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ABOUT THIS BOOK

This Course Book **"Introduction to Educational Research "** has been exclusively written by experts in the discipline to up-date your general knowledge of Educational Research in order to equip you with the basic tool you will require for your professional work as teacher and an administrator.

This two-credit course book of twenty-four (24) sessions has been structured to reflect the weekly two-hour lecture for this course in the University. Thus, each session is equivalent to a one-hour lecture on campus. As a distance learner, however, you are expected to spend a minimum of three hours and a maximum of five hours on each session.

To help you do this effectively, a Study Guide has been particularly designed to show you how this book can be used. In this study guide, your weekly schedules are clearly spelt out as well as dates for quizzes, assignments and examinations.

Also included in this book is a list of all symbols and their meanings. They are meant to draw your attention to vital issues of concern and activities you are expected to perform.

Blank sheets have been also inserted for your comments on topics that you may find difficult. Remember to bring these to the attention of your course tutor during your monthly meetings.

We wish you a happy and successful study.

Francis K. Amedahe
E. Asamoah Gyimah

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Prof. Isaac Galyuon
(Provost)

SYMBOLS AND THEIR MEANINGS

INTRODUCTION

OVERVIEW

UNIT OBJECTIVES

SESSION OBJECTIVES

DO AN ACTIVITY

NOTE AN IMPORTANT POINT

TIME TO THINK AND ANSWER QUESTION(S)

REFER TO

READ OR LOOK AT

SUMMARY

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ASSIGNMENT

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UNIT 1: INTRODUCTION TO EDUCATIONAL RESEARCH

Unit Outline

Session 1: Nature of Research
Session 2: Sources of Knowledge
Session 3: The Role of Research in Education
Session 4: Classification of Educational Research
Session 5: Variables in Educational Research
Session 6: The Research Plan

This course introduces you to research methods in education. It explains scientific methods employed by educational researchers in doing their research. As a teacher you need to know what kinds of materials, strategies and activities best help students learn. This you can do through research. You have benefited a lot from studies done by other educational researchers in your practice. Some of the best methods and principles you use in teaching were discovered through research. Indeed, research helps us to understand things (phenomena) and explain them. As a student pursuing a diploma programme in education, one of the requirements of the programme is a completion of a project. You will be expected to employ appropriate research procedures in carrying out the project. Your project must contribute, in modest way, to understanding and explaining whatever issue or problem in education you choose to study. This can be a novel way of teaching a topic in a subject area of your choice (e.g.. mathematics). This course, therefore is to help you know how to conduct educational research. Note that, you will apply what you learn in this course in doing your project in your last academic year on the programme. It is, therefore, necessary that you understand the procedures very well. In addition to carrying out your project work for your diploma, as a teacher, knowing how to conduct research, will help you to conduct a local study (e.g. the classroom) to help you in your decision making regarding what works and what does not work, employing the scientific approach. Furthermore, every educator should be able to read and understand educational research reports. This course will help you to achieve that. Note that what you have learnt in your educational measurement and evaluation modules will help reinforce your understanding of this course. Sometimes you may have to refer to the educational measurement and evaluation modules.

In summary, in this course, you will learn about:

- The nature of research and its role in education,
- How to identify and state a good research problem,
- The various procedures that you can use to conduct a study,
- How to analyse the data that you collect and
- How to write a good research report.

Unit Objectives

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

1. Define the term educational research in a scholarly sense;
2. State the characteristics of research;
3. State at least three source of knowledge and evaluate them;
4. Explain the role of research in education;
5. Classify educational research using the purpose and method and
6. Identify relevant variables in education and their characteristics.

SESSION 1: NATURE OF RESEARCH

This unit introduces you to the concept of research and its nature. It explains what is meant by research in a scholarly sense and gives examples of activities that cannot be meaningfully classified as research in a scholarly sense. The different sources of knowledge including the scientific approach, and their strengths and weaknesses are discussed. It also explains the role of research in education and the various phases of the research process. The Unit also deals with how educational research is classified using the purpose and method and important variables (characteristics) in education.

Objectives

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

(a) define research;
(b) explain educational research;
(c) distinguish between research in a scholarly sense and in an ordinary sense; and
(d) identify and explain the characteristics of educational research.

Now read on…

1.1 What is Research?

You are welcome to Session One of Unit One of this course. Please relax and take your time to read so that you will understand the issues in the Session well. Understanding the explanation given in this Session and other Sessions in this Unit will help you to understand other issue discussed later.

Research! Research! Research! What is research? Well, when you were at the training college, you at one time or another told your colleagues(s) that you were going to do research in the library. So, I hope this is not the first time you are hearing of the term research. You have also, probably, heard in the news that some people conducted some study and came out with some findings. Journalists, for example, tend to find out pieces of information that they publish in their newspapers. They apply the term research to the process. Scholars also identify a problem of interest and collect relevant information on it and analyse the information and come out with a solution to the problem by way of explanation or otherwise in journals. The questions you need to answer are: Can we classify the above examples of activities as research in a scholarly sense? If not, what is meant by research? What are the characteristics of research? These questions are the focus of this Unit.

The term research can be used in two senses. The term can be used in the layman's sense and in a scholarly sense. In a layman's view, looking up a few facts and writing them down is research. This is to say that the layman uses the term research as fact finding. Thus, when one goes to the library to find out some pieces of information then the one can be described as doing research in the layman's sense of what research is. If a journalist looks for some facts and reports them, then this activity will also be classified as research in the layman's view of what research is. Scholars do not use the term research only for fact-finding, even though looking for facts form part of the research process.

This is to say that scholars do not accept fact finding *per se* as research. In a scholar's view, research involves more than fact finding. Research entails identification of a problem, data collection, organisation, analysis and interpretation of the results obtained with the view to solving the identified problem. Research is the manner in which we solve perplexing problems in our attempt to push back the frontiers of our ignorance regarding phenomena (things or issues). That is, research is a systematic process through which we can solve some of the problems that confront us in terms of describing, understanding and explaining phenomena.

More formally, research can be defined as a systematic investigation to increase knowledge and/or understanding of a phenomenon. It is the search for an answer to an unsolved and perplexing question(s) using the scientific approach. Gay (1992), for example, defines research as the formal, systematic application of the scientific method to the study of problems. In short, we can say that research is the systematic application of the scientific method to answer perplexing questions in order to increase knowledge and understanding of phenomena. Research is a form of scientific inquiry. We will explain the scientific process in the next section under sources of knowledge.

Now that you have understood the meaning of the term research, we want you to apply it to educational research. How will you then define educational research? Pause for a few seconds and attempt to define educational research. Read on and see whether your line of thought is similar to the following explanation.

Educational research is the formal and systematic application of the scientific method to the study of educational problems. That is, educational research is applying the scientific method to solve problems that confront educators and other stakeholders in education. You probably are aware that there are a number of issues in education that are of concern to educators and stakeholders in education, including you. Some of the problem areas are effective school management, effective teaching and learning, motivation of teachers and students and how to deal with children with special needs in the classroom to help them maximize their potential. Research is done to solve problems related to some of these issues in terms of increasing our knowledge and understanding of them and to help improve practice. The effectiveness of some of the methods of teaching that you read about when you were at the training college was established through research.

It should be clear to you that when you set out to do research it means you must have identified a specific issue or problem that you want to describe by way of explaining it or establishing the cause and effect relationship between the relevant variables or determining some pattern in the relevant variables using the scientific method.

Now, from your understanding of the term educational research answer the following questions:

(1) Is it true to day that a systematic collection of data in education is research in education?

(2) Is it true to say that research is to help collect data on educational phenomena?

I hope your answer to both questions is No! If your answer is Yes! to any of the two questions, then go back and read the explanation on what research is.

Now that you have understood the term research and educational research, I will want you to learn more about research by knowing the characteristics of research.

1.2 Characteristics of Research

Research as a purposeful activity to increase knowledge and understanding of phenomena has some characteristics. Understanding these characteristics will help you to know more about what research in education is. Leedy (1974) pointed out that research has, at least, seven characteristics. The characteristics are described below.

(a) *Research begins with a question, an issue or problem in the mind of the researcher.* This characteristic points out that when you set out to do research you must have in mind a question to answer, an issue to explain or a problem to solve. Unless you begin your research in this way you will not be doing what scholars term research. You must note that research usually arises from a question, an issue or a problem that a researcher has observed and it puzzles him/her. So, if in your teaching you observe that a particular method is not effective in promoting your students' understanding and learning, then you have a problem you can seek a solution to through research. You can find out why the method does not work well with you. Your observation that the method is not effective and your concern for finding out why it does not work may begin the research into the method. Remember every useful research begins with a problem of some sort.

(b) *Research requires a plan.* Research entails a clearly stated plan, including direction and procedures. Research is a purposeful activity and for it to be successful, it requires a plan. In research language, the plan is known as a research proposal. The research plan (proposal) is important in the sense that if you set out on a journey without knowing your destination you cannot get there! By developing a plan you get to know what specific questions you want to answer, what data to collect, how to analyse the data and what conclusion to reach. This does not rule out accidental findings in research. However, a meaningful research must have a plan for it to proceed purposively. This characteristic behoves you to plan your project work once you have identified the problem or issue you want to study. We explain the research plan and its components in detail in Session Six of this Unit.

(c) *Research demands a clear statement of the problem.* A good research commences with a clear statement of the problem or issue of concern. The first characteristic says research begins with a problem. This characteristic says that the problem must be stated. Whatever problem, issue or question you set out to deal with in your research must be stated clearly indicating the relevant variables and the expected relationship, if any. It is important to note that the statement of the problem is preceded by background information. This will help any reader to understand what exactly you are studying. The statement of the problem must be made in the research plan as well as in the research report. In Unit two, you will learn more about the research problems.

(d) *Research deals with the main problem through sub-problems.* Usually, the main issue or problem of concern may be too big to solve at ago. What, therefore, is done is to break down the main problem into smaller problems to which the researcher will find solutions to. By solving the smaller problems within the bigger problem, the main problem is solved. Good researchable problems tend to have within them aspects and other areas of lesser breadth and importance. These are the sub-problems within the main problem. It is expedient for you to divide your main research problem into appropriate smaller problems. The sub problems take the form of specific research questions or hypotheses. Hypotheses are explained in Unit Two.

As an example, suppose your research problem is "Which of the two methods, combined phonics and whole language approach and totally phonics approach, is more effective in teaching reading in the elementary school"? You cannot resolve this issue meaningfully without examining some specific aspects of the problem. You may want to find out whether the combined phonics and whole language method is more effective with, say, primary one, two, three or six pupils. You may also want to find out whether the combined phonics and whole language approach is more effective with girls than boys. The two aspects of the problem delineated above are some of the sub-problems of the main problem that must be solved. We hope you have got the idea of sub-problems.

(e) *Research seeks direction through appropriate hypotheses or questions.* Having stated the problem or issue of study and the attendant sub-problems, the sub-problems are then each stated in the form of hypothesis or a specific research question. You will learn more about hypotheses and specific research questions in Unit Two.

(f) *Research deals with facts and their meanings.* Earlier, we explained that research does not mean data collection *per se*. Research goes beyond the collection of data. It is a fact that in research data are collected. However, in research whatever relevant data are collected must be organised into meaningful aggregate, analysed and interpreted.

The analysis may take the form of using descriptive statistics or inferential statistics. It may also take the form of content analysis. In Unit Four, you will learn about these analyses.

(g) *Research is circular.* The research cycle begins with a problem at hand. Next, the researcher formulates hypotheses or specific research questions that are related to the problem. The investigator continues the process by collecting relevant data, organizing, summarising and analysing the data after which he/she will interpret the result. The process may result in an identification of another problem and that problem may be taken up for investigation. Figure 1.1 illustrates the circularity of research. The end of a study may serve as the starting point of another study. That is why in any scientific study, the review of related literature is important.

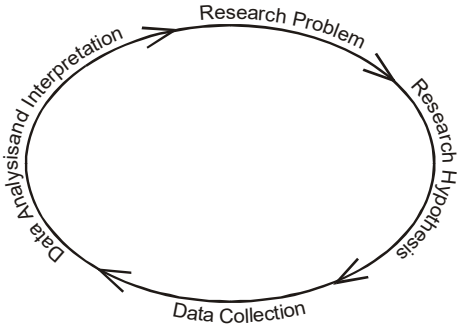


Fig 1.1 The Research Cycle

Note also that research is not vertical. That is, to say that, in doing research, you do not finish with one activity or stage and move onto the other without necessarily going back to review the earlier stage(s) in doing research, you will be moving back and forth until the problem you are investigating is solved.

SUMMARY

In this Session, you have learned about the concept of research in a scholarly sense and what educational research is. You have also learned about seven characteristics of research to throw more light on the term research. You need to keep in mind these characteristics when you embark on any research work such as your project work.

Self-Assessment Questions

Exercise 1.1

For each item select the best or correct option.

1. The purpose of educational research is to
   (a) Collect data on educational phenomena
   (b) Determine educational phenomena
   (c) State educational phenomena
   (d) Understand and explain educational phenomena

2. Educational research can be defined as
   (a) A way of generating solutions to educational problems
   (b) A systematic method of gathering and interpreting information regarding educational phenomena
   (c) Different methods applied to educational issues
   (d) Empirical methods of data generation and analysis in education

3. A student who goes to the library to obtain information to answer a question posed by his/her teacher in class. The student can be described as doing research in a scholarly sense.
   (a) True
   (b) False

4. The following statements are characteristics of research **except**
   (a) Research begins with an issue
   (b) Research demands a plan
   (c) Research requires clear statement of problem
   (d) Research is vertical

5. Data collection is a necessary condition for research.
   (a) True
   (b) False

6 To solve a research problem, a researcher must formulate only research questions.
   (a) True
   (b) False

SESSION 2: SOURCES OF KNOWLEDGE

Hello, you are welcome to Session Two of Unit One of this course. In Session One, you learnt about what research is and some of the characteristics of research. In that Session, we made the point that it is through research that we can describe and explain phenomena. In other words, it is through research that we obtain knowledge and understanding of things and people around us. For instance, on what basis do you decide how to teach a child to read? We hope you will agree with us that you need to know the child in many ways before you can succeed in teaching him/her reading. Or you must base your decision on some experience about the child. In this Session, you will learn about ways by which we get to know and understand phenomena and their strengths.

Objectives

By the end of the Session, you will be able to:

(a) list and explain various ways by which we get to know and understand phenomena;
(b) explain the weaknesses of each way of knowing;
(c) identify the characteristics of the use of the scientific method; and
(d) describe the steps involved in the use of the scientific method to obtain knowledge.

Now read on …

2. 1 Ways of Knowing

There are several ways by which we obtain knowledge. These are also our sources of knowledge. They include personal experience, tradition and authority, logic and the scientific method. Each way has weaknesses. However, the scientific method is the most preferred method of knowing. We now take each of the sources of knowledge and explain them as well as indicate their weaknesses.

(a) **Personal Experience:** Personal experience can be defined as the process of getting knowledge or skill by an individual through doing, seeing and feeling things as well as something that happens which has an effect on the individual. Each of us gains knowledge as we meet people, see things and feel things. In your life as a teacher, we believe you have gained knowledge on how to deal with certain classroom situations including class management. This is your experience. Personal experience therefore is one way of knowing.

It has been said that there is no substitute for experience, whether it is your own or someone else's. In education, we depend on direct experience to know what works. Also professionals like you become more knowledgeable and effective through practice and teaching (doing).

Personal experience, however, has limitations. These include difficulty in where to begin, knowing how to improve and how to handle new demands and situations without the relevant knowledge or experience. It is also subject to mistakes and individual biases. In addition, personal experience is not systematic. Despite its weaknesses, personal experience is a useful source of knowledge.

(b) **Tradition:** Tradition is a belief, principle or way of acting or doing thins which people in a particular society or group or institution have continued to follow for a long time. There are many things that seem to be done in certain ways simply because they have been done that way within a group or society. This is what is known as tradition. Through tradition, the ways of doing things or approaches to handling problems are passed on from one group to another as accepted "truths". It is, therefore, a way of knowing. Take a minute or two to reflect on some of the things you learnt through tradition in your society or school.

One limitation of tradition as a source of knowledge is that it eliminates the need to search for knowledge and understanding because we simply accept what has always been done and the way it is done as the best or right way. Reliance on tradition also makes it difficult to accept new knowledge. It tends to mitigate our desire to question existing practices for the better.

(c) **Authority:** Authority refers to experts or people of recognized positions in society or institutions that can as a result of their expertise and positions have the right or ability to control others. These people are a major source of knowledge. An authority, therefore, has experience or unique expertise in something and is able to provide insights and understandings that we are unable to see. Examples include doctors, lawyers, professors, teachers and chiefs). We depend on such authorities for information when it becomes necessary.

Similar to personal experience and tradition, authority can also hinder our knowledge of something. Authorities can be wrong. That is while experts tend to disagree. There is also the tendency to accept the opinion of an authority as fact. Just because someone of authority states that a multiple choice test is better than an essay test does not mean that it is true in your situation.

(d) **Logic:** Logic is also a way of knowing. That is, we know things logically. We tend to reason things out. Logic is a particular way of reasonable thinking that is based on good judgment. It can also be said to be a formal method of thinking about ideas. Syllogism is a form of logic. Consider the popular syllogism:

All human beings are mortal.
Kofi is a human being.
Therefore, Kofi is mortal.

The first statement is known as the major premise, which is a generalization from experience about mortality of individuals. The second statement is known as the minor premise and it is based on sensory experience. When the first two statements are true, the third statement must be true. Thus, the statement "Kofi is mortal" is true because the major and the minor premises are true. This is known as deductive reasoning, which proceeds from general to specific. The opposite of deductive reasoning is inductive reasoning. It begins with specific observations and based on the observations a generalization is made.

A disadvantage of logical reasoning is that it is only when the major and minor premises of a syllogism are both true that the conclusion is guaranteed to be true. If either of the premises is false, the conclusion may or may not be true.

(e) **The Scientific Method:** By the scientific method we are not concerned with the subject matter of science. Our interest as researchers is in science as a method of knowing. The scientific method is a way or method of knowing and not a body of knowledge. Essentially, the scientific method involves the testing or verifying educated guesses or hunches in the public arena. It is true that almost all of us humans are capable of seeing relationships and associations (connections) among the sensory information we experience. You may speculate. For example, that your students may be less attentive in class when you lecture than when you engage them in discussion. Similarly, a physician may guess that people who sleep between sis to eight hours each night will be less anxious than those who sleep more or less than that amount. In each case, we do not really know whether the guess is correct. What we must do is to put each of the guesses to a rigorous test to see if they hold up under certain conditions. Such investigations are described in detail so that the study can be repeated (replicated) by any one who questions the results.

The scientific method is a very orderly process of knowing. The process entails a number of sequential steps. The use of the scientific method in research is objective, systematic, testable, and relatively uninfluenced by personal beliefs, opinions and feelings. The purpose of scientific inquiry is to explain natural phenomena, to understand the relationships that underlie these phenomena and then to predict and influence behaviour as a result. Because the scientific method is orderly and it is preferred to other approaches of obtaining knowledge, you will learn more about it in the next section.

