lives. You could do the same to a person of your choice for example a spouse, children, parents or very dear friends. Sometimes the author may give a reason for the dedication.

### ***Acknowledgements***

In this sub-section, the researcher expresses gratitude to those people who have significantly contributed to the completion of the study by name such as donors, professional colleagues, supervisors, institutions of affiliation, research assistants and all the respondents collectively. Make a general statement to recognize all contributors. Keep this section as short as possible.

### ***The abstract***

The abstract should be placed at the front of the report preferably after the table of contents, but on a separate page.

It should enable the reader to determine the problem of the study, the purpose of the study, the population studied, the methods of a data collection, the analysis and the major findings and conclusions of the study. A good abstract is a brief report that makes it possible for the reader to grasp the reports significant information at a glance. Abstracts should be written after the report has been completed. It should be short, not more than half a page long [100-300 words, double spaced] type written.



### **Activity**

*Go through a collection of research reports in the library and pick any of your choice. Write an abstract to give a mini report of what is contained in the document.*

### **Table of contents**

The chapters, headings and sub-headings on the table of contents should correspond with those in the document/report.

Ensure that the paging is accurate for it is a map that guides the readers in locating various sections quickly and easily. A summary of this presentation is given in Figure 8.10, here below which summarizes the contents of the table of contents.

Figure 8.10: Format for table of contents

<b>Table of Contents</b>		
<b>Content</b>		<b>Page</b>
<b>Title</b>		
Declaration		(i)
Dedication		(ii)
Acknowledgement		(iii)
Abstract		(iv)
List of tables and figures		(vi)
Abbreviation		(vii)
Table of contents		(viii)
I	Introduction	1
	• Statement of the problem	3
	• Purpose of the study	5
	• Definition of terms	8
II	Literature Review	9
III	Research Methodology	16
	Research design	16
	The sample	18
	Instrumentation	19
	Data collection procedure	20
IV	Research Findings and Discussions	21
V	Conclusions and Recommendations	41
	Summary	41
	Conclusions	43
	Recommendations	44
VI	References	47

Source: Unpublished Research Report, Mwachanya, J. (2003), KTTC.

### ***List of tables and list of figures***

To summarize information in a logical format or sequence use a list of tables and figures. The tables and figures should be progressively and consistently numbered through the report. Figures commonly used in research reports include graphs, charts, diagrams, and photographs. You should come up with a meaningful, clear and descriptive title for the figures and tables. The list of tables and figures

usually follow on separate pages after the table of contents, except when you have only a few tables and figures, you can merge them on one page.

Each table and figure must have a title, the number and the page on which it occurs. Figure 8.11, presents a hypothetical list of figures and tables.

Figure 8.11: A list of tables and figures

Table		
1	Participation in Technical Education by gender	4
2	Participation in Technical Education by departments and gender	8
Figure		
1	Performance in male-dominated subjects by gender	20
2	Progression within Technical Teacher Education by Gender (1990-2004)	25

### ***Executive summary***

This is a summary of the research report, which provides readers with a concise and accurate picture of the entire document. It communicates one's research report in an economical way. It is time and energy saving for readers who have limited time to read the entire report.

In the executive summary, you must include all the salient points from the major components of the research report. In writing an executive summary, begin with a clear and brief statement of the problem, presenting details from the body of the report briefly and ending with conclusions and recommendations. You can make the summary reader friendly by using bullets. The summary should be self-explanatory and easy to understand. It should enable the readers to make sense of the research study.

## **Introduction**

This section should contain the problem of interest, the theoretical background of the study, the problem statement, objectives, hypotheses or research questions, limitations of the study. Literature cited in the introduction should be limited to the most relevant and current.

Write the report in past tense, unlike the research proposal that you had written in future tense.

## **Literature review**

After you are through with a comprehensive introduction, naturally you will move to the literature review section. Include the information gathered during the proposal writing and add any relevant literature to help expand the previous work done by other researchers. Give a critique of the findings from other studies done in related areas. Assess the methodologies and theoretical frameworks used in previous studies.

It is acceptable that you can interpret the information gathered and give a personal opinion in relation to your research. In order to present the information in a concise and orderly manner, you will need to organize the literature by subtopics specific sub themes or geographical spread. It is advisable to end this section with a summary of the literature reviewed and your conclusions on the information gathered.

## **Methodology**

This section has several sub-sections giving details of the procedures used by the researcher in conducting the study. It usually gives a detailed description of the population from which the sample was drawn, the sample and sampling procedures, outlining how the cases or respondents were selected. This information helps the reader to determine the representativeness of the sample. The research design, selection and preparation of the instruments used to collect the data, the procedures used in data analysis and if the hypotheses are to be tested should also be described in detail, to enable others replicate your study. Any readjustments made to suit the study should be included.



## **Data analysis and presentation**

This section includes a summary of the research findings obtained after data analysis as per specific topics or hypotheses. Results should be interpreted as they are presented to avoid repetition and maintain conciseness. The best method of organizing the findings is to follow the research questions or hypotheses systematically. For example, after a brief introduction of the section, you state the first research question/hypothesis as it appears in section 1 and then you present all the findings pertinent to the question or hypothesis. This same technique is then repeated for each question or hypothesis immediately before describing the results.

You can use tables and figures to summarize the information. You could easily and quickly use computers and relevant statistical packages to analyze the data.

Now we come to the really challenging part of the findings: when presenting the results, give all the evidence relevant to the research objectives and questions: (if any). In quantitative research, you are sometimes expected to test hypotheses stating whether each hypothesis is supported by the data or not.