You can take a ten minutes break now. When you return you will read about the characteristics of scientific inquiry and the steps used to carry out a scientific inquiry.

2.2 Characteristics of Scientific Inquiry

You are welcome back from the break. We hope you are fully refreshed to read the rest of this session. Now read on …

In explaining what the scientific method is, we alluded to some of the characteristics of the scientific method. In this section we explain in more detail the main characteristics of the scientific method which are objectivity, control of bias, willingness to alter beliefs, verification, induction, precision and truth.

(a) **Objectivity:** Being objective means not being influenced by personal beliefs or feelings but basing views on real facts. This is a characteristic of the scientific method. It behoves you. Therefore. to be objective in your observation, data collection, and reporting of results of your study.

(b) **Control of bias**: Bias is the tendency to support or oppose a particular person or thing in an unfair way by allowing personal opinions to influence your judgment. Bias affects objectivity. What control of bias means is that in scientific inquiry the researcher does not allow personal prejudices, beliefs, and attitudes to influence the process of the study or results.

(c) **Willingness to alter beliefs**: When a scientific study is being done, the purpose is to discover the truth. The truth as supported by available facts may not agree with existing beliefs. In scientific inquiry, the researcher must is willing to change his/her beliefs when this is justified by evidence (facts). For example, you will probably remember that earlier the belief was that the earth was flat but when evidence showed that the earth is, sort of, round the belief was changed.

(d) **Verification:** You remember we said the scientific method involves the testing of guesses in public arena. The process and findings of scientific inquiry are subject to replication by others. That is, others who question the results can repeat the study to verify for themselves.

(e) **Induction:** We explained this concept in the previous section when we dealt with logic as a source of knowledge. Induction involves drawing general conclusions from specific observations. Thus, a group of class three pupils will be randomly selected in a school and data collected on them can be summarized and generalized for all class three pupils within the school.

(f) **Precision:** Scientific inquiry is characterized by being exact. Definitions of terms and instruments, such as tests, contain sufficient details to convey exact meanings

(g) **Truth:** In scientific inquiry, conclusions reached are tentative. Conclusions of any particular study are based on available evidence. Once new evidence emerges and contradicts an earlier one, the conclusion is changed to reflect the facts. The earlier example given in explaining willingness to alter beliefs is applicable here. When evidence became available that the world is round and not flat, the conclusion about the shape of the world changed. This clearly demonstrates the point that in the use of the scientific approach, conclusions are tentative.

Now that you have understood the main characteristics of the scientific approach, we will proceed to discuss, briefly, the steps involved in scientific inquiry.

2.3 The Sequence of Steps in Scientific Inquiry

The general order of the scientific method is as follows:

(a) **Identification of a Problem or Question:** There is a problem or a question of some sort to start with. That is, in the use of the scientific method to obtain knowledge, there must be a problem to begin with. The problem may be an issue or something bothering the researcher and needs explanation or comprehension. If there is no problem of some sort to be solved, or a question to be answered, one cannot commence a scientific inquiry.

In Unit Two, detail explanation is given on the research problem and its various aspects.

(b) **Clarification of the Problem**: Once a problem is identified, the researcher takes steps to define it more precisely. The purpose here is to make the problem clearer and exact as to what the purpose of the study is. This second step directly relates to the characteristic of precision that we discussed in the previous section.

(c) **Determination of the information needed to solve the problem and how to obtain it:** Having clarified the problem either through operational definitions, review of previous research and formulation of hypotheses or specific questions, there is the need to determine the information relevant to be collected and how to collect the information. The information may be quantitative (i.e., dealing with numbers) or qualitative (i.e., verbal). The type of information and the characteristics of the participants of a study determine how to obtain the data. For example, you may decide to give a questionnaire to teachers to complete but interview their pupils on relevant issues.

It is important for you to note that, the data collected and how it is collected are very important in determining the credibility of the results of a study. In later Units, we shall explain and describe the various ways of obtaining data in a study.

(d) **Organisation of the Information (Data)**: In this fourth step, the researcher must decide how he/she will organize the information that will be obtained. This is to make sense out of the data collected. This can take the form of summarizing the data (e.g., computing descriptive statistics) and analyzing it (i.e., testing formulated hypotheses or guesses). You will learn more about this later in the course.

(e) **Interpretation of the Results:** After the data is organized, summarized and analysed, the next step is to interpret the emerging results. Interpretation of the results is one of the most important parts of research. Research is not data collection per se so we need to interpret the data and the results. This process ends with a conclusion which, we said, is tentative.

From the foregoing discussion on the steps in doing a scientific study, there are five main steps involved. However, in actual practice you no not complete one step or stage in the sequence before you move to the next step. As a researcher, you will move back and forth the steps until your identified problem is solved.

2.4 Applying Scientific Inquiry to Education

The use of the scientific method in educational research is illustrated in Figure 1.2 below.

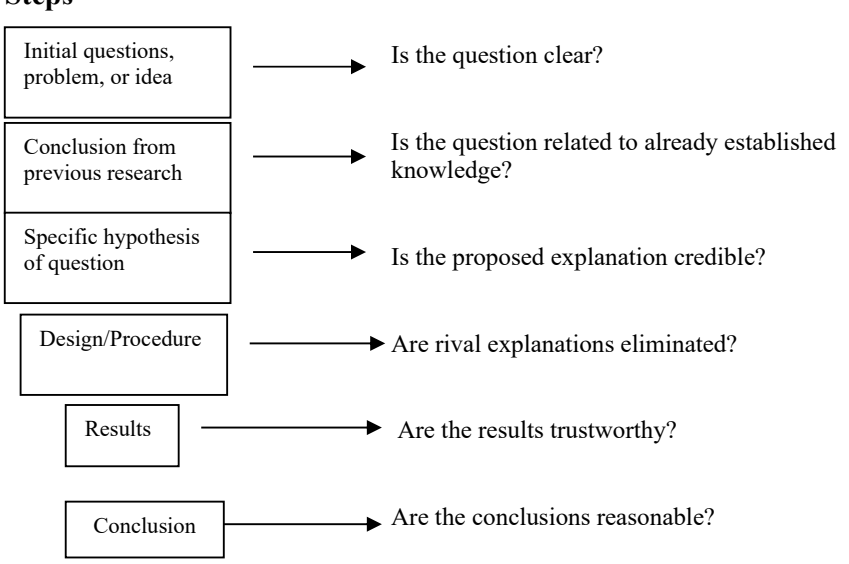


Figure 1.2 A framework for understanding the steps of scientific inquiry

The steps and the corresponding questions are explained in detail in later parts of this course. However, it is important for you to note of the following. The content of the first box of the figure relates to identification of a problem while the contents of the second and third boxes are concerned with clarification of the problem. The contents of the fourth and fifth boxes deal with the determination of the information needed to solve the problem and how to obtain it as well as the organization of the data. The contents of the last two boxes of Figure 1.2 deal with interpretation of the results of the study.

The first step is that the investigator faces an obstacle to effective decision-making or understanding or identifies an idea or question that warrants further thought. This can be thought of as general problem.

In this session, you have learned about the different ways of knowing. These include, personal experience, tradition authority, logic and the scientific method. The weaknesses of the different ways have been discussed. Of the different ways, it is the scientific method which is preferred because of its characteristic which include objectivity, control of bias, willingness to alter beliefs, verification, precision and truth. The session also presented the steps in scientific inquiry. These are five.

Self-Assessment Questions

Exercise 1.2

1. Which way of knowing is likely to provide you with the most valid knowledge?
   (a) Authority
   (b) Personal experience
   (c) The scientific method

2. A weakness of personal experience as a source of knowledge is that it is not objective.
   (a) True
   (b) False

3. Tradition as a source of knowledge has the advantage of engaging and accepting new knowledge.
   (a) True
   (b) False

4. The method of knowing which involves observing specific instances and then generalizing from the instances is known as
   (a) deduction
   (b) induction
   (c) syllogism

5. The following are characteristics of the scientific method, **except**
   (a) subjectivity
   (b) precision
   (c) verification

6. In using the scientific method to generate new knowledge a researcher must complete one stage before moving on to another.
   (a) True
   (b) False

7. The conclusion of a study is final.
   (a) True
   (b) False

SESSION 3: THE ROLE OF RESEARCH IN EDUCATION

We hope you are doing well and that you got all the self-assessment items of the previous session correct. That is good.

This session explains to you why research is important. By the end of the programme, you will be required to produce and submit a research work in the form of a project that invariably is the second phase of this course. To start with, the question we need to answer is: Why is research important in education as in other disciplines? Not all educators understand and appreciate of research in education. For some, research may seem like something that is important only for university teachers. Although it is true that university teachers by virtue of their appointment are required to conduct research, personnel in other educational settings like teachers and school administrators also read and use research in a number of ways. Interest in reading research and applying it to study educational issues and practices depend on valuing it and understanding its contribution to our advancement. This session explains the contribution of research in four important ways.

Objectives

By the end of the session, you should be able to:

(a) explain the importance of research in adding to knowledge about educational issues;
(b) describe the role of research in improving educational practice;
(c) state how research can inform important policy issues; and
(d) explain ways research skills can help the student.

Now read on…

3.1 Adding to Knowledge About Educational Issues

All educators, including you, want to do things in a better way to ensure success of children in their up bringing. Educators, therefore, strive for continued improvement of what they do. As a teacher when you teach and your students do not perform well to your expectation, you begin to ask why it happens so. You may want to know whether your presentation has some weaknesses in terms of the methodology you employed or because the students do not have the necessary prerequisite entry behaviour. These questions are aimed at improvement in your teaching. This requires addressing problems or issues relevant to teaching and searching for potential solutions to them. It is through research that we address problems or issues with the view to finding solutions to them. In the example given about the performance of students after instruction and the questions raised, you may want to find a solution to the poor performance by trying to establish the cause of it through research. By this action, you add to your knowledge and practice.

THE ROLE OF RESEARCH IN EDUCATION

Adding to knowledge means that educators undertake research in order to contribute to existing information about issues. It is through research that we extend as well as broaden our understanding of phenomena.

You are aware of pressing educational issues in Ghana today, such as:

- performance of students in Mathematics and English language
- supervision by some headteachers in the public schools
- inadequate school infrastructure
- dealing with children with special needs
- managing the classroom to ensure effective teaching
- determining effective methods in teaching different subject areas to students
- determining which medium of instruction to use in the first three years at the basic level.

Research can play a vital role in addressing these issues. Through research we develop results that help us answer some questions. As we accumulate these results, we gain a deeper and deeper understanding of the problems.

At this point, it is useful for you to recollect what you read in Session One about what research is. We hope you have seen the relationship between the point being made here that research helps us to add to our knowledge about educational issues and what research is about.

Research adds to our knowledge about educational issues by addressing the gaps in knowledge, expanding knowledge, replicating knowledge and adding voices of individuals to knowledge.

By investigating a pressing educational issue, the void in existing information is filled. For instance, if you are to choose the most effective method among existing methods of teaching religious and moral education in your school and you are not sure which is the most effective method, research can help you address this gap in your knowledge. In terms of expanding knowledge, when you extend research to new ideas or practices then your knowledge will expand. That is you will get to know more about those ideas or practices. Replicating knowledge involves testing old results with new participants or at new research sites. Sometimes results of a study may apply to only some category of participants or under certain conditions or contexts. Replicating a study helps throw more light on the issue and help us understand it better. Through research we tend to know the perspectives and views of individuals on an issue. This helps us to appreciate the issues involved and how people react. In all of these ways, research contributes to our knowledge of educational issues.

3.2 Improving Practice

In the previous section we discussed the importance of research in adding to knowledge. In this section we present how research improves practice.

Research is also important because it suggests improvements for practice. In most scientific inquiry solutions are sought for identified problems. Based on the information from the study recommendations are usually made as a way forward. These recommendations suggest ways of improving upon the current status of whatever is researched. As a teacher (educator) when you are armed with research results you become more effective as a professional. This effectiveness translates into better learning of your students. For instance, through research, educators know much more about which methods of reading are effective with certain categories of children as well as the importance of community and parental involvement in the education of the child, besides the work of the teacher. It is true that educators such as teachers, headteachers/supervisors and guidance and counselling coordinators are helped to improve their practices on the job by reading and practicing research findings. Indeed as a teacher, you benefit a great deal in your practice as a teacher from research.

While research supports improvement for practice, it also offers practicing educators new ideas to consider as they go about their jobs. For instance, a recommended way of doing something in the classroom based on research may not work with you. You may begin new ways of doing it, considering the specific context. These new ways can be tested for their validity through research. In addition, from reading research studies, you can learn about new practices that have been tried in other settings or situations. The main point being emphasized here is that research helps bring about new ideas to be considered when we are doing our jobs. In addition to the two other roles of research in improving practice, research also helps practitioners evaluate approaches that they hope will work with individuals in educational settings. For instance, studies on strategies of teaching children with certain characteristics, leadership styles of school administrators and their effectiveness and the use of audio-visuals in enhancing teaching will help you as a practitioner to evaluate approaches that will work. This process involves going through research to determine which results will be most useful. A three-step process can be used. First you have to decide what you want to do in, say, your classroom. Second, you have to find out what research has to say (review of relevant literature). Third, you decide which line of action to take based on the literature reviewed. For example, in determining whether you should use discussion or lecture method in teaching a social studies topic you may have to review studies on the effectiveness of the two methods taking into consideration the context and the developmental level of the students before making the final decision. Remember that research will help you-evaluate approaches that will work in some specific settings.

So far we have discussed three main ways by which research helps in improving practice. Do you remember them? List them. Have you got them? They are:

(a) Research suggests improvement for practice
(b) Research offers educators new ideas, and
(c) Research helps practitioners evaluate approaches that will work.

We hope you have got them right. Proceed and read about the fourth way by which research improves practice.

Research helps the practicing educator, like you, build connections with other educators who are trying out similar ideas in different locations. The connections with other educators can take the form of attendance of seminars, workshops and conferences. At research conferences, for instance, educator researchers may present their findings on similar issues or practices. This may lead to establishing connections with those people due to your interest in what they do. This process results in knowing what works and what does not.

3.3 Informing Importance Policy Issues

Research does not only add knowledge and improve practice but also informs policy formulation. Research informs and guides the formulation of policy issues. Policy issues are broad frameworks within which things must be done. An example of educational policy in Ghana is the medium of instruction at the first three grades (i.e., class 1 – 3). Any meaningful policy framework should be based on credible information. Research creates the conditions for discussions about important issues by policy makers. In Ghana, these individuals may range from the Ministry of Education (MOE) and Ghana Education Service (GES). Such individuals may collectively discuss and take positions on important educational issues. For these individuals, research offers results that can help them weight various perspectives. When policy makers read and review research an issues, they are informed about current debates and stances taken by other people.

On the other hand, research can lead to the modification of an existing policy. Earlier in this Unit, we mentioned that conclusions reached in any scientific inquiry is tentative. Thus, if a policy is based on an existing knowledge and a new available knowledge obtained through research indicates otherwise, the policy must be accordingly modified. A typical example is that in the past with the free textbook system at the Basic Education Level, pupils were not allowed to send the textbooks home. This was the existing policy. Following a study conducted by the Centre for Research in Improving Quality in Primary Education in Ghana (CRIQPEG) at the University of Cape Coast showing how the policy affected pupil learning, the policy was modified. These days with the consent of the parent to be responsible for any damage to the books of his/her ward, the child is allowed to send the textbooks home for study.

It is important to note that for research to be useful, the results should be clear and include data-based evidence.

3.4 Building Students Research Skills

You are now on the last section of this session. It explains how research builds students research skills. The implication is that as you go through this course you must acquire research skills to help solve some of the educational problems you are confronted with.

The process of research helps individuals develop conceptual, writing, organizing and presenting skills. You will recall that every scientific inquiry begins with a problem. To begin a piece of research you must conceptualize a good problem. Thus, you must develop the skill of conceptualizing issues during this course. Equally important are the skills of writing and organizing ideas. These are prerequisite skills for being a successful researcher. We said earlier that in research, data is collected and the data collected must be organized so that meaning can be made of it. This is the reason why skills in organizing that by the student is important. You will learn at the later part of this course how you will organize and analyse your data. Synthesizing and analyzing data are all important skills needed for conducting research. The activity of reviewing existing literature also helps to develop skills in organizing complex materials.

Acquiring the above skills helps the individual to evaluate studies reported in the literature more effectively. To meaningfully read studies reported in the literature, individuals also need conceptual skills, which will assist them in analyzing material for relevant ideas.

Utilization of research results is maximized if the results are appropriately presented. Learning how to do research, therefore, helps individuals to acquire presentation skills.

This session discussed the role of research in education. Essentially, four main roles of research in education were discussed. These are adding to knowledge, improving practice, informing policy issues and the development of research skills.

We hope you have understood the contents of the session. Now attempt the self-assessment questions.

Self-Assessment Questions

Exercise 1.3

1. Research is important because it
   (a) determines everything that we do.
   (b) fills the void in our knowledge.
   (c) guides our value system.

2. Repeating a previously conducted research using new participants does not usually add to knowledge.
   (a) True
   (b) False

3. Research, on the whole, tends to push back our horizon of ignorance.
   (a) True
   (b) False

4. As a teacher how can research help you to improve your practice?
   (a) By establishing questions to be answered
   (b) By helping students know what they are taught
   (c) By indicating what works

5. How will you make use of research to determine the effectiveness of certain methods of doing things in the classroom?
   (a) Asking people about the methods
   (b) Effective teaching
   (c) Review of research on the methods

6. Educational policies formulated based on research are likely to be better than those formulated without considering relevant research results.
   (a) True
   (b) False

7. Once an educational policy is formulated, there will be no need to change it.
   (a) True
   (b) False

8. Research will help you to acquire the following skills except
   (a) conceptualizing.
   (b) organizing
   (c) reading
   (d) writing

SESSION 4: CLASSIFICATION OF EDUCATIONAL RESEARCH

Dear learner, this session explains the various types of educational research. Even though in our previous session we noted that research adds to knowledge, improve practice and influences policy issues, the different types of educational research have different degrees of impact on these roles of research. It is, therefore, important for you to know the different types of research and their contribution to any of the roles discussed. It is hoped that you will enjoy reading this session.

Objectives

By the end of the session, you should be able to:

(a) define basic and applied research;
(b) distinguish between basic research and applied research;
(c) explain evaluation research and research and development;
(d) define action research; and
(e) explain quantitative and qualitative research.

Now read on…

4.1 Classifying Education Research

For the purpose of identifying the different types of educational research in terms of what they help achieve (contribute) and how they are conducted they are classified generally, using the purpose and method. The purpose deals with what a researcher hopes to achieve for carrying out the study. For example, a study may be initiated to explain how something works. That is, the study is essentially adding to knowledge. Another study may focus on the practice or use of certain procedures found to be useful to determine their worth within a context. This is how purpose can be used to classify educational research.

Using purpose as a criterion, educational research can be classified into five categories (Gay, 1992). These are:

(a) Basic research
(b) Applied research
(c) Evaluation research
(d) Research and development
(e) Action research

These categorizations are discussed in the following section of this session.