You should begin this section with a short introduction describing the general procedures followed in data analysis, as well as the objectives or hypotheses of the study.

## **Summary, conclusions and recommendations**

This is usually the last chapter in academic reports. The researcher summarizes the processes of study undertaken, the major findings of the study, concludes and makes recommendations based on the study findings. A summary of a research is in many ways similar to an abstract. Hence, it must reflect as accurately as possible the body of your report. It should be short (100 to 500 words) and should give the reader an idea of exactly what the study is about.

### ***Conclusions***

While concluding the study, discuss the practical applications and implications of your findings in the real world. The conclusion ties up the themes, ideas and concepts together in a broader perspective and indicates possible action, where appropriate.



### **Activity**

*What is the implication of the high drop out rate among primary school pupils for the teachers and the pupils?*

We asked this question to the Diploma students in KTTC and they came up with the following suggestions. It could compare or differ from your list. It could mean changing the teaching methods or the curriculum while to the pupils; it could call for the need for personal counselling and the use of motivational techniques. Remember that your summary and conclusions should lead logically to your recommendations

### **Recommendations**

In this section, the researcher has more freedom to express opinions on the research subject, which do not necessarily relate directly to the area studied. Discuss the theoretical and policy implications of your findings. Recommendations of area that deserve further research especially if other factors or variables are suspected to be influencing the independent variable as observed during the study. The recommendations should be practical and achievable. They must be consistent with the purpose of the study, the objectives, the evidence presented by the data and the interpretations given.

Some common recommendations often made by researchers include:

- Areas of further research with an emphasis on the questions in the study that remain unanswered and deserve further investigation.
- Issues in methodology that could be refined and modified to improve future research in that area of study.
- Actions that need to be taken to resolve the issue at hand based on the findings of the study. This may even involve designing and implementing a project. For example, "Group Guidance and Counselling" could be initiated in Technical Training Institutes to reduce absenteeism and disinterest among students in Kenya.

What this all adds up to is that you are now ready to ensure that your study findings spread out for use by the consumers.

## **References / Bibliography**

In writing a research report, a researcher relies heavily on existing documents or books, which may be published or unpublished but related to the study.

In the reference section, list all the sources you referred to in the report in an alphabetical order, by author's last names. The researcher should give credit to authors of any work or materials referred to by listing them. The sources you list in the references section must correspond to those listed in the report.

The style of referencing may differ according to institutional or journal requirement for publication. At KTTC, we recommend the American Psychological Association (APA) style. Be sure to follow the APA style consistently. In general, a reference gives the author, the year of publication of the document, the title of the book or journal and the publisher.

### **Example**

1. Achola, P. W. (1987) *selected social Attitudes of Zambian Youth*. Lusaka, Zambia, Educational Research Bureau, The University of Zambia.
2. Mwiria, K, and Wamahiu, P.S. (1995). *Issues in Educational Research in Africa*. Nairobi. EAEP

The system for entering references (or Bibliography) is similar to that applied for footnotes. Journals and Magazines bear the pages to show exact location of the article/information.

In the two examples given, the author's names come first, beginning with surname of last name, then first name, followed by middle name(s) as initials. Then year of publication should come immediately after the author's name followed by the title of the publication. Only the first letters of the title, subtitle and proper nouns are capitalized. Take note that entries are arranged in alphabetical order rather than how they appear in the text. Page numbers are not used for book entries as with journal articles.



### Activity

*Pick any textbook, theses or report, and find the back pages. You may have located the reference page. Go through the list comparing with what you have learnt in this section on Bibliography/References.*

I am sure you were able to identify the method of referencing used in the book you have just opened. As you do your term papers, practice compiling your own reference list following the suggested guidelines.

### Appendices

Most research reports may require one or more appendices for presenting items that may not be necessary to include in the body of the report, yet might be of interest to some readers.

Materials commonly placed in the appendix include; tables that are very long or that contain material not essential to understand the study, original research instruments, copies of letters used to request and inform respondents of what information is desired.

- Statistical tables from data analyses where applicable, include the research permit and the terms of reference.
- A code sheet used to code the items for statistical analysis
- Data that are too detailed,
- Lengthy quotations from primary and secondary sources that may not be easily accessible (Borg and Gall 1989: 874).
- In interview studies, the appendix can be used to report case study information collected from the respondents

### TOPIC 2: Dissemination of research findings

Now we come to how we can make our research findings reach the users. This is commonly referred to as dissemination or the spread of information. It should be

an integral part of the research process although it is often neglected in research proposal formulation. Research scientists are interested in publishing their research results in reputable journals so that their peers can be informed of new findings / discoveries and lines of thinking. However, we need to think about various possible audiences besides the readers of international journals. In the realm of applied research, researchers should think of the following categories of scientists:

- Peer and other senior scientists in the field;
- Policy makers and other senior executives interested in the field,
- Funding agencies,
- Final consumers, such as practicing teachers and farmers.



### **Activity**

*Try thinking of whom else may need to use research findings and make your list.*

Dissemination should not only come at the end of research process. Consumers should be involved right from the identification of the research problem and the search for its parameters. Standards and legitimacy of the research process itself should never be compromised. Consumers should be sensitized even before the project starts because the different audiences may determine the manner in which the information/findings is written and organized for dissemination.

### **Some dissemination strategies**

During a workshop on report writing, participants brainstormed and gave the following strategies.

- Progress reports these could be both verbal and written evaluation reports based on field visits, workshops, and seminars.
- Films, charts and other visual aids can be useful for dissemination to a less literate target group.
- Executive summaries are aimed at policy makers, senior executives and funding agencies.
- Personal communication, that is, long letters and memos to key people such as senior researches, and directors in related field.
- Formal articles in scientific journals

## **Conclusion**

The research report provides information that describes the research problem that the researcher sought to investigate. It also provides comprehensive information on how the study was planned and developed in chapter one, two and three. Research findings are discussed in chapter four. The researcher then presents conclusions and recommendations drawn and provided on the basis of findings. The quality of a research study is evaluated on the basis of the research report. This is where the success or failure in your study will be judged.

## SECTION 10 INTEGRATING ICT IN EDUCATIONAL RESEARCH

### Introduction

Information and Communication Technology (ICT) is a tool, it is not just concerned with the use of modern electronic media and equipment in accessing information faster and efficiently. The use of libraries in searching for information for research has been the tradition. Your ability to use the Internet will enhance your speed for accessing and disseminating information concerning your research study.

### TOPICS

- Importance of ICT in Research
- What is e-Research?
- What are the qualities of the e-researcher?
- How do you find information for research from the
- Summary



### LEARNING OUTCOMES:

By the end of this section, you should be able to:

- Explain the importance of ICT in research.
- Explain what e-research is
- Develop the qualities of an e-researcher
- Use the Internet to access information (literature) and data for your research study.

## TOPIC 1: Importance of ICT in research

London (2002) defines ICT as the computer hardware, software data and storage technology and networks providing a portfolio of shared information technology resources for an organization.

Also, ICT is a broad subject that is concerned with all aspects of managing and providing information on databases or in electronic libraries especially within an organization. Using ICT applications especially the Internet provides opportunities and techniques that enhance various tasks in research practice. For example we can use the Internet to enrich the literature review process. We can also use the internet to get guidance in research.



### Activity

*Identify other possible ways in which internet research can improve your research study*

Your list must have included some of the following:

- Search of relevant literature.
- E-mail surveys in data collection.
- Distribution and retrieval of text-based surveys.
- Net-based telephone interviews.
- Tracking and synthesis of online activities.
- Sourcing for secondary data.
- Virtual reality analysis.

The power and ubiquity of net-based research continues to increase.

## TOPIC 2: Internet research

The Internet research provides a wide range of communication modes and information processing tools. The network is a database of large volumes of data. In this way it helps us to translate this data into information. This information can then be transformed into knowledge and wisdom by researchers, educators and the general public. This does not however happen automatically: it requires a critical thinking process.



You will notice that, as you make use of the Internet, skills in selection of right or relevant information is important for you. Internet research also helps one to evaluate and improve on the information and data already available in the Internet. For example, other researchers using the network will use your research findings. You may also encounter contradictory information, which should assist you in engaging in more critical analysis of information.

E-research is becoming a formal function in electronic applications alongside, e-commerce, and e-learning and so many other e-concepts.



### **Activity**

*Develop a research title or issue in education for your study. Explain how you would use the Internet to identify the information you will need to develop the study.*

Table 10.1 provides an illustration of some possible activities in E-research.

**Table 10.1: Possible activities in E-research**

	<b>ACTIVITY ON THE NET - "CYBERSPACE"</b>	<b>ACTIVITY NOT ON THE NET - "REAL WORLD"</b>
<b>RESEARCH ACTIVITY ON THE NET</b>	<p>Analysis of Web server and application logs, data mining for exploration, description or quasi-experimental research.</p> <p>Online surveys, interviews, and focus groups with subjects using the Net.</p> <p>Online ethnographies and participant research with virtual community members.</p>	<p>Email, Web surveys, and online focus groups focusing on offline activities, experiences, beliefs and attitudes.</p> <p>Web Cams and other sensors recording offline behaviour.</p>
<b>RESEARCH ACTIVITY NOT ON THE NET</b>	<p>Face-to-face interviews, telephone surveys, and mail surveys of Net participants.</p> <p>Quasi-experimental or experimental lab simulations of Net activities.</p> <p>"Think aloud" or order observations of subjects engaged in Net-based activities.</p>	<p>Pre-Net research, such as mail, telephone, or face-to-face surveys; Delphi studies; or focus groups.</p> <p>Experimental or quasi-experimental non-Net-based research.</p> <p>Ethnographic study of non-networked components of society.</p>

*Source: Terry and Kanuka (2003)*

### **TOPIC 3: The qualities of the Internet researcher**

You are encouraged in this section to become a proficient Internet researcher. In order for you to do so, you should develop some of the qualities discussed here. Take a look at figure 12.1, which compares research skills and Internet skills.