Irrespective of the purpose of a study, a method of some sort is used to carry out the study. However, method is also used to classify educational research. With the criterion method, educational research can be classified essentially as experimental or non-experimental.

Experimental research involves determining the causal relationship between two or more variables or phenomena by direct manipulation of factors that influence the variables or phenomena. It also calls for control of other variables that can affect the outcome of the manipulation. Experimental research, therefore, has two main characteristics. These are manipulation and control of variables. There are different specific ways (designs) in conducting experimental research. You will learn more about some of these in Unit 3 of this course.

Non-experimental research, on the other hand, describes and predicts phenomena without manipulating factors that influence the phenomenon. It is not very useful in describing cause-and-effect relationships.

Non-experimental research can take various forms. It can take the form of a descriptive survey, correctional research, causal comparative research and case studies. Again, these forms of non-experimental research are described in detail in Unit 4. In fact, Unit 4 is devoted to the description of the various designs both experimental and non-experimental. A design is a specific strategy employed to carry out a study.

In addition to the classification of education research using purpose and method, educational research is also classified as quantitative or qualitative. Quantitative research tends to emphasize numbers, measurement, experiments and numerical relationships and descriptions. This type of research is based on the positivist philosophy of how new knowledge is generated. The positivist philosophy holds that there are facts with objective reality that can be expressed numerically. Hence, the emphasis on measurement. Before the 1980s, most studies in education were quantitative in nature. A study to determine the relationship between the amount of time of study and student achievement can be described as quantitative. In such a study, a researcher has to measure time spent studying and attainment (achievement) and relate them before reaching a conclusion.

Qualitative research, on the other hand, focuses on understanding and meaning through verbal narratives and observations rather than numbers. Unlike quantitative research, qualitative research is based on phenomenological model. The model is based on the perceptions of the subjects of study. Usually, qualitative research takes place in naturally occurring situations. For instance, a study to understand parental role in the education of the child can be termed qualitative. In this case, measurement of variables may not be done but parents may be interviewed about their role in educating their children.

It is important for you to note that quantitative research involves measuring of variables, assessing the relationship or impact of variables, testing hypotheses and applying results to a large number of people. Qualitative research, on the other hand, involves learning about the views of individuals, assessing a process over time, generating theories (grand theories) based on participant perspectives and obtaining detailed information about a few people or research sites.

So far, we have explained different ways of classifying education research. You may be wondering as to which is the best way to classify educational research. Well, there is no best way of describing a piece of educational research. A piece of research in education is classified based on the dominant features of the research. A piece of research can also be mixed. It can be both quantitative and qualitative. This means both quantitative and qualitative elements are found in the research. However, most people tend to classify research by using method, that is, whether the study is experimental or non-experimental. Units 3 and 4 of the course will deal with the different methods. In the next section, we explain the earlier classification of educational research we gave based on purpose.

4.2 Classification of Educational Research Using Purpose

In the previous section we delineated five categories of research using purpose as a criterion. In this section, we explain these categories of research in detail.

(a) **Basic Research:** This is also known as pure research. This type of research is designed to contribute to theory development and the refinement of theory. Basic research is not concerned with practical applicability. In education and psychology, the main purpose of basic research is to gain an understanding of underlying processes involved in, say, learning, schooling and other educational phenomena. For instance, a study to understand how human beings remember what they learn can be termed basic research. A study of animals to determine principles of reinforcement and their effect on learning can also be basic.

(b) **Applied Research:** As the name implies, applied research is conducted to solve practical educational problems. In other words, applied research is conducted for the purpose of applying theory and evaluating its usefulness in solving educational problems. For instance, a study to determine the best approach to teach a particular topic in a subject area to a specific level of students may be described as applied research. With regard to the study of animals to determine principles of reinforcement, applied research can test these principles to determine their effectiveness in improving learning and behaviour.

It is important to note that basic research and applied research can be put on a continuum. Some studies can be located in the middle of the continuum. Such studies integrate elements of both basic and applied research.

(a) **Evaluation Research:** This type of research involves decision-making regarding the relative worth or effectiveness of two or more alternative actions. The purpose of evaluation research is collecting and analysing data in order to make certain decisions. For example, an evaluation research can be conducted to determine whether a programme is worth its costs or has achieved its objectives. Thus, an evaluation research can result in phasing out a programme or keeping it. Evaluation research has its own approach or methodology.

(b) **Research and Development:** This is a type of research directed at the development of effective products that can be used in schools. The main purpose of research and development is to develop effective products for use in schools. Such products may include teacher training materials, instructional materials learning materials, media materials and school management systems. The development of such materials constitutes the research. Such materials must be first developed, field-tested and revised until a pre-specified level of effectiveness or quality is achieved before they are put in schools. That is their validity is ascertained before their put in schools for use.

In Ghana, the Curriculum, Research and Development Division (CRDD) of the Ghana Education Service (GES) has the responsibility to carry out research and development and provide the schools with effective teaching and learning materials, among other things.

(c) **Action Research:** These days many people talk of action research. What do you understand by action research? Action research is a study concerned with immediate solution to local problems. It is a type of an applied research. The purpose of action research is to solve classroom problems or a local school problem through the application of the scientific method. Action research deals with a local problem and is conducted in a local setting. It is not aimed at contributing to science or general knowledge.

Action research, by its nature, can be conducted by teachers to solve problems in their classrooms. For example, a teacher can conduct an action research in his/her classroom to determine which grouping procedure results in the highest achievement for all students.

In this session you have learnt about various ways in which educational research is classified. We noted that two main criteria are used to classify educational research. These are purpose and method. Using purpose as a criterion, research can be classified into five categories. Using method, research can be said to be experimental or non-experimental. Educational research can also be said to be quantitative and qualitative. A particular research can take the form of being, for example, applied research but quantitative.

Self-Assessment Questions

Exercise 1.4

(1) The type of educational research that helps in understanding and explaining phenomenon is
   (a) an evaluation research
   (b) applied research
   (c) basic research

(2) A research to test the effectiveness of a theory within a specific context can be described as
   (a) applied research
   (b) basic research
   (c) research and development

(3) A study in which a researcher manipulates a factor to determine its effect on another factor can be described as
   (a) action research
   (b) experimental research
   (c) non-experimental research

(4) Which type of research emphasizes measurement of variables and their relationship?
   (a) Applied research
   (b) Quantitative research
   (c) Qualitative research

(5) A piece of research that is aimed at obtaining the perspectives of participants through verbal narratives is qualitative research.
   (a) True
   (b) False

(6) Which of the following types of research can be under taken by a classroom teacher to solve his/her problems?
   (a) Action research
   (b) Applied research
   (c) Basic Research

(7) Suppose you want to investigate the effect of using a new technique to teach mathematics on mathematics achievement. Your research can be described as
   (a) basic, experimental and qualitative
   (b) applied, experimental and quantitative
   (c) action, non-experimental and quantitative

SESSION 5: VARIABLES IN EDUCATIONAL RESEARCH

Welcome to this session, dear learner. By now, we hope you have clearly understood what research is, its characteristics and how to classify a piece of educational research. You know by now that research is about explaining and understanding phenomena, including how things or variables relate. You need to know further what are the important variables in education so that when you are stating your research problem you can use them appropriately. In fact, stating a good problem involves specifying the specific variables of interest in a particular study. It is therefore important to understand the variables of interest in educational research and their characteristics. This is pertinent because, the type of data analysis to be done in a study depends on the type and characteristics of the variable of interest. This session explains to you what variables are and the different types in educational research.

Objectives

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

(a) explain what is a variable;
(b) give examples of variables in educational research;
(c) identify and state the different types of variables in educational research; and
(d) use variables appropriately in stating a research problem

Now read on…

5.1 The Meaning and Examples of Variables in Education

A variable is a concept or characteristics that contains variations. The variations can be described numerically or categorically, in other words, a variable is a characteristic or term that can take on different values or have categories. Examples of variables in education include achievements/performance, intelligence, aptitude, attitude, and behaviour. These can take on different values. Consider achievement for example. As a teacher you measure the achievement or performance of your students in various subject areas. When you measure their achievement, some of them may exhibit excellent performance as shown by their scores. Others may exhibit satisfactory performance. Or achievement. Thus, individuals are said to vary on the characteristic achievement. Similarly, individuals vary in terms of intelligence, aptitude, attitude and other behaviours. You will agree with us that your attitude toward an issue may differ from the attitude of others toward the same thing. For instance you may like mathematics but some others may dislike mathematics. This means that attitude is a variable. That is, it varies from person to person and the amount can be measured and determined. Similarly, we can measure the other variables too and express them numerically to show their variation.

In education and psychology, we are interested in these variables in terms of how we can impact them and how they are related to other variables. This is because as educators, we strive to improve these characteristics of our students. In the next section of this session, you will learn more about the how these variables are classified, that is their types.

Other variables of interest in educational research are socio-economic status (SES), cognitive style, gender (male, female), and methods of instruction and leadership styles. They are better described categorically and not numerically. That is, this category of variables is better described in terms of their kind not the amount available. The next section explains in more detail what categorical variables are.

5.2 Types of Variables

Now that you have known some of the variables of interest in educational research we proceed to discuss with you the types of variables and their roles in research.

There are several types of variables in educational research. These include:

(a) Independent and dependent variables
(b) Extraneous or confounding variables
(c) Categorical and continuous variables

5.2.1 Independent and Dependent Variables

An **independent variable** is that characteristic or activity believed to make a difference in another variable, the dependent variable. It is also known as experimental or treatment variable. In experimental research, the independent variable is the variable manipulated by the experimenter. The independent variable is the variable in whose effect the researcher is interested. If in a study, a researcher wants to determine the effect of using teaching aids on students' mathematics achievement, then the independent variable is teaching aids. The aids can be varied from group to group and the effect determined.

Other examples of independent variables in educational research include method of instruction, type of reinforcement, frequency of reinforcement, type of learning materials and size of learning group, to mention a few.

A **dependent variable**, on the other hand, is a characteristic that measures the influence of the independent variable. It is also referred to as the effect, criterion variable, or post-test. The dependent variable is the outcome of the study or the change or difference between groups that occurs as a result of the manipulation of the independent variable. It is referred to as the dependent variable because it is "dependent" on the independent variable. That is, whatever change is observed in the dependent variable depends on the independent variable. In the example of research given above, the dependent variable is achievement in mathematics.

Other examples of dependent variables in education include performance, attitude, aptitude, and behaviour. These are variables that change as other variables change.

It is important to note that the terms independent and dependent variables are best applicable in experimental and causal comparative studies.

5.2.2 Extraneous and Confounding Variables

A variable is said to be an extraneous variable when it affects the outcome of the independent variable but is unknown to the researcher and therefore not controlled by the researcher. Extraneous variable tends to control or impact the effect of an independent variable. A confounding variable is a type of extraneous variable that affects the outcome of the independent variable systematically. In an experimental study, involving the effect of two methods of teaching, "teachers" may serve as a confounding variable in the sense that teachers' characteristics may affect the dependent variable in a systematic form, either bringing about an increase or decrease in the measurement of the dependent variable. In an experimental study, extraneous variables must be identified and controlled.

5.2.3 Categorical and Continuous Variables

Categorical variables are variables that assign a person or an object to a group using specific characteristics or properties. They can be said to be group variables. Some categorical variables are dichotomous while others are not. Dichotomous variables can take only two forms. Dichotomous categorical variables include gender (male, female), dead/alive, and high/low, pas/fail. Other categorical variables include occupation, religious denomination one belongs to, nationality or level of education. They are measured on the nominal scale. Discrete variables are related to categorical variables. They can take the form of whole units or groups.

Continuous variables, on the other hand, are variables that take infinite number of values within a given range of scores. That is, they are variables that can take on any value. For instance in measuring the age of a person, we can get 150. 50 kilograms or 120.25 kilograms. That is the measurement can take on any value. Thus categorical variables are assigned numbers to indicate the magnitude of the characteristic present. Other examples of continuous variables are achievement, aptitude, attitude, weight, and height. They are usually measured on interval or ratio scales.

The distinction between categorical and continuous variables is pertinent in determining how one should analyse research data collected. This is because the scale on which data are measured determines how to analyse the data.

In this session, we defined what is a variable and gave examples of variables. We went on to describe different types of variables and their characteristics. We noted in particular independent and dependent variables, extraneous and confounding variables and categorical and continuous variables.

Self-Assessment Questions

Exercise 1.5

(1) An example of a continuous variable is
   (a) Height
   (b) Method of instruction
   (c) Nationality

(2) Which of the following variables can serve as dependent variable?
   (a) Type of reinforcement
   (b) Attitude
   (c) Method of instruction

(3) A variable that can be described in terms of kind only can be said to be
   (a) continuous.
   (b) categorical.
   (c) extraneous.

(4) A variable that can take only two forms is known as a
   (a) continuous variable.
   (b) dichotomous variable.
   (c) extraneous variable.

Use the problem statement below to answer items 5 and 6.
"The purpose of this study was to examine the impact of systematic cooperative learning and test-taking strategies on one component of academic performance, the recall of text material".

(5) Which type of research was done?
   (a) Applied research
   (b) Basic research
   (c) Research and development

(6) What is the dependent variable in the study?
   (a) Cooperative learning
   (b) Recall of text material
   (c) test taking strategies

(7) What is/are the independent variable in the study?
   (a) Cooperative learning
   (b) Cooperative learning and test taking strategies
   (c) Performance

SESSION 6: THE RESEARCH PLAN

In the first session of this Unit, we discussed the characteristics of research. Do you remember some of those characteristics? Well one of the characteristics we discussed is that research requires a plan. In that session, we explained that research like any purposeful activity requires a plan. For any researcher to be successful in his/her attempt to conduct a good research, the researcher needs to prepare a plan. This plan in research language is known as a research proposal. In doing your project, you may be required to develop a plan for the project. In this session, you will learn about the essential elements of a research proposal and their relevance.
You are to note that some of the terms and concepts may be new to you but you should not worry about not understanding all of them at ago. Most of them are explained in detail in later Units of the course.

Objectives

By the end of the session, you should be able to:

(a) define a research proposal;
(b) state the importance of research proposal in executing a study;
(c) list the major elements of a good research plan; and
(d) explain the major elements of a research proposal.

6.1 Research Proposal and its Importance

In Session One, we explained that research in a scholarly sense is a systematic investigation to increase knowledge and/or understanding of phenomena by which means we push back the frontiers of human ignorance. A research proposal is a detailed formal plan or scheme of how to carry out a study. In other words, a research proposal describes in detail how to investigate a given problem.

Like any purposeful activity, conducting research requires a plan. As we are all aware, when you want to put up a building, you need to prepare and give the constructor or the mason the plan of the building. It is not surprising that one of the characteristics of scientific inquiry identified by Leedy (1974) is that research requires a plan. As Gay (1992) puts it the "development of a research plan is a critical step in conducting research" (p. 89). It is not expedient to set out on the journey of research without a plan hoping naively that somehow, in some way, the truth being sought will be discovered. This does not rule out accidental discoveries - (the serendipity pattern in research). The important point is that for a meaningful research, there must be a plan so that the researcher can proceed purposively.

THE RESEARCH PLAN

A research proposal is important for several reasons. We proceed to discuss six of the reasons why it is important to prepare a plan when you want to embark on a research.

First, a research proposal makes the researcher think through every aspect of the study, including making his/her intention known to others, the problem to be studied and the methodology to be employed. It also helps the researcher to identify the materials and resources needed for the study for the commencement of the study.

Second, the proposal serves as a guide for conducting the study. The research plan or proposal is like a building plan for the mason, which the individual researcher can follow in executing the study. Without it, you may sometimes digress from what you originally thought of doing. This does not mean that when you prepare a plan you follow it rigidly in carrying out the study. Some modifications are done, if it will result in a more credible conclusion.

Third, the preparation of a research proposal saves time for the researcher. Once a researcher goes through the preparation of the plan, the steps to be taken the materials to be needed are all taken care of such that one does not get to a stage and has to pause to really plan things and secure things at that stage. It saves the time for supervisors too, since they have ideas about what the student is doing before hand and advise them according before the study begins.

Fourth, by planning a research a head of time, the probability of making avoidable mistakes in carrying out the study is reduced. This is because once you set out to prepare a research plan, you will think through some of the obstacles you are likely to come across and the likely mistakes you can make. You will benefit from the mistakes of other people in the area of study through reviewing their studies.

Fifth, preparing a research proposal results in a higher quality of research. All the panning that go into the write up of the proposal will ensure that the final product of the study has high level of quality. The high quality also stems from the fact that once the plan is made available to people to read (e.g., supervisors and peers), they may make some inputs in terms of suggestions for the improvement of the study.

Sixth, the research proposal facilitates evaluation of the proposed study by the researcher and by others. The evaluation is based, in some cases, on whether the basic idea of the study seems to be a good one and the strength of the case that is made for the study in the proposal itself is acceptable.

For the above reasons, among others, research proposal is important in any meaningful study.

6.2 Essentials of a Research Proposal

It is important note from the outset that, agencies and institutions have their requirements for research proposals. For example, the Faculty of Education, at the University of Cape Coast, has an approved standard component of a research proposal for undergraduate projects, master's theses and doctoral dissertations (see Appendix A). You will be expected to follow the style and the format in presenting your proposal and research report. You will need the Faculty's brochure on project writing to guide you when you are about stating your project. It can be obtained from the Dean of Education Faculty's Office at Cape Coast.

Nevertheless, whether you are preparing a proposal for an agency for your undergraduate project the proposal should be written so that its objectives, theoretical framework, and methodology are made intelligible to a well-informed specialist and non-specialist alike.

Generally, research proposals have four main component parts. These are introduction, methodology, time schedule, and the budget. However, for this course the emphasis will be placed on the introduction and methodology.

6.3 Introduction Section of a Proposal

The introduction section of a proposal puts the study into perspective. It describes the background to the problem, states clearly what specific issue, problem or question the researcher wants to investigate, how the study relates to literature in the area of study, and the statement of the specific hypotheses or questions to be tested or answered.

Proposals will vary in terms of emphasis with regard to the above mentioned aspects of the introductory part of the proposal depending on whether the problem is given or not. In cases of undergraduate projects where the individual student moots the idea of the study, the issue of clearly stating the background to the problem and its statement is crucial. The description of the background should be concise and help the reader to understand and appreciate the specific problem to be investigated and its objectives. The background description may be historical and must include relevant literature. In fact, in practice, you must review literature review before stating the background to the study and the problem as well as the formulation of the hypotheses and /or questions.

6.3.1 Statement of the Problem

The statement of the problem directly follows the description of the background to the study. It is a concise statement of the problem the study is addressing, including its scope. The statement of the research problem is very pertinent and must be considered with all the seriousness that it deserves. A research problem can be defined as an issue in need of investigation. Thus, problems spring from puzzling experiences. However, a vague feeling that something is wrong or that some theory or policy is not adequate does not constitute a problem. Such a situation is an indication that a problem may exist. Before you proceed with your proposal you must isolate, sharpen, and clarify the pertinent variables and relationships that give rise to the problem statement. This you can do by reviewing the related literature. This will help you put the problem in appropriate theoretical framework or context.

The statement of a problem should indicate the variables of interest to the investigator and their relationships, as well as the subjects of study. A research problem can be stated in different ways. Three examples of problem statements are as follows:

- The problem to be investigated in this study is secondary school teachers' attitudes toward school-based assessment in Ghana.
- The purpose of this study is to investigate the effect of the CHILDSCOPE
  Project on drop out rates in implementing districts in Ghana.
- This study is to investigate the effect of kindergarten attendance on pupils' reading performance at class one.

Even though the researcher has to evaluate the entire proposal at the end, it is expedient to evaluate the problem in terms of its appropriateness. MacMillan (1996) identified six criteria that can be used to evaluate a research problem. In relation to the six criteria, the researcher should ask him – or her-self the following questions and if the answer to each of them is yes then the proposed problem is a good one.

- Is the problem researchable? (i.e., the problem should be such that you can collect data, organise data, analyse data to solve it).
- Is the problem important? (i.e., significant to practice, policy or theory)
- Does the problem indicate the type of research? (e.g., experimental or non-experimental).
- Does the problem specify the population? (i.e., the target group of study).
- Does the problem specify the variables of interest? (e.g., achievement, attitude, aptitude, perception).
- Is the problem clear? (i.e., devoid of ambiguity).

We want to emphasize that a good problem statement should have most if not all the characteristics mentioned above. The next Unit discusses the research problem in detail showing you how you can come by a meaningful research problem. In this session our concern is to introduce you to the essential element of a research plan.

6.3.2 Hypotheses/Research Questions

After stating your research problem and making sure that your problem is a good one by evaluating it, you must formulate either the relevant research hypotheses or research questions. The hypotheses or questions must be directly related to the research problem under consideration. You will recall that when discussing the characteristics of research, we noted that the main problem is solved through sub-problems. These sub-problems are what you restate as research hypotheses or questions, depending on the problem.

Hypotheses are educated guesses or conjectures that are testable. Hypotheses are formulated usually in quantitative research while research questions are used in qualitative research and evaluations. Quantitative research, however, can involve the formulation of both hypotheses and questions. Depending upon the problem of study, the researcher should state the specific hypotheses or questions of the study. This is in line with the fact that research deals with a main problem through sub-problems. It is expedient to divide the main problem into appropriate sub-problems and formulate hypotheses or questions to cover them.

Hypotheses must be stated in a research form and a null form. It is appropriate to state your hypotheses in both ways. You will learn more about hypotheses statement in the next Unit. As a researcher you may be interested in the research hypothesis (substantive hypothesis), but it is the null hypothesis that will assist you to reach a decision on whether to accept the research hypothesis or not.

If a study is qualitative, questions and/or objectives may be formulated as it may be in evaluation research, for example. It is worthy of note that the research hypotheses may be stated in a directional or non-directional form. This is guided by review of related literature. A directional form is written if you believe that the relationship will be in a particular direction. An example of a directional research hypothesis is “there is a positive relationship between secondary school students’ performance in mathematics and physics”. If you are not sure about the direction then the research hypothesis must be stated in a non-directional form. The equivalent non-directional research hypothesis is “there is a relationship between secondary school students’ performance in mathematics and physics”. The direction of your hypothesis has implications for the probability level you will use for your data analysis, particularly the power of the test. A one-tailed test (i.e., directional) is more powerful than a two-tailed test.

You can evaluate your research hypotheses using the following questions (McMillan, 1996):

- Is the hypothesis stated in a declarative (statement) form?
- Is the hypothesis consistent with known facts, previous research, and theory?
- Does the hypothesis state the expected relationship or difference between two or more variables?
- Is the hypothesis testable?
- Is the hypothesis clear?

You will learn more about how to state a hypothesis in the next Unit of this course.

6.3.3 Significance of the Study

Even though the problem may be clearly stated, there is the need to explain to the reader the significance of the study. That is, it should be clear as to why the problem should be investigated. You need to explain how the results of the study will be useful in terms of how it will influence practice, inform policy or contribute to theory. The review of related literature is a useful source for this.

6.4 The Methodology Section of the Proposal

Having satisfied yourself that your proposed problem is a good one by candidly answering the above questions and also establishing its significance, you proceed to discuss in detail how you propose to carry out the study. This is the methodology part of the proposal. Methods and/or techniques should be described in detail and be appropriate for addressing the problem.

The methodology section of a research proposal describes subjects/participants (respondents) of the study, the design, research instruments and procedures to be followed, including how you will analyze data collected to test each hypothesis or answer each research question. Generally, it is required that the description of the methodology must be particularly clear and precise to permit replication. When written well, the method section of a proposal becomes Chapter 3 in most project or thesis reports, just as the introduction section becomes Chapter 1.

In a study, a researcher may be interested in a group of elements or cases, whether individuals, objects, or events, that conform to specific criteria and to which he/she intends to generalize the results of the research. The group becomes your target group. The target group is the population of study. In the methodology section of the proposal, you have to define your population (target group) of study and explain why it is relevant for the study. An example of a target group is all elementary school teachers in Cape Coast Municipality. If all members of the target group are not accessible then it will be expedient to define the accessible population in addition to the population of study.

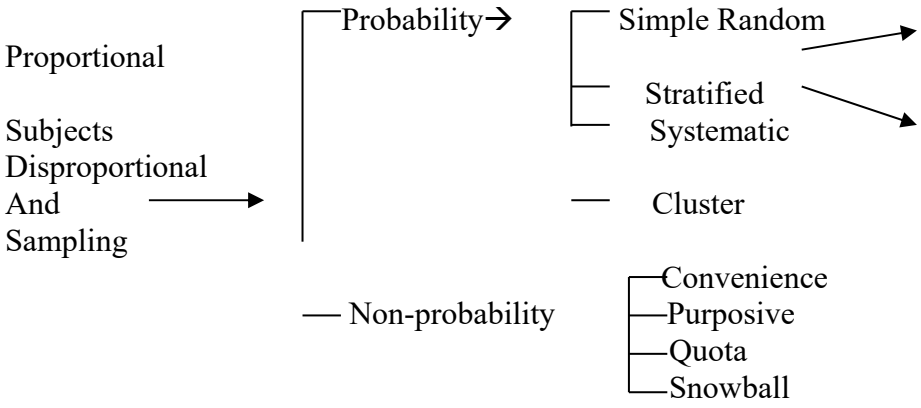
You partly take care of the population if in your problem statement the population of study is made clear. If the population is going to be studied without selecting a subset (a sample) of it then you need not think about selecting a sample for the study. On the other hand, if you are going to select a sample then you must describe the process of selecting the sample in the procedure section. For you to be able to generalize the results of your study, a representative sample is required.

6.4.1 Sample Size and Sampling

If a study will involve a sample, then you need to determine the sample size. Appropriate sample size is needed for the credibility of the results. The sample size is also important in making sure that your study is able to detect an impact if there is any. In sample surveys of very large populations, one to five per cent of the population will be adequate for a study when the sample is well selected to be representative of the population. Generally, the larger the sample the better the results of the study. For statistical analysis, a sample size of 30 or higher is considered to be large. This brings us to the issue of sampling.

A sample can be selected using a probability or non-probability method. Probability methods include simple random sampling, stratified sampling, systematic sampling, and cluster sampling. Examples of non-probability sampling are convenience sampling, quota sampling, purposive sampling, and snowball sampling. The diagram below shows the sampling procedures.

Sampling Procedures



The specific sampling procedure must be selected based on the characteristics of the population and the practicality of the sampling process, bearing in mind that the selected sample should be representative of the population. You will learn more about the different types of sampling procedures in Session 3 of Unit 3.

6.4.2 The Design

The investigator needs to state and describe the proposed design. Generally, the design is the specific strategy you will employ in collecting, analyzing and reporting the research. For example, if a study is an experimental research, you must select a specific experimental research strategy that you think is appropriate to carry out the study. You will learn about the different designs in Unit 3. The design must be appropriate to enable you to collect relevant data to test your hypotheses or answer your research questions. The problem, if well stated, gives direction as to the appropriate design to be used. Basic designs in education include experimental, quasi-experimental and non-experimental. The diagram below shows the basic designs. The specific designs under each categorization have not been shown. You will learn more about some of them in Unit 3.

Basic Research Designs

Research Designs → control of factors)
- → Experimental (Involves manipulation and
- → Quasi-Experimental (Involves the use of intact groups)
- → Non-experimental (No manipulation or control of variables)

But to give you some ideas about what these designs are we explain them briefly in the following paragraphs.

Experimental design involves manipulation of factors that may affect subjects' behaviour while at the same time controlling any other factor(s) or phenomena that may affect the subjects' behaviour by confounding the results. Essentially, the difference between experimental and quasi-experimental designs is the random assignment of subjects to treatment groups. While in purely an experimental study you randomly assign subjects to treatment groups in quasi-experimentation, subjects are not randomly assigned to groups but rather intact groups are used such as classrooms or whole schools.

In the use of non-experimental design, the investigator does not manipulate or control factors that may influence the subjects' behaviour or performance. Examples of non-experimental designs are descriptive surveys, correlational study, ex post facto (causal comparative), case study, and analytical research (historical and philosophical study).

Note that when you prepare a proposal, you need to state your design and show its appropriateness to the solution of the proposed problem. In other words, your design should match the problem. It is also useful to discuss the strengths and limitations of the design, particularly when you are preparing a project or theses proposal.

6.4.3 Instruments/Tools

The instruments that you will use to collect data must be described in the proposal. By instrument, we mean research tools such as a questionnaire, interview schedule, observation guides or tests. If multiple instruments are involved in the study you must describe each. If you are going to use an available instrument you need to show evidence of its reliability and validity for your study. If no instrument is available for your study and you have to develop an instrument then you need to explain how the instrument will be developed and what it will measure. Such an instrument must be pilot tested and validated before use. The process of developing the instrument must be clearly explained in the proposal. It is necessary to state when each instrument will be used or administered and for what purpose. Any other instruments that you will use in the study must also be described.

6.4.4 Data Collection

The procedure section of the methodology should concisely describe how you would collect your data step by step using the instruments. If a pretest or baseline data collection is necessary it must be indicated, including when and how and by which instrument? This applies equally to post test data collection. If some people will assist you, there may be the need to train them. That is, the assistants must be given some type of orientation that explains the nature of the study and the part they will play in it. They should understand exactly what they are going to do and how they are to do it. For instance, when the study involves interviewing participants then there is the need to train interviewers and let them take part in mock interviews until they acquire the necessary level of skills and competencies in interviewing. This must be made clear in the proposal including the number of assistants.

6.4.5 Analysis of Data

The last section of the methodology section of a proposal should explain to the reader how data collected would be analysed. For quantitative studies the researcher may have to employ statistical procedures in analysing the data. The choice of the specific type of analysis depends on (1) the scale of measurement to be used in collecting the data and (2) the characteristics of the data to be collected in terms of meeting or not meeting the conditions/assumptions underlying the use of the chosen statistics. The use of inappropriate statistical procedure to analyse the data can result in a wrong conclusion. Usually, it is expected that for each hypothesis, the researcher should indicate the specific statistical analysis he/she proposes to use to test it.

In your case, you may use only descriptive statistics or percentages to analyze your data. Unit 5 deals with data analysis in detail.

For qualitative research, content analysis and other methods can be used to analyse the data. Again Unit 4 treats the specific procedures in detail. The important issue here is that the researcher must show in his/her proposal how each hypothesis will be tested or how each specific research question will be answered using data collected. Data analysis goes with interpretation of the results. There must be an indication of how you intend to interpret the results and the implications of what the results say. That is, the proposal should include a summary of the anticipated conclusions and implications in light of the proposal findings and previous research.

6.5 Evaluation of a Research Proposal

It is useful to evaluate your proposal before submitting it to your supervisor for consideration. You can use both informal and formal ways to evaluate the proposal. Informally, you can review the proposal several days after you had written it. You can also give it to a colleague or an expert to review. By this process you will benefit from the insights of others in terms of improving the proposal before submitting it to your supervisor.

Formal evaluation of a research proposal involves a pilot study - a mini study or a sort of dress rehearsal. In this case, the entire study is conducted in a miniature form. Weaknesses discovered during the pilot study are corrected in the proposal. The proposal must be written in the future tense. A complete proposal should provide relevant references.

In this session, you learnt about research proposal, its importance in the research process and the essential elements of a research plan. The essential elements include the problem statement, the research hypotheses or questions and the significance of the study among others. These form the introduction section of the plan. The second major section of the plan is the methodology to be employed. In this section, the design to be used, the population of study, the sampling procedures, the data collection procedures as well as the plan for analyzing data is described.

Self-Assessment Questions

Exercise 1.6

1. A research proposal is a plan of how a study is to be conducted.
   (a) True
   (b) False

2. Without preparing a research plan, a researcher is not likely to proceed systematically in conducting a study.
   (a) True
   (b) False

3. A research proposal should indicate the results of the study.
   (a) True
   (b) False

4. The introduction section of a proposal should clearly indicate the following, **except**
   (a) design to be used.
   (b) problem to be investigated.
   (c) research questions.

5. Which type of research will warrant the formulation of research hypotheses?
   (a) Qualitative research
   (b) Quantitative research
   (c) Both quantitative and qualitative research

6. In writing a research proposal, the researcher must indicate the research instrument he/she will use as well as how valid the instrument is.
   (a) True
   (b) False

7. A research problem statement should indicate the following, **except** the
   (a) expected results.
   (b) target group.
   (c) variables of interest.

8. The data analysis section of a proposal must indicate how each hypothesis is to be tested.
   (a) True
   (b) False

THE RESEARCH PLAN

This is blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics if any.

UNIT 2: THE RESEARCH PROBLEM

Unit Outline

Session 1: The Research Problem and its Characteristics
Session 2: Sources of Research Problems and their Statement
Session 3: Research Hypotheses and Questions
Session 4: Literature Review: Secondary Sources
Session 5: Literature Review: Primary Sources
Session 6: Writing the Review Chapter

Hello! You are welcome to the second unit of this Course Book. I hope you have enjoyed reading, studying and doing what is expected of you in the previous unit. That is good.

In the first unit, you remember that we considered among other things, the nature of research where you learnt that research take many forms. We also looked at the sources of knowledge. We then moved to the role of research in education. Classification of Educational Research was also learnt. The last two sessions covered variables in educational research and the research plan respectively. In this unit, we shall look at the research problem. We start by looking at the characteristics and the sources of the research problem in the first two sessions. This will be followed by the research hypotheses and questions. The sources of literature review – the secondary and primary sources, as well as writing the review chapter is the focus of the other sessions in this unit.

Unit Objectives

By the end of this unit you should be able to:

1. State a research problem as the relationship between two or more variables
2. Identify some sources for locating a problem or a topic.
3. Give some examples of potential research problems in education.
4. Distinguish between researchable and non-researchable hypothesis and questions.
5. Identify literature sources and their characteristics.
6. Write a review chapter.

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 1: THE RESEARCH PROBLEM AND ITS CHARACTERISTICS

You are welcome to this session. In this session, we will be looking at the research problem and its characteristics. An explanation of what a research problem is would be offered. We will also discuss the characteristics of a problem. How the research problem is stated, as well as some examples of potential research problems in education would be offered. Even though some of the terms may appear "big and unfamiliar", do not worry. An attempt would be made to explain them in their simplest forms.

Objectives

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

(a) explain the term research problem;
(b) identify the characteristics of a good research problem;
(c) state a good research problem; and
(d) give some examples of potential research problems in education.

Now read on …

1.1 The Research Problem

A research study begins as a question that the researcher would like to answer or a problem that the researcher would like to solve. A problem may usually imply that a controversy or difference of opinion exists. It is the desire to find a solution to or investigate this problem (or question), which motivates the researcher to undertake the study. The problem that motivates the researcher to undertake his/her study is what is known as the Research Problem.

In order to understand the term research problem better, let us look at how some authorities in the field of research have explained it. Frankel & Wallen (2000) note that a research problem is the focus of a research investigation. In fact, it is exactly what its name implies – a problem that a researcher wishes to investigate. Polit & Hungler (1995) indicate that a research problem is exactly that issue which someone would like to research.

Now let us look at some problem situations. What is a problem? Write your answer in your jotter. Compare your answer to the following. A problem can be anything that a person finds unsatisfactory or unsetting; a difficulty of some sort; a state of affairs that needs to be changed; anything that is not working as well as it might. We need to note that problems involve areas of concern to researchers. As educators, we want to improve our conditions and we want to eliminate difficulties. Questions for which we seek answers are part of the problems we encounter.

THE RESEARCH PROBLEM AND ITS CHARACTERISTICS

Is there any condition you want to improve in your school, environment or community? What are some of these difficulties you would wish to eliminate in your work place? Are there some questions that you are seeking answers? List a condition, difficulty and question for FTF meeting.

1.2 Characteristics of a Good Research Problem

Although selecting a research problem is often one of the most difficult steps in the research process, it is unfortunately the one for which the least guidance can be given. No rules have been established for making a final selection of a research problem. In fact, problem selection is not subject to some degree of technical rules or requirements as are research design, measurement or statistics. Fortunately, however, some guidelines could be offered.

Write any two guidelines that must guide a problem statement in your jotter. Compare your response to the following characteristics of a problem statement.

1. It should ask about a relationship between two or more variables

A good problem statement of any simple study must name the variables and how they may be related in a single sentence. For example, the problem "How many students in Cape Coast Municipality JSSs can perform above average in mathematics" makes no attempt to deal with a relation between variables. If however the problem is worded, "Are boys more likely than girls to perform better in mathematics in Cape Coast Municipality JSSs?" then it would involve the relationship between the variables of "gender and "mathematics ability".

Give another example of a problem that deals with no relationship between two or more variables. Reword the problem to make it ask about a relationship between two or more variables for FTF discussion.

2. It should be clearly and unambiguously stated

The importance of a clear concise research problem cannot be overemphasized. Can you offer any one reason why the research problem should be clear and stated in unambiguous form? Now read on.

One purpose of the research problem is to communicate the purpose of the study. This can occur only when the reader's understanding of the purpose is consistent with the researcher. The terms in the problem must not be ambiguous. When do we say a term/statement is ambiguous? Compare your response to this. According to Amedahe (2002) ambiguity is seen when different people reading the same thing derive different meanings from what is read. Thus, if a term or phrase can mean several things, it is ambiguous. Terms such as effect, effective, achievement, methods, curriculum by themselves are ambiguous or vague. Why is it so? Don't answer, read on.

These terms are too general and should be defined specifically so that their meanings are clear. The terms can be given operational definitions or qualified to make them clearer. The researcher as well as other researchers and readers must know precisely the problem that is being investigated. For instance, terms like "students and methods" could be made clearer by adding gender or course say female/male students or English/History students whiles "method" could be clarified by stating the type of methodology, say, English as a second language (ESL) methodology.

3. It should be stated in a question form

The problem statement should preferably be in a question form. Alternatively, it should be in the form of an implicit question such as "the purpose of this study was to determine whether …". Let us consider the following examples of statement of a problem in a question form:

i. What is the relationship between socio-economic background and school dropout rate?
ii. Can students who have had pre-training be taught a learning task more quickly that those who have not had pre-training?