**Figure 10.1: E-research skills**

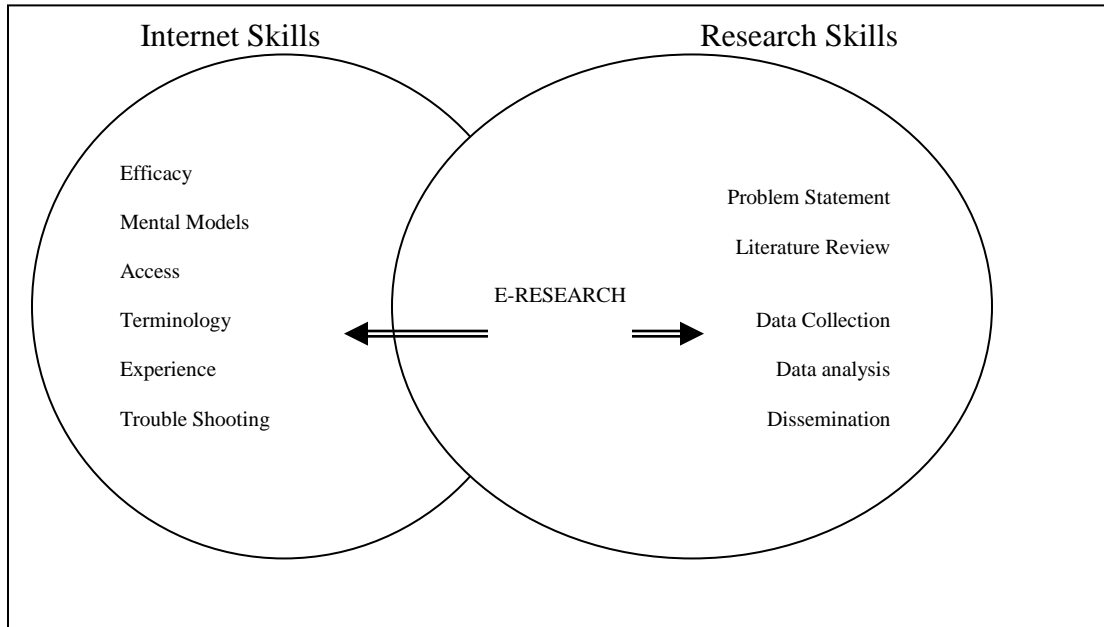


Figure 10. 1 provides an illustration of Internet skills and research skills that will be useful to you in your research.

As an e-researcher, you need to develop these skills. They will help you in the process of undertaking your research project. It is, however, important to note that no single minimum level of competency is needed. All you need is to increase your skills at all levels. This will result in more effective and efficient use of the Internet for the benefit of your research study.

*Efficiency:* This is associated with your competence and accomplishment. It means that you will develop confidence and willingness to learn to use new programmes or tools. Eventually, you will be more confident in applying the tools to accomplish your research tasks.

*Mental models:* This is your mental picture of how the Internet works and the way various organizations and resources function on the network. You need to develop this mental model to become an effective e-researcher. Mental models help us to predict, anticipate and manipulate Internet resources or materials.

*Access:* This is the most significant of all e-researcher skills. Access is related to availability of hardware, software's and stores. It is also related to nearness to

Internet service providers. It is also related to speed and capacity of computers used. It is also dependent on mastery of the computer technology.

*Network skills:* This relates to your efforts to use the Internet technology. Your skills improve through face-to-face on-line courses and practice. You need to develop Internet and motivation to move on.

When you expand your Internet skills and self-efficiency, you are in a better position to enjoy your research exercise through e-research.



### Activity

*Examine the Internet skills listed to the left of the Figure 10.1. Find out what your personal rating indicates.*

Internet skills	Poor (1)	Good (2)	Very Good (3)	Excellent (4)
Efficiency:				
Mental Models:				
Access:				
Terminology:				
Experience:				
Trouble-Shooting:				

What is your score out of a maximum of 24?



### Activity

*Extract of E-research*

*Examine the following case and find out other alternatives the researchers could have used.*

*We used the Net to source the ERIC database and Google (a search engine) to search for related terms like peer moderators and peer teaching, and we ordered texts not available in our university library using online interlibrary loan request forms. We created a research plan and shared it with a colleague for critical*

*review. We then downloaded and completed the research ethics forms from our faculty. Web page and of course, submitted them electronically. Upon approval of the project, we drafted a letter of introduction to students, in which we informed them of the intent of the research and the proposed activities. We emailed this letter and opened a forum on a conferencing system for discussion of the research process. In some cases, a follow-up email was required, but eventually all eighteen students gave their consent to participate. We then developed a short Bet based survey on the elements of teaching presence. These results were triangulated with information from a transcript analysis. During the six weeks of the experiment, we emailed each of the students reminding them of the day they were to complete the weekly online questionnaire. After the course completed, we conducted semi-structured telephone interviews with a sample of the students, applied our transcript analysis instrument with tow independent coders, and reflected on our own experience of the course. From these data sources, we drafted and revised a paper and emailed it to the students for comments (as a member check). After a final revision, we submitted the paper to the Journal of Interactive Media in Education (<http://www.jime.ac.uk>) - a non-blind, peer reviewed, on-line journal. The article was reviewed by three reviewers and after some minor edits and improvements; it was accepted for publication by the editor. In addition, we posted the paper along with additional output from our research group on our own Web dissemination site at <http://www.atl.ualberta.ca>*

Source: An extract from Terry and Kanuka (2003)

The foregoing e-researching was developed in an educational research study. Using the case, determine the following:

1) Find out the meaning of the following terms as used in the study:

- Peer moderators
- Peer teaching
- Letter of introduction
- Electronic conferencing system
- E-mail
- Bet based survey
- Triangulation
- Transcript analysis
- Telephone interview
- Online questionnaire
- Non-blind
- Web dissemination

- 2) What were the main sources of literature?
- 3) Which electronic methods and instruments were used to collect data?
- 4) Explain the data collection procedures used.
- 5) How was the data analyzed?
- 6) How were the instruments and data analysis results validated?



### Activity

*Find out the meanings of the following terms:*

- *Search Engine*
- *Web site*
- *Encyclopaedias and Almanacs*
- *Dictionaries*
- *Biographical Dictionary*
- *Atlas*
- *Translators*

You may have noted the following: A search engine is a program that searches for websites on the World Wide Web (Cohen, 2003). You will find the search engines useful for finding reference information.



### Activity

*Try these examples in your computer: Type the name or title of the information you want references for. Websites: are the places in World Wide Web where information is located (Cohen, 2003)*

- ITools: [www.itools.com](http://www.itools.com)
- Google: [www.google.com](http://www.google.com)
- [www.factmonster.com](http://www.factmonster.com)
- [www.infoplease.com](http://www.infoplease.com)

- [www.wordcentral.com](http://www.wordcentral.com)
- [www.biography.com](http://www.biography.com)
- [www.mapquest.com](http://www.mapquest.com)

What have you found out about the Webs?

Almanacs are used to locate birth or death dates of famous people. They also include statistics about cities and countries, and information about major awards.

Try: information please: ([www.infomapquest.com](http://www.infomapquest.com))

Biographical Dictionaries: contain information about famous people.

Try: Biography. com: ([www.biography.com](http://www.biography.com))

Dictionaries: Contain meanings of words and a guide to their pronunciation.

Words are listed alphabetically.

Try: Merriam-Webster online ([www.m-w.com/home.htm](http://www.m-w.com/home.htm))

Word central: ([www.wordcentral.com](http://www.wordcentral.com))

Encyclopaedias - contain information about people, places and events.

Try: Fact Monster: ([www.factmonster.com/encyclopedia.htm](http://www.factmonster.com/encyclopedia.htm))

Foreign Language Dictionaries: usually comprise two sections:

- List of words in another language and their definitions.
- List of words in English and definitions in another language.

Try: Alta Vista Babel Fish Translator

([www.babelfish.altavista.com](http://www.babelfish.altavista.com))

Study Figure 10.2 which list useful websites

The following are a few examples of the different kinds of search tools available with specific aims.

- MedNet (<http://www.mednets.com/>) is devoted exclusively to medical information.
- Kids search Tools(<http://www.rcls.org/ksearch.htm>) has been developed exclusively for children's searchers, to be used by children.
- Search Engine Colossus (<http://searchenginescolossus.com>) provides search engines focused on particular regions and countries.

If you are not sure which search engine to use, or even what search engines are available, Noodle Quest (<http://www.noodletools.com/noodlequest/is>) A web site with an automated Web form that will generate a list of appropriate search engines based on both your Internet skills and your search needs.

- Searchability (<http://www.searchability.com/>) and NeuvaNet (<http://noodletools.com/noodlequest/>) are Web sites that provide listings of specialty search engines with advice on how to choose the search engine most appropriate for your needs. For, example, if you are a few good hits fast, NeuvaNet recommends the use of Google (<http://www.google.com/>), Vivisimo (<http://vivisimo.com/form?form=advanced>), and Ixquick(<http://ixquick.com/>).
- If you are looking for a general and broad academic subject and need to focus it, NeuvaNet recommends search guides such as:  
Encarta Online (<http://www.encarta.msn.com/reference/>)  
Encyclopedia Britannica (<http://www.britannica.com/>)  
Northern Light (<http://northernlight.com/search.html>)  
Librarian's Index to the Internet (<http://lii.org>), or Infomine (<http://infomine.ucr.edu/>)
- If you are looking for biographical information, try using Lives ([http:// amillion-lives.com/](http://amillion-lives.com/)) Biography.com (<http://biography.com/search>), or Biographical Dictionary (<http://www.s9.com/biography>).
- There is rapid progress being made in the cataloging and retrieval (through metatag descriptors) of graphic images that you can use to enhance a research presentation. Two of the largest collections of graphic images and pictures are available at <http://ditto.com/and> <http://altavista.com/sites/search/simage>.
- Sound and music files are also difficult to find due to problems in classification. Moodlogic ([www.moodlogic.com](http://www.moodlogic.com)) creates search applications that allow you to listen to sound segments and use proprietary meta tag systems to selectively search through their large collections of songs music.
- An excellent and always available starting point for spelling, translation, thesaurus, and encyclopedia references and occasional relevant links is the program Atomica (<http://www.atomica.ca>). This free program, when installed on your machine, provides instant (ALT CLICK) access to any word in your browser, word processing document, or any other text program – very hand!
- Other services function by quickly submitting your single request to multiple search engines and displaying the results on the single (long!) screen. For example Dog Pie ([www.dogpile.com](http://www.dogpile.com)) “fetches” the results of your search from sixteen different search engines.
- Finally, most search engines allow the user to turn on a “kiddie filter” to eliminate adult content hits, and some such as SurfSafety (<http://www.surfsafety.com/>) or Family Safe Startup Page (<http://startup-page.com/>) index only family rates sites.

Source: Adaptation from Terry and Kanuka (2003)

#### Guidelines for selecting useful and relevant materials from the Internet

- Begin your search by analyzing your needs. For example ask, what specific information do you require?



- Isolate your keywords.
- Select a search tool that matches your needs.
- Experiment with a variety of search engines and subject guides'
- Although our favourite search engines tend to change over time, we have found Google (<http://www.google.com>) to be the fastest, most effective, and least ad-cluttered site.



### Activity

*Critically examine the following websites. Determine how the information they contain may be useful to enrich your study. NOTE: Download only what you need. How will you determine what you need?*

### General areas websites

#### 1. Purdue University Online Writing Workshop

<http://owl.english.purdue.edu/handouts/research/index.html>

Handouts and exercises on research skills and resources and the writing of research papers.