Problems stated or given in the form of implicit question include:

i. The purpose of the study is to find the effect of socio-economic background on academic achievement
ii. The study investigated whether the ability to discriminate among parts of speech increased with chronological age and education level.

Give an example each of a problem stated in a question form and implicit question form. Write your answer in your jotter for FTF discussion.

4. It should be researchable

When do we say a problem is researchable? Read on.

A problem is said to be researchable when it is possible to collect data to answer the questions asked. A researchable problem is one that can be investigated through the collection and analysis of data. In other words, it should be possible to construct a potential solution to the problem that can be verified by the collection of certain evidence or disconfirmed by the collection of other evidence. Problems that are concerned with value questions or philosophical ideas are not researchable in the sense that a specific question has a correct answer. Many interesting questions in education concern ethical issues that do not lend themselves to easy scientific study. To be able to conduct research, the question must lend itself to the systematic process of gathering and analysing data. Research can assess how people feel about such issues but cannot resolve them. Consider the following examples:

(a) Charity begins at home
(b) The evil that men do lives after them

Are these two statements researchable? Give reasons to your response. Compare it to the following:

The questions are not researchable because they are philosophical in nature and it is not possible to collect data to investigate them.

5. The problem should not represent a moral or ethical position

The research problem must not involve physical and psychological harm or damage to human beings or to the natural social setting or environment of which they are part. Questions about ideals or values are often more difficult to study than questions about attitudes or performances. Examples of such problems that would be difficult to study or answer clearly include "should children be seen and not heard?"

Problems such as "Should people avoid cheating/lying under all circumstances?", and "Are all teachers/chiefs equally inspiring?" represent moral and ethical issues and should be avoided.

6. The problem must be significant

The solution to the problem must not be a trivial one. It should be seen as adding information to the present state of knowledge either in theory or practice. The solution of the problem should contribute to extension, refinement or revision of a theory or contribute to improvement of the educational process in terms of practice or policy. Amedahe (2002).

7. The research into the problem must be feasible

The feasibility here implies:

i. The researcher should be able to get the necessary financial support or has the necessary funds available as will be required by the study.
ii. The researcher would be able to complete its study in good time. It must be noted here that good time may depend on the duration of one's programme or the time available for one to submit his/her research report.
iii. The researcher has adequate knowledge of the required research design and statistical procedures for the study.

To be sure of the goodness of your problem, McMillan (1996) identified six criteria that could be used to evaluate a research problem. The criteria in question form are:

1. Is the problem researchable?
2. Is the problem important in terms of contributing to understanding of the issues being investigated?
3. Does the problem indicate the type of research?
4 Does the problem specify the population (target group) of the study?
5. Does the problem specify the variables of interest?
6. Is the problem clear?

If your answer to each question regarding a problem statement is yes, then the problem is a good one.

Dear student, we have spent time in discussing the research problem and its characteristics. You are very much aware that no aspect of conducting a research study is more unnerving to the student than the selection of the research problem. An understanding of the concept is very paramount to the prospective research student. Among the areas discussed were the characteristics of a good research problem. Examples of research problems in education were also given.

Self-Assessment Questions

Exercise 2.1

1. The problem which motivates the researcher to undertake his/her study is known as the research problem.
   (a) True
   (b) False

2. A problem is anything that a person finds unsatisfactory or a state of affairs that needs to be changed.
   (a) True
   (b) False

3. There are established rules that govern a final selection of a research problem that every researcher must know.
   (a) True
   (b) False

4. The research problem must be ambiguous and complex so that readers would spend time to understand, as a way of making it researchable.
   (a) True
   (b) False

5. The significance of a topic implies, it must be capable of adding new information to the present state of knowledge.
   (a) True
   (b) False

THE RESEARCH PROBLEM AND ITS CHARACTERISTICS

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 2: SOURCES OF RESEARCH PROBLEMS AND THEIR STATEMENT

This session is concerned with the sources that are commonly used to begin the process of problem formulation. You should note that coming up with a good research problem is usually a difficult and time-consuming task. There is no single strategy for identifying research problems that works best for all the investigations.

The session explains to you the several sources that have been useful to most researchers. It will also look at how the problems are stated.

Objectives

By the end of the session, you should be able to:

(a) identify the sources of research problems;
(b) explain the sources of research problems; and
(c) state a research problem

Now read on…

2.1 Sources of Research Problems

In session one, you learnt the characteristics of the research problem. Beginning researchers often are puzzled and perhaps even threatened by a requirement to develop a research problem. Now pause and reflect on the following questions:

i. Where, then, do ideas for research problems come from?
ii. How can a topic be selected?

In this session, some sources for locating a problem or topic would be suggested. Can you name the some sources? Make an effort. Write any four in your jotter. Compare your response to the following:

Seven sources are commonly used to begin the process of problem formation. Research problem may be obtained from any of the following sources:

i. Theory
ii. Experience
iii. Literature
iv. Ideas from external sources/experts
v. Replication/previous studies

SOURCES OF RESEARCH PROBLEMS AND THEIR STATEMENT

2.1.1 Theory

A very common source for a research problem is a theory that has implication for educational practice. Think about the theories you have been studying in your subject area. What is a theory? McMillan (1996) defines a theory as a set of propositions that explain the relationship among observed phenomena. Theories are, thus, general explanations of behaviour. It contains generalizations and hypothesized principles that should be subjected to thorough and exact scientific investigation. One approach to obtaining a research problem is to take a theory in a related area such as psychology, sociology and mathematics and develop a problem that is applicable to an educational setting. A theory in this case would suggest implications that can be further researched in educational settings.

Another way to apply theories is to directly test, revise, or clarify an existing theory. The intention here is to develop and change the theory rather than to test its implications. Can you think of a theory that has been tested, revised or clarified in your field/subject of study?

State a theory in your subject area, you would like to test, revise or clarify. Send your response for FTF discussion.

2.1.2 Experience

Every individual's everyday experience provides a rich supply of problems for investigation. Some of the best sources of ideas come from ones interest, personal and practical experiences. Recall some of the situations you met that you found puzzling or problematic. If you have ever asked such questions as "Why are things done this way?", "I wonder what would happen if…" or "What method would work better?", you may be well along the way to developing a research idea.

As a teacher you encounter many problems in the classroom, the school, or community that lend themselves to investigation. These problems are perhaps more appropriate for the beginning researcher than are problems more remote from his/her own teaching experience. There may be concerns about teaching methods, grouping, classroom management, tests and continuous assessment or a multiple of everyday experiences. What problems do school administrators face in course of their duty? List any three and compare to the following. Administrators may face problems in scheduling, communicating to teachers/workers, providing instructional leadership, generating public/community support, handling serious disciplinary issues. For the beginning researcher in particular, experience is often the most compelling source for research topics. In addition to personal experience, individuals have interests and knowledge about their profession/work that can also yield good researchable problems.

2.1.3 Literature

Ideas for research projects often come from reading the relevant and related literature. What do we mean by literature? Don't answer. Read on.

According to Amedahe (2002), by related literature, we mean all written documents including scholarly textbooks, journals, theses, dissertations related to a general issue of interest. The beginning researcher can profit from regularly reading current books and journals especially those that report the results of studies in their areas of interest. Reading published reports may help the neophyte researcher to find a problem amenable to scientific investigation. It may also help to familiarize the beginning researcher with the wording of the research problems and the actual conduct of research studies. Published reports may suggest problem areas indirectly by stimulating the reader's interest in a topic and directly by specifying further areas in need of investigation.

2.1.4 Ideas from External Sources

External sources, here, means course lecturers, project work supervisors, and development agencies like DFID, USAID, GTZ and other NGO's. External sources can sometimes provide the impetus for a research problem. Research topics/problems may be given as a direct suggestion from an external source. For example, a course tutor/faculty member/project work supervisor may give students a list of topics from which to choose or may actually assign a specific topic to be studied or researched into. Entities that sponsor funded research such as NGO's, DFID, UNICEF, USAID and ODA often identify broad or specific topics on which research proposals are encouraged. For example, in recent years NGO's and the Government of Ghana have requested a variety of AIDS – related research projects as well as research into cassava and yam at the Science Faculty and the School of Agriculture at the University of Cape Coast.

However, even when a research area is suggested, it is better for the researcher to identify the aspect of the problem that is of greatest interest to him/her. This is because curiosity is a critical ingredient in a successful research.

2.1.5 Expert

An expert here refers to anybody knowledgeable on certain issues and can therefore guide others with regard to those issues. Consulting and or talking to such experts would be helpful in identifying a research problem. This important because such experts may have knowledge on topical and contemporary issues in their field of specialization which they can share with others.

2.1.6 Replication

Have you met this word before? Look for the meaning and write it in your jotter.

Compare what you wrote with the following. A type of study is one that replicates, that is, repeats a completed study with relatively minor changes that will further contribute to knowledge by either confirming earlier findings or disconfirming them.

A researcher may, for instance, wonder whether a study similar to one reported in journal article would yield comparable results if applied in a different setting or with different subjects. Studies that are repeated for the purpose of verification are known as replication (Polit and Hungler, 1995).

Replications are, therefore, needed to establish the validity and generalisation of previous findings. It may also be needed to verify and extend the initial findings of an already published work.

Borg and Gall (1989) summarised four reasons for conducting replication studies.

1. To check the findings of a major or milestone study. Replication can confirm or disconfirm the validity of a study that produces new evidence or that reports findings that challenge previous research or theory.
2. To check the validity of research findings with different subjects.
3. To check trends or change overtime. Replications can be used effectively to see if vital findings hold overtime.
4. To check important findings using different methodologies

2.1.7 Classification of Contradictory Results

Contradictory results/findings exist on many topics in the literature. Some studies indicate one conclusion, and other studies of the same thing come to an opposite conclusion. These apparent contradictions present very good opportunities for research. Once there are contradictions on a specific issue, there is room to investigate it further for its better understanding.

2.2 Statement of the Research Problem

You have now known that a study cannot progress without the choice of a problem. You have also learnt that the problem should be carefully stated in written form before proceeding with the design of the study. Why should we do this? Hold on, do not answer. Continue your reading.

Putting one's ideas in writing is often sufficient to illuminate (bring to light) the ambiguities and uncertainties.

A good research statement of the problem should serve as a guide to the researcher in the process of designing the study. What ingredients should then be included in the problem statement? Now read on. The problem statement should identify the key study variables and their possible interrelationships, and the nature of the population of interest.

Researchers have alternative ways of expressing the research problem. Can you identify some of these alternative ways? Write your response in your jotter. Compare your response to the following:

Research problems are expressed in two main forms:

i. Statement form
ii. Question form

We shall discuss the two.

2.2.1 Statement Form

Many researchers state their research problem in the declarative form as a broad statement of purpose such as:

The purpose of this research is to examine the relationship between the retention levels of students who are taught addition of numbers using concrete materials (real objects) and those who are taught without concrete materials (in abstract).

Does this statement of purpose indicate the population of interest? Compare your answer to the following.

The statement of purpose indicates the population of interest. These are students taught with concrete materials. The independent variable is the method of teaching the addition of numbers and the dependent variable is the retention levels of the students.

2.2.2 Research Question Form

A research problem may also be presented in an interrogative form, that is, as a question. For example, the problem expressed in statement form above can be stated in a question form as: What is the relationship between the retention level of students who are taught with concrete materials and those who are taught without concrete materials? Another example is: What is the process by which adult children make decisions regarding the placement of their elderly parents in a nursing home?

The question or interrogative form has the advantage of simplicity and directness. Questions require an answer and help psychologically to focus the researcher's attention on the kinds of data that would have to be collected to provide that answer.

Give three examples each of declarative and interrogative forms of an identified problem in your area of work/study. Write your response neatly for FTF discussion.

We have discussed the sources of research problems and their statement. Specifically, we looked at the sources of the research problem where we discussed theory, experience, literature ideas form external sources and replication of previous studies. We have also discussed the statement of the research problem as well as the two main forms of expressing the research problem.

Self-Assessment Questions

Exercise 2.2

1. Each of the following is a criteria for a good research problem **except** that the problem
   a) is clear and concise
   b) indicates the type of research
   c) indicates the expected results
   d) indicates the variables

2. A common source for research problem is
   a) the researcher's own experience
   b) the available literature
   c) opinions from experts
   d) theory

3. A teacher encounters a problem in the classroom that leads to investigation or a research into such a problem. What source of a problem is this?
   a) Experience
   b) Opinion
   c) Theory
   d) Ideas from external source

4. Research problems that are obtained as a result of reading journals, especially those that report the results of studies in their area of interest, is from what source?
   a) Literature
   b) Replication
   c) Textbooks
   d) Development agencies

5. Research questions are stated in a declarative form.
   a) True
   b) False

6. Stating a research problem as a research question has the advantage of simplicity and direction over the statement form.
   a) True
   b) False

SOURCES OF RESEARCH PROBLEMS AND THEIR STATEMENT

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 3: RESEARCH HYPOTHESES AND QUESTIONS

This session discusses research hypotheses and questions. Your knowledge of these concepts will help you understand the two terms, distinguish between them and state them as well. They will also guide you in your search for relevant literature. By stating your hypotheses or questions clearly you will also make the goals of your study very clear and specific. This will help you to be able to identify the kinds of data that must be collected in order to answer the problem you identify.

Objectives

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

(a) define a hypothesis and research question;
(b) identify the purposes of both hypotheses and research questions;
(c) list and explain the characteristics of hypotheses and research questions;
(d) list the main types of hypotheses;
(e) identify the criteria for evaluating research hypotheses; and
(f) formulate testable hypotheses and researchable questions.

Now read on…

In session two, we discussed the sources of research problem and their statement. We said that generally study cannot progress without the choice of a problem. We also learnt that a good statement of the problem should serve as a guide to the researcher in designing the study. It was further stated that researchers have alternative ways of expressing a research problem. These are statement form and question form. Both the statement and question are often phrased concerning how phenomena are related and interact.

In research, investigators often make educated guesses about a correct solution to a problem in the form of possible relationships or differences. These guesses are stated in the form of hypotheses or questions. This session discusses research hypothesis in detail. We will specifically discuss among other things, what is a hypothesis, when researchers use hypothesis, types of hypothesis and criteria for evaluating research hypotheses.

3.1 What is a Hypothesis?

The next step after the selection of the problem is to state a hypothesis. Tuckman (1994) defined hypothesis as a suggested answer to the problem. According to Amedahe (2002), a hypothesis is an informed/educated guess about the answer to a question.

It is a tentative expectation about a correct solution to a problem, descriptions, possible relationships or differences. In research, a hypothesis is the investigator's prediction or explanation of relationships between two or more variables. In fact, it is a tentative explanation for certain behaviours, phenomena or events that have occurred or will occur as part of solving the problem. It is the most specific statement of a problem. It states what the researcher thinks the outcome of the study will be. In other words, it is the researcher's expectation of what results will show.

The following are examples of a hypothesis.

1. Intelligence quotient (IQ) and academic achievement are positively related.
2. The amount of time spent learning a task is directly proportional to the level of achievement.
3. There is a relationship between dropout rate among children in the urban and rural settings in first cycle schools in Ghana.

3.2 Importance of Research Hypothesis

Amedahe (2002); Polit and Hungler (1995) and Tuckman (1994) maintained that a research hypothesis is important in the following ways.

i. It provides a focus for the study.

ii. The research hypothesis often provides a clear framework and a guide when designing the data collection instruments and when collecting, organising, analysing and interpreting the data.

iii. It allows the investigator/researcher to confirm or disconfirm a theory and help advance knowledge. The most common use of hypothesis is to test whether an existing theory can be used to solve a problem. In everyday situations, those who confront a problem often propose informed hypothesis that can be tested to directly solve a problem. For example, when a lamp/bulb fails to light, when the switch is turned on, several hypotheses come to mind based upon our understanding of electricity and our past experiences with bulbs/lamps.

What are some of these hypotheses? Write any two. Compare your response to the following.

- The plug is not properly connected to the wall outlet.
- The bulb is burnt out.
- The fuse is burnt out.
- There is power failure.
- A disconnection by the ECG as a result of nonpayment of bills, etc.

Each of these speculations can be tested directly by checking the plug, connection, inspecting fuse, replacing burnt bulb, by noting whether there is light at near by houses, etc.

iv A hypothesis helps the researcher to know exactly what to do.

3.3 Types of Hypotheses

There are many forms and types of hypotheses, depending on their structure, goals, nature, how they are derived, or how they are stated. We shall consider two main ways of classifying hypotheses. These are described briefly below.

(a) Classification in terms of whether they are derived from inductive or deductive logic and

(b) Whether the hypothesis is stated as a research or statistical hypothesis (declarative versus null hypothesis)

These terms seem unfamiliar, do not be disturbed. You will surely understand them after reading this session.

3.3.1 Inductive Hypothesis

An inductive hypothesis is a generalisation based on observation. In induction, the researcher starts with specific observations and combines them to produce a more general statement or relationship – hypothesis. Inductive hypothesis is, thus, formed from a researcher's direct observations of certain variables, patterns, trends or associations among phenomena or behaviour and the uses of these observations as basis for a tentative explanation about how the behaviours are related to one another and how other variables such as teaching methods, curricular materials, teacher behaviour and socio-economic status. In the school situation, teachers can provide a rich source of inductive hypothesis because they can use their rich experiences and knowledge to formulate hypotheses that may explain observed relationships.

Think of any limitation of the inductive hypothesis. Write it down. Now read on.

A limitation of the inductive hypothesis is that because they depend on local data and direct observation by researcher, the generalisations are often restricted and hard to relate to a broader theory or established body of applied research.

3.3.2 Deductive Hypothesis

The other mechanism for deriving hypothesis is through deduction. Deductive hypotheses are derived from theory and thus the testing of them contributes to a better understanding of the theory or its application. Theories of how phenomena behave and interrelate cannot be tested directly through deductive reasoning. A researcher can develop scientific expectations or hypotheses based on general theoretical principles. In deduction, general expectations about events, posed on presumed relationships between variables are used to arrive at a more specific expectation or anticipated observation.

Although a full text on deductive reasoning is beyond the scope of this course, the following syllogism illustrates the reasoning process involved. Do you remember the one given in Session 2 of Unit 1 where we explained ways of knowledge?

All men are mortal.
Aban is a man.
Therefore Aban is a mortal.

In this simple example, the hypothesis is that Aban is in fact a mortal, a deduction that could be verified.

Hypotheses are also classified as being either research hypothesis or statistical hypothesis.

3.3.3 Research Hypothesis

Research hypothesis, also referred to as substantive, working, declarative or scientific hypotheses, are statements of expected relationship between variables. It states an expected relationship or difference between two variables. In other words, it states what relationship the researcher expects to verify through the collection and analysis of data. It is, thus a declarative statement of results the investigator expects to find.

Examples of Research Hypothesis

1. "Teenagers who have been sexually abused as children are at higher risk of depression and suicide than teenagers with no history of sexual abuse".
2. "Infants born to drug addicted mothers have lower birth weights than infants with non-addicted mothers".
3. "There is significant difference in reading comprehension of primary school children who participate in cooperative learning activity than those two receive regular instructions only".