#### 2. University of British Columbia Library Services

[http://www.slais.ubc.ca/resources/research\\_methods/](http://www.slais.ubc.ca/resources/research_methods/)

Research methods resources on the WWW

#### 3. African Resource Service

<http://www.kwetu.net/home.asp>

**KWETU** is a resource service of African content. It is full view, allowing users to actually view and read the material online. A highly effective search engine and database run the service ensuring content searches are always relevant. The content includes, but is not limited to;

Aids, Alcoholism, Animals and Nature, Arts, Black Heritage, Celebrations, Children, Church, Colonialism, Communication and Mass Media, Counselling, Culture and Traditions, Development Issues, Drug Abuse, Ecumenism, Education and Literacy, Entertainment, Ethnicity, Environment and Ecology, Exploration, Family Life, Food and Hunger, History, Geography, Health and Nutrition, Liturgy, Management, Music,

People, Philosophy, Political Issues, Religion, Science and Technology, Sexuality, Social Issues, Sports, Theology, Tourism, Women's Issues and Youth.

#### 4. **African Digital Library**

<http://www.africandl.org.za/>

The African Digital Library (ADL) is a collection of electronic books (eBooks) that can be accessed and used free-of-charge by any person living on the African continent. Individuals can assess the library from any PC that is connected to the Internet in Africa. The collection includes books on a wide variety of subjects ranging from Arts & Crafts and Astronomy, to mathematics, to technology and Engineering, Medicine & Health, Education, Library.

#### 5. **East African Social Science Research Review**

<http://www.ossrea.net/publications/eassrr/index.htm>

The **EASSRR** is a bi-annual journal that serves as a forum for scholarly discourse on the social, economic, political and environmental aspects of Eastern and Southern Africa. The journal first appeared in January 1985 and has since been coming out regularly twice a year.

Eighteen volumes of this journal have been published to date. Some of these issues have been devoted to specific problems, such as the African Economic Crisis, the Arusha Declaration twenty years after Industrialization and population issues. Each issue is printed in 500 copies. Several institutions both in Africa and outside subscribe the Review.

The abstracts and TOC of each issues of the EASSRR are published online by the **African Journals Online** (AJOL) project, URL (<http://www.inasp.org.uk/AJOL>). Access is free to all interested users.

Women and science websites

<http://www.kent.k12.wa.us/KSD/KR/LIBRARY/WOMEN/teacher.html>

Gender and science and technology association conference papers

<http://www.wigsat.org/qasat/index.html>

Research Reports and government papers on HIV/AIDS in Kenya

<http://hivinsite.ucsf.edu/global?page=cr09-ke-00>

Ministry of Education, Science and Technology

<http://www.education.go.ke/>

**Conclusion**

The importance of ICT in research cannot be overemphasized. Modern technology has embraced nearly all sectors of education and other fields. We cannot avoid them. In your study, you will always find it useful to secure information from the internet. In this way E-Research becomes a necessary component of your study.

You have to develop the right skills and knowledge on how to engage in it. You must however, be careful to avoid use of garbage from the cyberspace that may not be useful to you. Critical thinking and caution is a must for your success.

## **SECTION 11**

### **THE ETHICS OF WRITING**

#### **Introduction**

This section introduces you to the need to appreciate ethics when developing your research study. You must be aware of standard ethical issues such as protection of copyrights.

Ethics is also necessary in observing confidentiality in data collection, recognition of other authors' contributions to your study, observing privacy of respondents or subjects and informed consent. It is therefore important to recognize areas of your study where you may be accused of plagiarism or cheating.

#### **TOPICS**

- Plagiarism
- Informed Consent



#### **LEARNING OUTCOMES:**

After going through this section, you should be able to:

- Observe standard referencing procedures in research writing.
- Appreciate the values of moral concerns, informed consent, confidentiality and privacy.
- Be aware of dangers of plagiarism.

## TOPIC 1: Plagiarism

Ideas, and the words that express those ideas, are the valuables of scholarship. The people who create them have a right to receive credit for them. When one person appropriates the ideas or text of another person and presents them as his or her own, it is theft. The technical term is plagiarism, but it is theft, and the ethics of scholarship make no provision for petty crime - it is all grand theft.

Yes, grey areas exist where ideas, phrases, and even entire ways of thinking about things pass into the public domain where acknowledging their origin is no longer obligatory. And yes, the distinction between a paraphrase in your words and one that derives too much from the original author is a judgment call. For problems of that kind, we leave you to other resources - and your conscience.

What we are talking about here is thievery, and that includes failure to use quotation marks where they belong, omitting citation that credit material found in someone else's work, shoddy carelessness in preparing the list of references, and failure to obtain permission for the use of figures, tables, or even illustration from another document - whether published or not. In each of those, doing the right thing does not involve knowing the niceties of custom or the precise reading of an obscure rule. You know exactly what is ethical without any coaching. All you need to remember is what your mother said: "Don't cheat!" If you need more motivation than that, you might consider the proposition that it is prudent to treat the property of others as you hope they will treat yours by doing the following:

- ✓ Providing all the facts is extremely important: the purpose of the proposal is to help you and other people understand what you plan to do.
- ✓ Manufacturing the facts is scholastically criminal: collect data, not create it; interpret the available data, not tamper with it to make it appear what it is not.
- ✓ Use the data you collected, use it correctly, and tell the reader exactly what you did.
- ✓ Avoid the temptation to ignore recording the precautions you were unable to take even if it was inadvertently done.
- ✓ The discussion, interpretation, conclusions and recommendations, all should be truly based on your findings.