A research hypothesis can be directional or non directional.

3.3.4 Directional Hypothesis

What is a directional hypothesis? Do not refer to any textbook or dictionary. Write in your own words, how you understand the term, in your jotter. Now read on.

A directional hypothesis is one in which the specific direction, such as higher, lower, more or less, that a researcher expects to emerge in a relationship is indicated. It indicates or states the nature of the expected relationship or differences. This is, here, the researcher predicts not only the existence of a relationship but also the nature of the relationship. It is used when the researcher anticipates the specific outcome of the study. For example, in a study of the two groups of pupils mentioned in the example under research hypothesis, the expectation may be that one group may score higher or perform better than the other group. In this case the researcher may formulate a directional hypothesis.

Let us look at the following examples of directional hypothesis.

1. Lower primary pupils who are given concrete teaching aid/materials in mathematics lessons would demonstrate higher achievement than pupils who are taught without teaching aids.
2. Newly trained teachers tend to be more approving of the teachers expanding role than older teachers.
3. There is positive correlation between time spent on task/activities and how well the task is performed.

Give three more examples of directional hypothesis. Write your response in your jotter for FTF discussions.

3.3.5 Non-Directional Hypothesis

A research hypothesis can also be non-directional. In your own words, describe how you understand non-directional hypothesis. Write your answer in your jotter for FTF discussion.

A non-directional hypothesis, by contrast, does not stipulate/state the direction of the relationship. Such a hypothesis predicts that two or more variables are related but makes no projections concerning the exact nature of the association. The researcher believes there will be a difference in relationship but is unsure about the nature of it.

Examples of non-directional hypothesis

1. There is a relationship between the age of a teacher and approval of the teachers expanding role.
2. Older teachers differ from younger teachers with respect to approval of the teachers expanding role.

3. There will be a difference in achievement between lower primary pupils who are given concrete teaching learning materials in mathematics lessons and their counterparts who are taught without concrete teaching learning materials.
4. There will be a difference in achievement when individually tutored children are compared to those who received group tutoring.

3.3.6 Statistical Hypothesis

The statistical hypothesis is a statement of a relationship or difference that can be tested statistically. Herman (1996) maintains that statistical hypotheses are translations of research hypothesis. It allows us to rephrase our research hypothesis in such a way that we can apply statistical procedures to them. He continued by stating that statistical hypotheses are statements that describe the population parameters our sample data will represent if the predicted relationship exists or does not exist. A statistical hypothesis is nothing more than a claim made about a population-a claim that can be subjected to testing by drawing a random sample from the population of interest.

3.4 Stating the Statistical Hypothesis

Statistical hypotheses are usually stated in what is called the "**null form**" hence, it is also known as the null hypothesis. Let us now look at the null hypothesis.

3.4.1 What is a Null Hypothesis?

A null hypothesis states that there is no relationship (or difference) between variables and that any relationship found will be a chance relationship, not a true one. A null hypothesis is, thus, a statement that differences or relationships have occurred because of chance. Normally, this is a statement of no difference or relationship.

The null hypothesis is tested and its acceptance or non-acceptance provides support or no support for the research hypothesis.

With regard to the example of research hypotheses given above, the corresponding null hypotheses are?

1. There will be no relationship between the age of a teacher and the approval of the teacher's expanding role.
2. There will be no difference between old teachers and younger teachers with respect to the approval of the teacher's expanding roles.
3. There will be no difference in achievement between lower primary pupils who are taught with concrete teaching materials in mathematics and those who are taught without concrete materials.

It is important for you to note that, usually, research hypotheses are formulated when a study is more or less quantitative in nature.

3.5 Relationship between Directional and Non-directional Hypothesis

The table below shows the relationship between directional and non-directional hypotheses.

Relationship between Directional and non-directional Hypotheses

Directional	Non-directional
1. Upper primary children like school less than lower primary children but more than JSS students.	1. Lower primary, upper primary and Junior Secondary School children have different degrees of liking school.
2. Students with academic disabilities will have more negative attitude about themselves if they are in special classes than if they are placed in regular classes.	2. There will be difference between the scores in an attitude measure of students with academic disabilities placed in special classes and such students placed in regular classes.
3. Counselees who receive client centred therapy express more satisfaction with the counselling process than do counsellees who receive traditional therapy.	3. There will be a difference in expression of satisfaction with the counselling process between students who receive centred therapy and students who receive traditional therapy.

3.6 Relationship among Research Problem, Research Hypothesis and Null Hypothesis

The table below shows the relationship among the Research Problem, Research Hypothesis and Null Hypothesis.

The Relationship among the Research Problem, Research Hypothesis and Null Hypothesis

Research Problem	Research Hypothesis	Null Hypothesis
1. What is the effect of mainstreaming workshop on the attitude of teachers towards mainstreaming?	Teachers' attitude towards mainstreaming will improve as a result of attending a workshop on mainstreaming.	There is no difference in teachers' attitude towards mainstreaming measured before a workshop on mainstreaming compared to their attitudes after the workshop.
2. Is there a relationship between teachers' attitudes towards the curriculum and students achievement?	There is a positive correlation between teachers' attitude towards the curriculum and students achievement.	There is no correlation between teachers' attitudes towards the curriculum and students achievement.
3. Is there a difference in achievement between students who are given highly detailed written comments on their work compared to students who are given grades only?	Students receiving highly detailed written comments on their work will show higher achievement than students given grades only.	There is no difference in achievement between students receiving highly detailed comments about their work compared to students receiving grades only.

3.7 Characteristics of a Good Research Hypothesis

By now it should be clear to you that a hypothesis, ideally, should be based on a sound rationale. You would have noted that, hypotheses have to meet a number of standards. Write any two of such characteristics that will make a research hypothesis a good one. Now read the following.

Hypothesis can be in any form except in the form of a question. The form notwithstanding, they have to meet a number of standards. In general, hypotheses are required to demonstrate the following characteristics (Amedahe, 2002; Gay, 1991; Polit and Hungler, 1995; Sarantakos, 1998).

1. The research hypothesis should be empirically testable. Being testable means being verifiable. That is, it can be empirically verified as right or wrong. It should be possible to support or not support the hypothesis by collecting and analysing data.

2. A good hypothesis should normally be testable within some reasonable period of time. For example, the hypothesis that requiring nursery pupils to brush their teeth after lunch everyday will result in fewer people with false teeth at age 60, would obviously take a very long time to test and the researcher and some respondents might very likely be dead before the study was completed.

In addition to the above, McMillan (1996) has offered 7 criteria for evaluating the research hypothesis.

1. The research hypothesis should be stated in a declarative form and not in a question form. A question cannot be a hypothesis.

2. The research hypothesis should be consistent with known facts, preview research and theory. The research hypothesis should follow from other studies and established theories. In general, it should not contradict previous research but rather should build on related literature. The result should contribute to an established body of knowledge.

3. The research hypothesis should follow from the research problem. Do not use variables in the hypothesis that have not been identified by the research problem. Generally, a problem may include several variables and thus several research hypotheses may be derived to indicate all the anticipated relationship.

4. The research hypothesis should state the expected relationship between two or more variables. A hypothesis must have at least two variables and must indicate how the variables are related.

5. A research hypothesis should be testable.

6. The research hypothesis should be clear. Similar to the terminology used in research problems, words, phrases, and descriptions in the research hypothesis should be unambiguous. A clear hypothesis is easier for the reader to understand and easier for the research to test. Vague terms and jargons should be avoided.

7. The research hypothesis should be concise. The hypothesis should be sufficiently detailed to communicate what is being tested and of the same time be as succinct (i.e. expressed in few words) as possible. A concise hypothesis is easier to comprehend.

Dear learner, we have spent time in this session looking at the research hypotheses and questions. We have identified the purpose of the research hypothesis and the research question. We also looked at the characteristics as well as the main types of hypotheses. The criteria for evaluating the research hypotheses were also considered.

Self-Assessment Questions

Exercise 2.3

1. A statement of predicted outcomes of the study is called the
   (a) null hypothesis.
   (b) research hypothesis.
   (c) research problem.
   (d) statistical hypothesis.

2. The null hypothesis states that there is
   (a) a statistical difference between the groups.
   (b) no chance for a difference between the groups.
   (c) no difference between the groups.
   (d) a small chance of a difference between the groups.

3. It is essential that the research hypothesis is
   (a) testable.
   (b) stated in question form.
   (c) follows from the research problem.
   (d) states that there is a positive relationship between two or more variables.

4. The type of hypothesis that is formed from a generalisation based on observation is known as
   (a) deductive hypothesis.
   (b) declarative hypothesis.
   (c) null hypothesis.
   (d) inductive hypothesis.

5. The type of hypothesis which states the nature of the expected relationship or differences is a
   (a) directional hypothesis.
   (b) non-directional hypothesis.

6. “There is a relationship between the number of years of schooling and the salary one receives” is an example of
   (a) directional hypothesis.
   (b) non-directional hypothesis.

7. Hypothesis can be in any form except in the form of a question.
   (a) True
   (b) False

Written Assignment/Discussion Questions

1. What are the main reasons for using hypothesis in research?
2. What is the difference between the null and research hypothesis?
3. Give two examples each to research and null hypothesis.
4. What are the criteria for evaluating the research hypothesis.

RESEARCH HYPOTHESES AND QUESTIONS

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 4: LITERATURE REVIEW: SECONDARY SOURCE

You are welcome to this session. In this session you are going to be introduced to literature review. Specifically you will be introduced to the definition, purpose and scope of the literature review. You will also be introduced to the primary and secondary sources of literature review. Secondary sources would be treated in detailed in this session whiles primary sources is considered in the next session.

Objectives

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

(a) define and explain what is meant by the term, literature review;
(b) identify the purpose and scope of the literature review;
(c) explain the secondary and primary sources of the literature review; and
(d) identify and explain secondary sources of the literature review.

Now read on…

Having happily found a suitable problem, the beginning researcher is naturally eager for action. However, it is a mistake to rush headlong into planning and carrying out a study before making a thorough survey of what is already known in the area of interest. The topic must be related to relevant knowledge in the field. It is, therefore, important for researchers to know how to locate, organise and use the literature in their field. The review of literature is at this stage seen as a necessary evil to be completed as fast as possible so that one can go on with the study. The question then, is, why do beginning researchers see the review of related literature as a necessary evil? Can you suggest an answer? Hold on. Read the following: The feeling of uneasiness on the part of the beginning researcher at this stage of the work is due to a lack of understanding concerning the purpose and importance of the review. In fact, many students are not too sure of exactly how to go about it. But the review of related literature is as important as any other component of the research process and it can be carried out quite painlessly if it is approached in an orderly manner. What is the review of related literature?

4.1 Definition of Literature Review

Before planning the details of a study, researchers usually dig into the literature to find out what has been written about the topic they are interested in investigating. Opinion of experts in the field, as well as other research studies are of interest to the researcher in performing this important duty. Such reading is referred to as a review of the literature. The review of literature involves the systematic identification, location and analysis/"digging" of documents containing information related to the research problem. Can you mention some of these documents? List any three in your jotter for FTF discussion. Let us continue.

These documents include periodicals, abstracts, reviews books, and other research reports. Don't bother yourself looking for explanations and examples of the documents listed above. We shall look at all of them later in this session.

4.2 Purpose of Reviewing Related Literature

Literature reviews serve a number of important functions in the research process. By examining some of their specific functions, we hope to clarify their value. But before that, can you list at least three (30 such purpose/values in your jotter? Now compare your response to the following. Do not throw away the response(s) you do not find in what have been listed in this book keep them for FTF discussion.

4.2.1 Avoidance of Unintentional Replication

1. A thorough search through related research avoids unintentional replication of previous studies. Do you remember the term replication? Hope you do. That is nice. Lets continue. A researcher may through the review of related literature discover that a very similar study has already been made in his/her research problem. In such a case, the researcher must decide whether to deliberately replicate the previous work or to change the proposed plans and investigate a different aspect of a problem.

Review of related literature, thus, helps to determine what has been done that relates to the problem under investigation. This leads to the avoidance of unnecessary duplication of research work.

4.2.2 Refining/Delimiting Research problem

Reviewing related literature helps researchers to delimit the research problem which results in limiting their question and to clarify and define the concepts of their study. A problem or research question may be too broad to be carried out, or too vague to be put into concrete operation. For example a problem like "the practice of continuous assessment in Ghana" would be too broad to be carried out. What is some of the aspects that can be carried out as a means of delimiting this problem? Write your answer in your jotter for FTF discussion. Now read on …… Continuous assessment in Ghana may be delimited to the following; "the classroom practice"; "teacher utilization of assessment results for decision making"; "testing practices of teachers"; "children/students/parents perception of continuous assessment". Similarly, a problem like "school dropouts" in Ghana would be both broad and vague. Literature review also helps in clarifying the concepts involved in the study and in clearly defining the terms in relation to the study. For example through review, many educational and behavioural constructs such as stress, creativity, frustration, aggression, motivation, bright and dull could be clarified and operationally defined.

4.2.3 Identifying Useful Methodology Techniques

By studying related research, investigators learn which instruments that have proved useful and those which have not been productive in investigating the particular problem and thus guide the researcher in the study. Many research projects fail because of the use of inappropriate procedures, instruments, research designs and statistical analysis. A thorough examination of the methodologies of previous studies often results in finding the reasons for the failure of past studies, as well as insight into the selection of an appropriate methodology for one's own research. Both the successes and failures of past work provide insight for designing one's own study.

4.2.4 Facilitating the Interpretation of Results of the Study

The study of related literature facilitates the interpretation of results of the study. In fact the review of related literature places researchers in a better position to interpret the significance of their own results. How does this come about? Hold on, don't answer. Read on. The researcher learns how other researchers have interpreted their results. Becoming familiar with theories of the field and with previous research, prepares researchers for fitting the findings of their research into the body of knowledge in the field.

4.2.5 Identifying contradictory Findings

A review of related literature may reveal contradictory findings that may be a fertile area in which to conduct subsequent research.

4.2.6 Developing Research Hypotheses/Questions

Appropriate hypotheses or questions are usually based on a review of literature. The literature provides a basis for a hypothesis or research question.

4.2.7 Desirable Replication

Review of related literature may suggest the desirability of replication to confirm previous findings. Do you remember the term replication? Repeating a study increases the extent to which the research findings can be generalised and provides additional evidence of the validity of the findings.

4.3 The Secondary Sources

A secondary source is a description of a study or studies prepared by someone other than the original researcher. In other words a secondary source is one that reviews, summarises, or discusses someone else's research. Review articles that summarise the literature on a topic are secondary source. When you have completed and written up a review of the literature on a topic, your document will be considered a secondary reference. If you go on to collect a new data on the same topic, however, your description of the research problem, methods, and results of the study will be a primary source reference for others doing a literature review.

Some examples of secondary sources are textbooks, scholarly books devoted to a particular topic, reviews of research in books or journals, yearbooks, encyclopaedias and handbooks. These sources would be looked at in greater detail.

4.4 Importance of Secondary Sources

Secondary sources are useful in providing bibliographical information on relevant primary sources.

They are good to start with because they provide an overview of the topic, often citing relevant research studies and important primary sources.

A limitation of secondary sources is that they are rarely possible to achieve complete objectivity in summarising and reviewing written materials. In other words it could be possible that the researcher or author did not accurately report the research since they combine the information from other secondary sources and actual studies.

We talked about the definition of literature review and the purposes of reviewing related literature. Secondary sources, their importance and limitation have also been discussed.

Self-Assessment Questions

Exercise 2.4

1. Which of the following documents can be described as a secondary source?
   a) A review of a book in a journal
   b) A report written by an investigator
   c) An article published in a refereed journal

2. The purpose of review of literature is to identify previously used methods of investigation to avoid past mistakes
   a) True
   b) False

3. The review of literature is useful for
   a) determining the direction of the study.
   b) introducing the methodology to be used in the study.
   c) resolving contradictory findings.

4. Opinion of experts in a field of study is NOT of interest to the researcher in reviewing related literature.
   a) True
   b) False

5. The review of related literature provides a basis for the formulation of hypothesis and / or research questions.
   a) True
   b) False

6. A scholarly textbook is a secondary source.
   a) True
   b) False

Written Assignment

1. State six purposes for conducting a literature search and discuss only two.

2. Why might it be unwise for a researcher not to do a review of literature before planning a study?

LITERATURE REVIEW: SECONDARY SOURCE

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 5: LITERATURE REVIEW: PRIMARY SOURCE

Once again, we welcome you to another session, dear learner. This session is the concluding part of materials on literature review and we would be looking at the primary sources. We have no doubt that you have enjoyed your readings on literature review, the secondary source. Yes, we have to deal with so much information but I have the conviction that you have found your encounter with these knowledge extremely useful. Aren't you extremely glad that at this stage you can explain to any person the term literature review, purposes of reviewing literature and above all secondary sources of literature review? In this final part, we shall focus on primary Sources of literature review, steps to review related literature, the search for primary and secondary sources and finally the criteria for evaluating the review of literature.

Objectives

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

(a) explain what primary source of literature is and the role primary sources play in research;
(b) discuss the steps to review related literature;
(c) search for primary and secondary sources; and
(d) identify the criteria to be considered when reading and evaluating the review of literature section of a research study.

Now read on…

5.1 Primary Source

References can be categorised as being either primary or secondary sources. Are these terms familiar to you? Hold on, don't respond. Now read on.

Although the distinction between primary and secondary sources of literature review, probably, is familiar to you, it is sufficiently important to merit a comment here.

Definition of Primary Sources

A review of literature involves identifying primary sources that investigate a problem or idea of interest. A primary source, from the point of view of the research literature, is the description of an investigation written by the person who conducted it. Primary sources are, thus, original articles and reports in which researchers communicate directly to the reader the methods and results of their study. They are reported in a wide variety of journals both refereed and non-refereed. For example most of the articles appearing in journals such as "Ife Psychologia" and "Ogua Educator" are mostly original research reports and therefore are primary sources.

5.2 The Role of the Primary Source

Having read the write up on primary sources of literature review, can you think of any one importance of this source? Write at least one importance of this source in your jotter. Now read on. According to Amedahe (2002), it is important to read primary sources because they allow more informed judgment about the quality and usefulness of the information. They tend not to be distorted through being summarised or reported in another form. The primary sources of literature provide sufficient detail about research studies. It is possible to achieve complete objectivity in summarising and reviewing written materials.

5.3 Steps to Review Related Literature

A set of sequential steps can be followed in reviewing literature to ensure the quality of the review and lessen the time necessary to locate the most appropriate studies. This sequence is also appropriate for learning about recent research in the area.

MacMillan (1996) identified 6 main steps in reviewing related literature. These are:

1. Locating Existing Reviews and Other Information in Secondary Sources
   Examples of secondary sources are textbooks in most major fields of education (e.g., educational psychology, reading, special education, measurement and evaluation) and scholarly books.

2. Identify Key Terms
   Once a research of secondary sources is completed and the research problem is refined, the investigator needs to make a list of key terms that represent the problem. How is this accomplished? Hold on, don't answer. Read on.