- ✓ **REMEMBER:** The choice to do the right thing can be inconvenient, expensive and even painful: no investigator, no matter how experienced, would claim that research is a Rose Garden.

The research project should always remain in the realms of a sound ethical study. The researcher should address several ethical considerations before and during the research project. Individuals who use research should determine if the findings being reported were ethical and accurate. This refers mainly to the theme of objectivity and the absence of personal bias in the collection, analysis, and interpretation of the data. Researchers should make scientific observations with a minimum of bias and still remain socially responsible [Kathuri and pals, 1993]

Let us now turn to specific ethical issues related to research.



### **Activity**

*Think of an explanation for the usefulness of ethics in research and state it before you proceed.*

We think that the purpose of considering ethical issues in research is to protect human rights and privacy from being infringed on by scientific experimentation and to safeguard the credibility of research and the investigators. You as a student of research, in your pursuit of knowledge should consider human rights.

## **TOPIC 2: Informed consent**

Researchers must ensure that informed consent, freely given by the participant, is obtained for every research project involving people. Research carried out without such consent is usually considered infringement on and exposure of participants' personal rights and welfare. Consent for children and mentally sick persons should be sought from the parents or the guardians. There should be neither undue influence nor conditions before giving consent; for example, promising rewards or threatening withdrawal of benefits.

Remember that you can be sued in court if you violate the rights of respondents or misuse the findings of your research

Diener and Crandall, (1978) have defined informed consent as; "the procedures which individuals choose whether to participate in an investigation after being informed of the facts that would be likely to influence their decisions".

However, it must also be noted that there are some research methods where it is impossible to seek informed consent. For example, covert observation or experimental techniques involving deception. There are also occasions when problems arise even though consent has been obtained.

### **Guidelines for informed consent**

#### **The first ethical issue is informed consent**

According to Cohen Manion and Morrison (2000) the following are some of the guidelines for reasonably informed consent:

- A fair explanation of the procedures to be followed and their purposes.
- A description of the respondents discomforts and risks to be expected.
- A description of the benefits reasonably to be expected.
- A disclosure of appropriate alternative procedures that might be advantageous to the participants.
- An offer to answer any inquiries concerning the procedures.
- An instruction that the participant is free to withdraw consent and to discontinue participation in the project at any time without prejudice to the participant.

#### **The second issue is moral**

This states that no experimental procedure involving some risk to a human being is permissible if one involving less risk is available and only when such a procedure is likely to bring better results than other alternatives available. In medical sciences or in controlled clinical trials, research on new drugs can be conducted, but must avoid unnecessary risk and suffering, whether mental or physical. The researcher should never withhold a procedure of proven value from one group and give it to another in his trials. All participants need to be treated equally.

### The third ethical issue is confidentiality and privacy



#### **Activity**

*Give a personal definition of confidentiality and state why it is an important ethical issue in research.*

We have defined confidentiality "as the art and ability of the investigator to protect and keep secret the participants' shared information unless consent is granted." How does this definition compare with yours?

Kimmel (1988) cited in Cohen Manion and Morrison(2000) notes that one general finding that emerges from the empirical literature is that same potential respondents in research on sensitive topics will refuse to cooperate when an assurance of confidentiality is weak, vague, not understood, or thought likely to be breached.

Frankfort-Nachmias and Nachmias(1992) have listed a number of techniques that have been developed to allow public access to data and information without confidentiality being betrayed.

Two examples are given herein:

- Deletion of names, addresses, and any other means of identification from the data released on individuals.
- Crude report categories, for example, releasing the year of birth rather than the specified date, the profession but not the specialty within that profession, general information rather than specific.





### Activity

*Think about what you would do to protect participants' identification while you release the data. Add to the list*

**The fourth ethical issue is physical or psychological harm:** A researcher should never undertake research that may cause physical or psychological harm. For example, asking embarrassing questions, expressing shock or disgust while collecting data, using threats and compelling people to say what they do not believe in or causing fear and anxiety among respondents, may cause psychological harm.

Mugenda and Mugenda (1999) state that any statement or action, which lowers a subject's self-esteem or self-worth, is also considered unethical and should always be avoided. Causing discomfort and resentment by forcing respondents to recall traumatic experiences is also psychologically harmful.

### **The fifth ethical issue focuses on use of vulnerable and special populations**

These include children, the poor and mentally sick people. It is considered extremely unethical if people who are disadvantaged in one way or another are used without their consent or the consent of a guardian. Permission must be sought from those who care for these special populations, so that there is informed consent.



### Activity

*Give reasons why there is a great concern for special populations*

### **The sixth ethical issue is to do with dissemination of findings**

How do you intend to let the findings of your research project be known to the relevant consumers? How might the procedure you use be unethical? Let us now see what other researchers have to say.

First, it is unethical to conceal findings after completion of research. For example, a researcher may fail to reveal research findings if they are likely to affect certain policies negatively or an institution may keep the results, which are likely to bring protests. Besides being unethical, it is a waste of time, money and energy to undertake research only to conceal findings. Therefore, for sensitive findings, methods of releasing them should be agreed upon rather than shelving the findings completely.