   This step is accomplished by identifying the most important terms in the problem and then thinking of other terms that are closely related. These terms are then located in appropriate indexes to find related literature. The indexes organise the literature by subject, title, key terms, and author. For example suppose your research problem is related to the teaching styles and student achievement, key terms are "teaching style" and "student achievement".

3. Identifying the Appropriate Journal Indexes and Abstracts
   Many indexes may be used to locate research on education. The most useful and comprehensive is "Current Index to Journals in Education (CIJE)" CIJE is published monthly by the Educational Resources Information Centre (ERIC) CIJE provides abstracts of articles from almost 800 journals and periodicals.

4. Search Indexes for Primary Sources
   The ultimate objective in a review of related literature is to identify primary sources that investigate a problem or idea of interest. A useful primary source is reading a book as it was originally written by the author.

5. Summarise and Analyse Primary Source Information
   Once you locate the primary source, the article or report that contains the original data collection and analysis, you will need to read it and summarise the information it contains.

What is the effective way of doing this? Read on.

It is useful to have a strategy for recording notes on the article as you read it. Begin by reading the abstract of the article, then proceed with the purpose of research problem. Read the results and decide if it is worthwhile to read the article more carefully and take notes on it. It is also useful to note or write down the full reference of your source (i.e., the author, year of publication, title of the article and the journal)

6. Organising the Review
   The review of literature can be organised in different ways. The most common approach is to group together studies that investigate similar topics and subtopics. This process is initiated by coding the studies as you read them. The articles with the same code are then put in one pile, those of another code in a second pile etc. Usually the review chapter in the thesis or project work is chapter 2. The review should be exhaustive. Generally the review chapter should be organised into three main parts. These are the introduction, body of the review and summary of the review. The introduction part explains briefly the nature of the research problem and the structure of the review chapter. It is useful to present the outline of the review in the introduction.

The body of the review reports what others have found or thought about the research problem. Related studies are usually discussed together, grouped under subheadings.

Major studies are discussed in detail while less important work are not emphasised. The review should not be reporting what others found but it should show how results from similar studies are similar or different.

The summary of the review puts together the main trends and points of the review.

5.4 The Search for Primary and Secondary Sources

How can one search for the various sources in literature? Write your response in our jotter for FTF discussion.

The search for primary and secondary sources is made in one of three ways.

1. By computer
2. By mediated online search done by a librarian or library staff
3. Manually.

5.4.1 By Computer

Technological advances now allow libraries to have indexes on computers which researchers can search by themselves. This can also be done through internet connections of the library by the researcher him/herself.

5.4.2 By Mediated Online Search done by a Librarian or Library Staff

This is the same process as the first, i.e., by computer except that librarian or library staffs typically performs these searches. This is done to help the researcher to get additional information or sources not available to all users such as interlibrary facilities.

5.4.3 Manually Search

To conduct a manual search, you must select the most recent available print index. Using the subject headings in the index, which are organised alphabetically, find the key terms you have previously identified. The index will list, by title, published articles that are related to the key term. Read through the list of titles and determine which of the articles may be useful for the review. Important information such as the name of the author(s) and journal, volume, number, date of publication and pages is recorded. Identify as many relevant articles as possible.

5.5 Criteria for Evaluating the Review of Literature

Several criteria should be considered, when reading and evaluating the review of literature section of research studies.

1. The review of literature should adequately cover previous research on the topic. To satisfy this criteria, questions that must be answered include:

Were important studies ignored or included? Does the number of studies in the review reflect research activities in the area?

2. The review of literature should cite actual findings from other studies.

   It is important for the review to be based on the empirical results of previous research, not on opinions of others about previous research or on the conclusion of previous research.

3. The review of literature should be up-to-date.
   The studies reviewed should include the most recent research on the topic. This does not mean that older studies are not relevant.

4. The review of literature should analyse as well as summarise previous studies.

   The analysis may be a critique of methodology or inappropriate generalisation, an indication of limitations of the study e.g. to certain population, instrument or procedures, or a discussion of conflicting results.

5. The review of literature should be organised logically by topic and not by author.

   A review that has one paragraph for each study usually fails to integrate and synthesize previous research.

6. The review of literature should briefly summarise minor studies and discuss in detail major studies.

   What is a minor study? Read on.

   Minor studies are those that are related to one or two aspects of the study. Major studies are directly relevant to most aspects of the study or have important implications.

7. The review of major studies should relate previous studies explicitly to the research problem or methods.

   The questions that one should ask here are, what is the implication of the review? How can it be helpful and improve subsequent research?

8. The review of literature should provide a logical basis for the hypothesis.

   If there is a hypothesis, it should be based on the review. There should be a clear connection among the problem, review and hypothesis.

9. The review of literature should establish a theoretical framework for the problem.

   For basic and most applied research, the review should provide the theoretical context for the study, so as to enhance the significance of the findings.

10. The review of literature should help establish the significance of the research.

Dear learner, we have so far discussed primary sources of literature review, steps to review related literature, how to search for primary and secondary sources and the criteria for evaluating the review of literature. These are very important in the research process. It is important to identify and read primary sources because they allow more informed judgment about the quality and usefulness of the information.

Self Assessment Questions

Exercise 2.5

1. A high quality review of literature will summarise, critique and relate the problem.
   a) True
   b) False

2. A review of literature should cover both theoretical and empirical issues related to the research problem under consideration.
   a) True
   b) False

3. The most effective way to organise a review of literature is …….
   a) to begin with the most recent studies.
   b) to structure paragraphs chronologically.
   c) by themes and sub-themes.
   d) to start with the primary sources.

4. The original articles and reports in which researchers communicate directly to the researcher the methods and results of their study are ..
   a) secondary sources.
   b) primary sources.
   c) authority.

5. Primary sources tend to be distorted through being summarised or reported in another form.
   a) True
   b) False

6. The most common approach to organising the review of literature is to group together studies that investigate similar topics or subtopics.
   a) True
   b) False

7. Publications in which authors describe the work of others are referred to as
   a) Primary sources
   b) Secondary sources
   c) Educational Index

LITERATURE REVIEW: PRIMARY SOURCE

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 6: WRITING THE REVIEW CHAPTER

Hello learner, good morning and welcome to the last session of the unit. We think you should first congratulate yourself for coming this far in this course. We have no doubt that you have found it quite challenging but we are also convinced that you have enjoyed it. We have had to deal with lots of information and I am certain that you are amazed at all the new things you have learnt about literature review. It is important that one undertakes a literature review on a subject before actually conducting a research project. Having gone through the steps involved in identifying a literature review which includes identifying potential references, locating references, reading relevant references and taken notes, organising, analysing and integrating the references; the final step is to write the review.

In this session we shall learn about writing the literature review. We would also look at the style of the review. We hope you will find the session very interesting.

Objectives

By the time you go through this entire session you would be able to:

a) discuss the parts of the literature review;
b) discuss the content of the written literature; and
c) identify the role of the reviewer.

Now read on…

6.1 Content of the Written Literature Review

Dear student, have you asked yourself what the content of the written literature review should be?

A written review of the literature should be neither a series of quotes nor a series of abstracts. The central task is to organise and summarize the references so that they reveal the current state of knowledge on the selected topics and in the context of a new study, to lay a systematic foundation for the research. The review should point out both consistencies and contradictions in the literature as well as other possible explanations for the inconsistencies.

As has been mentioned earlier, studies that are particularly relevant should be described in some detail. However, reports that result incomparable findings (i.e. similar findings from different authors) can often be grouped together and briefly summarised. For example: "A number of studies have it that academic achievement is highly related to socio economic background of the student (Aboagye, 1998; Bansah, 1994; Ogoe, 1993).

It is also important to paraphrase or summarise a report in ones own words. The review should demonstrate that thoughtful consideration has been given to the material.

Another point to bear in mind is that the review should be as objective as possible. Studies that conflict with personal values should not be omitted. It is not unusual to find studies with contradictory results. The review should not deliberately ignore a study simply because its findings contradict other studies.

6.2 Parts of the Literature Report

After reading and taken notes on the various sources collected, researchers can prepare the final review. Fraenkel and Wallen (1993) have identified five parts of the literature review. These include:

1. The Introduction
   The introduction briefly describes the nature of the research problem and states the research question. The researcher also explains in this section what led him/her to investigate the question and why it is an important question to investigate.

2. The Body
   The body of the review briefly reports what others have found or thought about the research problem. How is the related literature discussed in the review? Related studies are usually discussed together, grouped under subheadings to make the review easier to read. Major studies are described in more detail, while less important work can be referred to in just a line or two. In most cases this is done by referring to several studies that reported similar results in a single sentence as shown at the previous sub session.

3. The Summary
   The summary of the review ties together the main threads revealed in the literature reviewed. Have you met the expression, "the thread of a book"? Hold on. The thread of a book is the main line of reasoning connecting the parts of an argument or finding. The summary also presents a composite picture of what is known or thought to date.

   Findings, at the summary section, may be tabulated to give readers some idea of how many other researchers have reported identical or similar findings or have similar recommendations.

4. Conclusions
   This includes any conclusions the researcher feels are justifiable based on the state of knowledge revealed in the literature. The conclusions must also include what the literature suggest are appropriate courses of action to take to try to solve the problem.

5. References
   The last part is a reference with full reference data for all sources mentioned in the review. There are many formats that can be used to list references, but the format used by the American Psychological Association (APA) is the accepted format for the Faculty of Education, UCC.

For instance the accurate reference for a book entitled, "Nursing Research, Principles and Methods" authored by Denise F. Polit, Ph.D and Bernadette P. Hungler Ph.D., a fifth edition published at Philadephia by JP Lippincott Company in 1995, will be:

Polit, D. F & Hungler, B. P. (1995). Nursing research: Principles and methods. (5th ed.) Philadelphia: J.B Lippincott Company.

This session presented how researchers prepare the final review. We learnt that the written review should not be a succession of quotes or abstracts. The role of the reviewer is to point out what has been studied to date, how adequate and dependable those studies are, what gaps there seem to be in the existing body of research, and what contribution a new study would make. The reviewer should present facts and findings in the tentative language that befits scientific inquiry and should remember to identify the source of opinions, points of view, and generalization.

Self-Assessment Questions

Exercise 2.6

1. The review should omit studies that conflict with personal values.
   a) True
   b) False

2. Which part of the review of literature offers a brief description of the nature of the research problem and the statement of the research questions?
   a) Conclusion
   b) Methodology
   c) The body
   d) Introduction

3. The summary of the review presents a composite picture of what is known or thought to date.
   a) True
   b) False

4. Which part of the literature report must include 'what the literature suggests are appropriate course of action to take to try to solve the problem'?
   a) Summary
   b) Conclusion
   c) Introduction
   d) Reference

5. The section that acknowledge the source of opinions, points of view and generalisation is known as
   a) Summary
   b) Conclusion
   c) Introduction
   d) Reference

Written Assignment

1. Write an accurate reference for any one of the textbooks/resource handbook that is relevant to your course, using the style of the American Psychological Association (APA).

UNIT 3: RESEARCH DESIGN

Unit Outline

Session 1: Descriptive Design, Nature and Characteristics
Session 2: Descriptive Design, Population, Sample and Sampling
Session 3: Instruments and Procedure
Session 4: Correlational Design
Session 5: Case Studies
Session 6: Experimental and Causal Comparative Designs

We have come to unit 3 of this Book. You are welcome. We have discussed in detail what educational research is all about. We have also looked at the research problem, characteristics and statement as well as the research question/hypothesis that go with the problem.

Do you remember some of the main points discussed in each session of the previous units? We now proceed to present the different research designs that can be used to carry out a research. This will however depend on the problem that would be selected.

This unit, like others, has been organised into six sessions. Specifically, the unit starts with the descriptive design, its nature and characteristics. The second session discusses population, sample and sampling procedures. In session three, instruments and the procedure for using them are treated, while session four focuses on correlational designs. Session five covers case studies and the final session highlights on experimental and causal comparative designs.

Unit Objectives

By the end of the unit, you should be able to:

1. design and explain what descriptive design is;
2. list and explain the characteristics of the descriptive design;
3. identify the reasons for sampling and the problems of sampling;
4. list and discuss the types of sampling;
5. explain the terms Population and Sample
6. describe the sampling procedures for use in research studies;
7. identify the various purposes for which questionnaires and interviews are used; and
8. distinguish between the various designs.

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 1: DESCRIPTIVE DESIGN: NATURE AND CHARACTERISTICS

You are welcome to the first session of this Unit. We are looking forward to having a very fruitful and lively discussion with you. Now we believe you know what the whole unit is about.

We now proceed to look at what we mean by the term, "research design" and what is spelt out in the research design. Have you met the term, descriptive design? If you have, just take your time and read on for more knowledge on this term. If you have not met this term, don't worry. This session is devoted to this term, its nature and characteristics.

Objectives

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

a) describe the term, research design
b) explain the nature of research design
c) identify the characteristics of research design
d) give examples of the descriptive design
e) list the nature of the descriptive design

Now read on…

1.1 Definition of Research Design

Let us consider this question. What do researchers do to obtain answers to the research questions or test hypotheses they formulate? Write your answer in our jotter for FTF discussion. Compare your response to the following.

A researcher's overall plan for obtaining answers to the research questions or for testing the research hypotheses is referred to as the research design. Research design is thus a plan or blueprint which specifies how data relating to a given problem should be collected and analysed. It provides the procedural outline for the conduct of any investigation. Do you understand what is meant by procedural outline? Don't answer. What we mean here is that the research design spells out the basic strategies that the researcher adopts to develop information that is accurate and interpretable. The design, therefore, incorporates some of the most important methodological decisions that the researcher makes in conducting a research study.

We will now consider the definitions of some authorities. Gay (1992) notes that the research design indicates the basic structure of a study, the nature of the hypothesis and the variables involved in the study. The design thus indicates whether there is an intervention and what the intervention is, the nature of any comparisons to be made, the method to be used to control extraneous variables and enhance the study's interpretability, the timing and frequency of data collection, the setting in which the data collection is to take place, and the nature of communications with subjects.

We hope having read the above explanation of the research design, you now understand the term. Some of the terminologies used in this sub-session like variables and extraneous variables can be found in Unit 1 Session 5. Others like hypothesis, research question and intervention were explained in Unit 2 Session 3. We are now going to discuss the various designs in subsequent sessions. This will start with the descriptive research design.

1.2 The Descriptive Research Design

Definition

Now that you know what research design is all about, it is important that we look at the various forms. We start with the descriptive research. Have you read anything about this design? Now read on.

Descriptive research is research which specifies the nature of a given phenomena. It determines and reports the way things are. Descriptive research, thus, involves collecting data in order to test hypotheses or answer research questions concerning the current status of the subject of the study (Gay, 1992).

1.3 Purpose of Descriptive Research Design

The purpose of descriptive research is to observe, describe, and document aspects of a situation as it naturally occurs. It sometimes, serves as a starting point for hypothesis generation or theory development. In descriptive research, the events or conditions either already exist or have occurred and the researcher merely selects the relevant variables for an analysis of their relationships. Examples are "the perception of UCC students of the new accommodation system (in-out-out-in) at the university" and "the attitude of primary school teachers in the Cape Coast Municipality towards the introduction of the new English syllabus". In all these examples, the some conditions do exist and the researcher is to observe and report as it is.

1.4 Nature and Characteristics of Descriptive Research Design

Descriptive research, as we saw in the definition, is generally concerned with the present status of a phenomenon. According to Best and Khan (1998), descriptive research is concerned with the conditions or relationships that exist, such as determining the nature of prevailing conditions, practices and attitudes; opinions that are held; processes that are going on; or trends that are developed. Amedahe (2002) also maintains that in descriptive research, accurate description of activities, objects, processes and persons is the objective. He also noted that research is not a fact finding per se. In fact, there is considerably more to the descriptive research than just asking questions and reporting answers. What then does the descriptive research deal with? Hold on. Don't answer. Now read on …

It deals with interpreting the relationship among variables and describing their relationships. Descriptive research seeks to find answers to questions through the analysis of relationships between or among variables.

The descriptive research studies have all the following characteristics.

a. They may either be quantitative or qualitative. Thus, they may involve hypothesis formulation and testing or formulation of questions and seeking answers to them or describing situations.
b. They use the logical methods of inductive – (the process of reasoning form specific observations to more general rules) deductive (the process of developing specific predictions from general principles) reasoning to arrive at generalizations.
c. They often employ the method of randomisation so that error may be estimated when population characteristics are inferred from observations of samples.
d. Variables and procedures are described as accurately and completely as possible so that the study can be replicated by other researchers.
e. They are susceptible or easily influenced to distortions through the introduction of biases in the measuring instruments, etc. For example errors due to the use of questionnaires or interviews might distort a research findings.
f. There is the need to organise and present data systematically in order to arrive at valid and accurate conclusions.

1.5 Steps Involved in a Descriptive Research Design

1. Clear definition of problem or question to be answered.
2. The method of data collection should then be selected.

   The alternative methods available for collecting desired data in the descriptive research include administering questionnaire, interviewing subjects, observing events, or analysing documentary both primary and secondary sources.

3. Selection of sample for the study
   A meaningful and representative sample should be selected with regard to the population characteristics such as size, composition, and also with regard to data analysis procedures. For example in most quantitative studies, a sample size of 5% to 20% of the population size is sufficient for generalisation purposes.

4. Data collection then follows.
   It is necessary to check for completeness, validity, reliability and comprehensiveness of data.

5. Editing, coding and analysis of data using he relevant procedures. For example, one can develop frequency and percentage tables, and compute mean and standard deviations as well as test hypotheses using the t-test and chi-square.

6. Interpretation of Results.
   Results of the analysis must then be interpreted to show whether a solution to the problem has been found or not.

1.6 Forms of Descriptive Research

Descriptive research ranges from simple surveys that do little more than ask questions and report answers about the status of something (phenomena) to studies that present explicit statements about relationships between variables.

Dear student, we have spent time discussing the descriptive research, its purposes, nature and characteristics. We have defined this concept and clearly come out with examples. The steps involved in descriptive research as well as forms have also been discussed.

Self-Assessment Questions

Exercise 3.1

1. What type of conclusions are warranted from descriptive studies?
   a. Relationship
   b. Causal
   c. Causal comparative
   d. Current characteristics

2. A plan or blueprint which specifies how data relating to a given problem should be collected and analysed is known as
   a. research design.
   b. hypothesis.
   c. descriptive design.
   d. proposal.

3. A researcher decides to look at the perception of JSS teachers in the Ho Municipality towards the practice of continuous assessment. What type of design is this?
   a. Research design
   b. Descriptive design
   c. Causal comparative
   d. Case study

4. Which of the following is NOT a step involved in a descriptive research?
   a. Definition of the problem
   b. Selection of method of data collection
   c. Interpretation of results
   d. The cost involved in undertaking research.

5. Research is mainly a fact-finding and drawing of conclusion.
   a. True
   b. False

Written Assignment/Discussion Questions

1. Give any two examples of a problem that would be classified under the descriptive research.

2. What are the characteristics of the descriptive research?

DESCRIPTIVE DESIGN: NATURE AND CHARACTERISTICS

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 2: DESCRIPTIVE DESIGN: POPULATION, SAMPLE AND SAMPLING

Welcome to this session, dear learner. We talked about the descriptive design, its meaning, nature and characteristics in the last session. The various forms of descriptive research were also mentioned. I hope you have found the session very interesting. In this session, we shall talk more about population, sample and sampling.