Do you intend to publish your research findings? If you do, then you should be aware of intellectual property rights. This simply means consulting the other team members in case the research was done jointly by a team of researchers. No one individual has the right to publish the study as a personal effort so that every person's intellectual contribution is fairly recognized

### **Ethical issues in experimental designs**

You have probably conducted laboratory experiments while in secondary school. It entails control and treatment groups to provide meaningful comparisons. When dealing with human beings, some experts have seen the differential treatment among control and treatment groups as unfair and unethical. For example, the treatment interventions could be training or provision of medicine to the experimental group while the control group is denied the treatment. This helps in making conclusions about the effect of treatment on the group with a clear indication from a comparison with the untreated (control) group. Any difference would be as a result of the treatment. However, such kind of research studies are conducted, where the control group can be given the same treatment after the study if resources allow, or if not, the candid explanation must be offered to the control group by the researcher, to help alleviate the feeling of unfairness" [Mugenda and Mugenda, 1999; Gall; Borg; and Gall, 1996]

### **The seventh ethical issue is the use of tests in research**

Many participants develop extreme anxiety during tests or any kind of examinations. Some experts have argued that it is unethical to subject respondents to tests due to discomfort and anxiety experienced. In this regard, it is the researcher's responsibility to select a method for data collection that is fairly free of anxiety. If tests are the best method to use in a particular study, the researcher should prepare the respondents for the anticipated experience and reassure them.



### **Activity**

*You have been asked by your District Education Board (DEB) to undertake research on HIV/AIDS behavioural change among secondary school students in Kenya. Discuss some of the resources that you will need and outline five (5) ethical considerations that you would bear in mind.*

### **Conclusion**

Research must be conducted within an ethical framework. The researcher must not only understand what ethical issues but also put them into practice in his /her research. One must desist from any actions that could be termed deceitful. Such actions not only reflect badly on the researcher but could also lead the readers into assuming that whatever else is contained in a research report is questionable.

Ethical issues protect the researcher as well as the population that she /he will work with in data collection.

### **Review questions:**

Ask yourself the following questions with reference to your research study:

- Does the study in any way suggest an unreasonable compromise of any principle or value or place any of the subjects in the study at risk?
- What safeguards will be there to protect the rights of those involved in the study?
- Does the proposal clearly specify the obligations and responsibilities of all participating?
- How will informed consent be obtained from study participants?



### **Suggested further reading**

1. Gall, M. D. Borg, W. R. and Gall, J.P. (1996). Educational Research. An Introduction. 6<sup>th</sup> Ed. Oregon; USA: Longman.
2. Mugenda, O; and Mugenda A. (1999). Research Methods. Quantitative and Qualitative Approaches. Nairobi ACTS press.
3. Dillon, W; Madden, T. J. and Firtle, N. H. (1993). Essentials of Marketing Research, Boston. Irwin McGraw - Hill.

## **Bibliography**

Anderson, Terry and Heather Kanuka (2003) *e-Research Methods, Strategies and Issues*, Boston: Pearson Education, Inc

Burns, R. B, (2000), *Introduction to Research Methods*, London, Sage

Bussey, Michael (1999) *Case Study Research in Educational Settings*. Buckingham: Open University Press

Cohen, Sharron (2003) *The Mysteries of Internet Research*, 1<sup>st</sup> Ed. Wisconsin, Upstart Books.

Coleman, M. and Briggs, A.R (2002) *Research Methods in Educational leadership and Management*. London Sage

Dillon, W; Madden, T. J. and Firtle, N. H. (1993). *Essentials of Marketing Research*, Boston. Irwin McGraw - Hill

Free body, Peter (2004) *Qualitative Research In Education: Interaction and Practice* 1<sup>st</sup> Ed; London: Sage Publications Ltd.

Fraenkel, J. R. and Wallen, N.E. (2000) *How to Design and Evaluate Research in Education*, 4th ed. Boston, McGraw Hill.

Gall, M. D. Borg, W. R. and Gall, J.P. (1996). *Educational Research. An Introduction*. 6<sup>th</sup> Ed. Oregon; USA: Longman.

Hardy, Melissa and Alan Bryman (2004) Ed. *Handbook of Data Analysis*. London: Sage Publications Ltd

Kathura, N. J; and Pals, D. A. (1993): *Introduction to Educational Research*. Nakuru, Egerton, Educational Media Centre.

Keya, S.O et al. (1989). *Guidelines for the Formulation of Research project proposals*. NCST and IDRC. Oxford University press.

Kvale, Steinut (1996) *Interviews: An introduction to Qualitative Research Interviewing*. 1<sup>st</sup> Ed, London: Sage Publications

Miles, Mathew B. and Huberman, Michael A. (1994) *Doing Research*, 1<sup>st</sup> Ed, London: Sage Publications Ltd

Mugenda, O. M. and Mugenda, A.G. (1999): *Research Methods. Quantitative and Qualitative Approches*, Nairobi, Acts

Mwiria, K. and Wamahiu, S. P. (1995), *Issues in Educational Research in Africa*. Nairobi. East Africa Educational publishers

O'Leary, Zina (2004) *Essential Guide to Doing Research*, 1<sup>st</sup> Ed, London: Sage Publications, Ltd

Opie, C. (Ed) (2004) *Doing Educational Research: A guide for first researchers*. New Delhi: Vistant Publications.

Rewntree, Derek (2004) *Preparing Materials for open, Distance and Flexible Learner: An Action Guide for Teachers and Trainers*. London: Kogan Page

Wolcott, Harry F. (2001) *Writing Up Qualitative Research* 2<sup>nd</sup> Ed., London Sage Publications.

Wright, Daniel B. (1997) *Understanding Statistics: An introduction for the Social Sciences*. 1<sup>st</sup> Ed; London: Sage Publications Ltd

Study Guide 2: MEDEM2-R Research Methodology. Educational Management, Edited by Hoberg, SM Pretoria UNISA. 1999.