One of the most significant issues investigators have to consider when designing a project concerns the type and number of the respondents who will be included in the study. A number of very important questions have to be answered such as: Will the whole population of a sample be studied? If sampling is preferred, which sampling procedure is most suitable? How large should the sampling be? Is there a sampling frame required? If yes, is one available? How representative should the sampling be? How will possible problems, errors, distortions be prevented? Are the required time, funds and staffing available and if so how can they be rationally employed? Read this session to find the answers to these questions. You are therefore entreated to relax and enjoy the course.

Objectives

By the time you finish going through this session you would be able to:

(a) distinguish between a sample and a population;
(b) explain how a target population differs from an accessible population;
(c) identify and explain the reasons for sampling;
(d) list and explain problems of sampling; and
(e) identify and define or briefly describe the sampling techniques.

Now read on!

2.1 Population

What is a population? Write your answer in your jotter. Compare your response to the following. In a study, an investigator may be interested in a group of people. The group becomes the investigator's target group. Examples of such groups may include " "all teachers", "all senior secondary school students", "all principals in training colleges in Ghana, "all District Education Office staff in Amansie West District of Ashanti", "all State Registered Nurses at the Cape Coast Hospital", "all lower primary pupils in Takoradi Metro". The target group about which the researcher is interested in gaining information and drawing conclusions is what is known as the population. Polit and Hungler (1996) defined a population as the entire aggregation of cases that meet a designated set of criteria. It must be noted that whatever the basic unit, the population always comprises the entire aggregation of elements in which the researcher is interested.

2.2 Accessible and Target Population

It is often useful to make a distinction between the target and accessible population. The accessible population is the aggregate of cases that conform to the designated criteria that are accessible to the researcher as a pool of subjects for a study.

The target population is the aggregate of cases about which the researcher would like to make generalisations. Thus, the target population is the units for which the information is required and actually studied. A target population may be all teachers in basic schools in a region. However, the accessible population may be teachers in basic schools of a particular education district. Researchers usually sample from an accessible population and hope to generalise to a target population.

2.3 Samples and Sampling

In many cases a complete coverage of the population in a study is not possible. What then can the researcher do? The way out here would be to select a unit of the population to represent the whole. This will then lead us to the process of sampling.

Definition of Sampling and a Sample

Sampling refers to the process of selecting a portion of the population to represent the entire population. Generally, sampling enables the researcher to study a relatively small number of units in place of the target population, and to obtain data that are representative of the whole target population.

A sample consists of a carefully selected subset of the units that comprise the population. In most cases researchers opt for an incomplete coverage and study only a small proportion of the population. This small proportion of the population is the sample. Sampling is thus the process of choosing the units of the target population which are to be included in the study.

In sampling, the units that make up the samples and population are referred to as elements. The element is the most basic unit about which information is collected. In social research, the elements are usually humans.

2.4 Reasons for Sampling

Write any two reasons why researchers opt for a sample survey instead of using the whole population? Now read on.

Opting for a sample survey is guided by a number of factors. Sarantakos (1998) has identified the following as the most common.

- In many cases a complete coverage of the population is not possible.

- Complete coverage may not offer substantial advantage over a sample survey. Sampling provides a better option since it addresses the survey population in a short period of time and produces comparable and equally valid results.
- Studies based on samples require less time and produce quick answers.
- Sampling is less demanding in terms of labour requirement, since it requires a small portion of the target population.
- It is thought to be more economical, since it contains fewer people and requires less printed material, fewer general costs (travelling, accommodation, etc) and fewer experts
- Samples are thought to offer more detailed information and a high degree of accuracy because they deal with relatively small numbers of units.

2.5 Principles of Sampling

Samples are expected to be representative. In other words, the sample is selected such that it will be representative of the population. For this reason, samples are chosen by means of sound methodological principles. With regard to quantitative research, Sarantakos (1998) identifies the following as the most important.

- Sample units must be chosen in a systematic and objective manner.
- Sample units must be easily identifiable and clearly defined.
- Sample units must be independent to each other, uniform and of the same size, and should appear only in the population.
- Sample units are not interchangeable, the same units should be used throughout the study.
- Once selected, units cannot be discarded.
- The selection process should be based on sound criteria and should avoid errors, bias and distortions.

2.6 Types of Sampling

We have learnt that in a sample survey, the sample must be as representative as possible to allow for generalisation of findings to the population of study. There are a number of procedures by which a researcher can select his/her sample to ensure its representativeness. The specific procedure that may be employed may be guided by the following:

i. The structure of the population of study.
ii. The distribution of certain characteristics within the population.
iii. Other relevant factors available or present in the population that may threaten the validity of the study.

Sampling plans can be grouped into two categories. These are Probability Sampling and Non-Probability Sampling.

2.6.1 Probability (Random) Sampling

To explain this, break the concept into two. "Probability" and "Sampling". Write in your jotter, your own definition of probability sampling. Compare your response to the following. Probability sampling involves some form of random selection in choosing the elements in such a way that the researcher knows the probability of selecting each member of the population. It employs strict probability rules in the selection process. Thus every member or unit of the population or subgroup has an equal, calculable and non-zero probability of being selected for the sample. A random selection of the sample limits the probability that one chooses a bias sample. Indeed, a random selection is a strategy for controlling threats to external validity. Probability sampling is the more respected of the two approaches because greater confidence can be placed in the representativeness of probability samples.

2.6.2 Non-Probability Sampling

In non-probability sampling, elements are selected by non-random methods. There is no way to estimate the probability that each element has the chance of being selected in a non-probability sample. Usually, not every element in the population has a chance of being selected. This method is less strict and makes no claim for representativeness. It is generally left up to the researcher or the interviewer to decide which sample units should be chosen. It is generally employed in exploratory research, observational research and qualitative research.

2.7 Types of Non-Probability Sampling

By now, I hope, you understand what non-probability sampling means. That is good. Let us continue. Non-probability sampling is less likely than probability sampling to produce accurate and representative samples. Why then do people use it in spite of this shortfall? Hold on, don't answer. Despite the disadvantage that arise from their non-representativeness, they are far less complicated to set up, are considerably less expensive, and can prove perfectly adequate where researchers do not intend to generalise their findings beyond the sample in question or where they are simply piloting a survey questionnaire as a prelude to their main study. The major kinds of non-probability sampling are as follows.

- Convenience Sampling
- Quota Sampling
- Purposive Sampling
- Snowball Sampling

2.7.1 Convenience Sampling

Convenience sampling involves choosing the nearest or available individuals to serve as respondents and continuing the process until the required sample size has been obtained. When do we employ this type of sampling? Write your response in your jotter. Compare your answer to the following: This type of sampling is employed in qualitative research and in other studies where representativeness is not an issue.

It is also known as "accidental sampling", "chunk sampling", "grab sampling", and "haphazard sampling". When this sampling technique is employed all units of study that the research accidentally comes across or in contact with during a certain period of time are considered. The investigator may stand at a street corner, in front of a shopping centre or at a university gate and interview a certain number of people passing by between, say, 11.00 and 12.00 o'clock on certain days of the week. Similarly, captive audiences such as pupils or student teachers often serve as respondents in surveys based on convenient sampling. For example, the faculty member who distributes questionnaires in his/her class is using a convenience sample. Convenience samples like the example above are easy to construct and evaluate.

The problem with convenience sampling is that available subjects might be atypical (different from normal/usual) of the population with regard to the critical variables being measured.

2.7.2 Quota Sampling

Quota sampling has been described as the non-probability equivalent of stratified sampling. (Stratified sampling would be discussed under probability sampling). It attempts to obtain representatives of the various elements of the total population in the proportion in which they occur there. In simple terms, the researcher sets the 'quota' of respondents to be chosen from specific population groups by defining the basis of choice (gender, marital status, ethnicity, education, etc.) and by determining its size (e.g. 60 parents of mentally challenged children, 35 policemen, 66 graduate teachers, etc). The choice of the actual respondents is usually left up to the interviewer.

Ways of Determining the Quotas

The way quotas are determined varies depending on a number of factors related to the type and nature of the research.

- For instance the researcher might advise the interviewer to survey 50 female students who will attend tomorrow's lecture and 50 male students who will walk out of the lecture hall immediately the lecturer closes or 20 girls who will make 90% less attendance during the month of June etc.

- Another way of choosing the respondents is based on strict procedures. One such method is by choosing respondents according to their proportion in the entire population.

Relationship between Quota and Convenience Sampling
Except for identification of the strata and the proportional representation for each, quota sampling is procedurally similar to convenience sampling. Despite its problems, quota sampling is an improvement over convenience sampling.

2.7.3 Purposive Sampling

In purposive sampling, researchers handpick the cases to be included in the sample on the basis of their judgment of their typicality or particularly knowledgeable about the issues under study. Thus, in purposive sampling, also known as judgmental sampling, the researcher purposely chooses subjects who in their opinion are thought to be relevant to the research topic. In this case the judgment of the investigator is more important than obtaining a probability sample.

Purposive sampling is often used when the researcher wants a sample of experts as in the case of a need assessment using the key informant approach.

How are subjects sampled in this type of sampling?
The process of sampling in this case would involve identification of the informants and arranging times for meeting them.

2.7.4 Snowball Sampling

In this type of sampling, researchers begin the research with the small number of individuals who have the characteristics that they require and are available to them. The people are then used as informants to identify others who qualify for inclusion and these (i.e., those identified) in turn identify yet others. In other words, the researcher subsequently ask the few respondents available to recommend other persons who meet the criteria of the research and who might be willing to participate in the project. If and when such respondents are recommended, the investigator approaches them, collects the information required and ask them to recommend other persons who might fit the research design and willing to be studied. The process continues until the topic is saturated, that is, until no more substantial information is achieved through additional respondents, or until no more respondents are discovered.

When is the appropriate time to employ this method? This method is employed when

- lack of sampling frames make it impossible for the researcher to achieve a probability sample;
- the target population is unknown;
- it is difficult to approach the respondents in any other way.

2.8 Probability Sampling

Dear student, we have so far discussed the various kinds/forms of non-probability sampling. We shall now look at probability sampling. You have read earlier that majority of social researchers use probability sampling. The question then is, for what reason do majority of researchers use probability sampling? Majority of social researchers employ probability sampling for several reasons, among which are:

- its high reliability
- its high degree of representativeness and
- high generalisability of the results

The hallmark of probability sampling is the random selection of elements from the population. What is a random selection process? A random selection process is one in which each element in the population has an equal, independent chance of being selected. We shall discuss the four most commonly used probability sampling methods. This include:

- Simple Random Sampling
- Systematic Sampling
- Stratified Sampling
- Cluster Sampling

2.8.1 Simple Random Sampling

Simple random sampling is the most basic of the probability designs. This type of sampling gives all units of the target population an equal chance of being selected. The simple random sampling is appropriate when a population of study is similar in characteristics of interest. The sample units are selected by means of two main methods or strategies. These are the lottery method and the random number method.

(a) The Lottery Method

Choosing respondents by the lottery method follows a procedure that can be described in the following steps.

Step 1: Identify or construct a sampling frame. Constructing a sampling frame is preparing a list of the units of the target population, that is, the list of all elements in the population. Such frames are, for instance, the electoral register in the area, students records and include names and if possible addresses of sample units in alphabetical order and numbered accordingly.

Step 2: Write names listed in sample frame or their numbers on slips of paper and put them in a container.

Step 3: Mix well and remove one slip or paper at a time from the container without looking into it.

Step 4: Register or record the number or name on the slip. When a slip is selected and recorded, it is thrown back into the container before the next one is picked. The process is continued until the required number of respondents is recorded. If an already drawn number is selected for a second or third time it is ignored, that is, it is thrown back into the container.

(b) The Random Numbers Method

This method is similar to the lottery method, except that the container and strips are replaced by already generated tables of random numbers. These are usually found at the back of statistical textbooks (See Appendix B).

Choosing the sample by using the random numbers method involves the following steps.

Step 1: A sampling frame is identified or constructed as in the lottery method. Thus decide on the sample size.

Step 2: Appropriate tables of random numbers are selected.

Step 3: Numbers are picked from the tables randomly and registered, the name in the sampling frame corresponding to the numbers constitute the sample. For example, assume that we are interested in the attitudes of JSS teachers in Cape Coast Municipality to the Best Teacher Award scheme in Ghana. A sample of 100 teachers are required out of 5000 JSS teachers in the municipality. The following steps would then be followed.

1. A list of all JSS teachers' names (from the sampling frame) is obtained, numbered and ordered accordingly.

2. A list of random numbers that contains all numbers included in the sampling frame (in our example 0000-4999) is used.

3. The table is entered randomly, where the researcher proceeds vertically or horizontally using the appropriate number of digits. Here the researcher starts at any point on the table of random numbers.

With our 5000 teachers, the number of digits to be counted each time is four. Anytime the researcher encounters numbers falling within the sampling frame the specific element with that number is selected and recorded. For example, the four-digit numbers 1234 and 0069 are within the sampling frame. In fact, they are for the individual numbered 1234 and 69 and must be selected. However, the four-digit number 6934 and 5001 are rejected because there is no element in the population with this number.

The process is continued until the required number of teachers is achieved.

A number of additional techniques that have been devised to identify respondents in the simple random sampling which you may meet in the course of your reading include, the computer method, birthday, first letter and pin number.

It is important to note that the simple random sampling is appropriate when the population of study is similar in characteristics of interest. Can you think of one problem associated with this technique? One problem associated with this sampling method is that a complete list of population is needed and this is not always readily available.

2.8.2 Systematic Sampling

This method is a modified form of simple random sampling. It involves selecting the subjects from a population list in a systematic rather than a random fashion. A systematic sampling consists of the selection of K^{th} term from a list of all elements in a population beginning with a randomly selected element. For example, if there is the need to select 100 subjects from a population of 50,000,

Step 1: Select/compute the sampling fraction (the K^{th} term) which is N/n where N is the number of units in the target population and n the number of unit of the sampling. In the example above N=50,000 n=100; sampling fraction is K^{th} = 50,000/100 = 500^{th}. Every n^{th} would therefore correspond to 500^{th} subject/element.

Step 2: Select the first element randomly using lottery or random numbers. In this example that would be some number between 1 – 500.

Step 3: Identify all numbers between 0 – N that result from adding K^{th} to the random number. The process is repeated until N is reached. Suppose 240 was randomly selected as a starting point, in step 2, the first sample chosen would be the 240^{th} number the next subject would be the 740^{th} i.e. 240+500, the third would be 1,240 i.e. 740+500 etc.

Step 4: Locate the names on the sampling frame that corresponds to the number drawn above, example the names corresponding to 240^{th}, 740^{th} etc.

Step 5: These names correspond to the respondents who constitute the sample.

What is the main difference between the systematic and simple random sampling techniques? Write your answer in your jotter. Compare your answer to the following. Systematic sampling and simple random sampling differ in that in the latter the selections are independent of each other. In systematic sampling the selection of sample units is dependent on the selection of a previous one.

2.8.3 Stratified Random Sampling

Stratified sampling involves dividing the population into a number of homogeneous groups or strata. Each group contains subjects with similar characteristics. A sample is then drawn form each group or stratum. The sub samples make up the final sample for the study. The division of the population into strata or homogeneous group is based on one or more criteria, for example, sex, age economic status, professional status. For instance, group A or the stratum A might contain males and group B or stratum B females. In order to obtain a sample representative of the whole population in terms of gender or sex, a random selection of subjects from group A and B must be taken. The sample size can be proportionate or disproportionate to the units of target population. For example, the target population, consisting of equal number of males and females, may be divided into two strata or homogeneous groups males and females. Then if a proportionate stratified sample is drawn, 5 percent from each group may be taken. If the researcher decides for a disproportionate sample, 5 percent of males and 10 percent of females may be taken.

When do we employ a stratified sampling? A stratified sample is employed when there is a need to represent all groups of the target population in the sample. It is also used when a researcher has special interest in criteria strata/group.

A stratified sample is drawn in the following way.

Step 1: Identify the stratification variable. The target population is divided into a number of strata/homogeneous groups according to the number of the significant groups in the population.

Step 2: The sampling frames for each of the groups are identified. If not available, relevant sampling frames must be developed.

Step 3: Employing one of the methods discussed above simple random sampling, systematic etc, a sample is drawn from each group. This can be proportionate or disproportionate to the number of units in the population.

Step 4: The individual samples are merged into one, and this constitutes the sample for the study.

2.8.4 Cluster Sampling

For many populations, it is simply impossible to obtain a listing of all the elements. When population is large and widely dispersed, gathering a simple random sample poses administrative problems. Cluster sampling is used when it is impossible or impractical to sample individual elements from the population as a whole or when there is no exhaustive list of all elements. In cluster sampling, there is a successive random selection of naturally occurring groups or areas and then selecting individual elements from the chosen group or areas. Thus, a characteristic of this sampling method is that first groups of elements (clusters) are selected (e.g., schools, classes, suburbs) and then individual elements are selected from these clusters. To choose the clusters and the respondents from the clusters one of the methods discussed above can be employed.

Cluster sampling is considerably more economical and practical than other types of probability sampling, particularly when the population is large and widely dispersed.

Sampling is one of the most fundamental elements of research and one that has attracted the interest of many social researchers and critics alike. In this chapter we described the main elements of sampling and noted that sampling is the method of choosing the respondents of a study.

There are two major types of sampling, probability and non-probability sampling. The various types under these two main categories have also been discussed.

Self-Assessment Questions

Exercise 3.2

1. The sampling frame is most similar to the
   a. population
   b. sample
   c. respondents
   d. elements

2. We use the results obtained from a sample to
   a. generalise to the population
   b. stratify to the sample
   c. select convenience sample
   d. identify the subjects used in the study.

3. Probability sampling is to systematic sampling as non-probability sampling is to
   a. stratified sampling
   b. proportional sampling
   c. disproportional sampling
   d. purposive sampling

4. Systematic sampling is preferred when
   a. stratified sampling is not possible
   b. certain subjects need to be selected because of their position or special knowledge
   c. it is not possible to number all members of the population
   d. there is periodicity in a list of the population

5. A researcher decides to select a sample by taking simple random samples from three subgroups that have been identified from the population. What type of sampling was used?
   a. Proportional
   b. Cluster
   c. Convenience
   d. Stratified

6. Each of the following about the subjects of study should be indicated in a research **except**
   a. return rate of surveys
   b. method of sampling
   c. clear description of samples
   d. names of subjects

Written Assignment or Discussion Questions

1. What is the meaning of a sample and population?

2. How is cluster sampling different from stratified sampling?

3. When should the researcher use stratified random sampling?

4. What are some of the strengths and weaknesses of the following types of sampling?
   a. Simple random sampling
   b. Cluster sampling
   c. Snowball sampling
   d. Systematic sampling
   e. Quota sampling.

DESCRIPTIVE DESIGN: POPULATION, SAMPLE AND SAMPLING

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 3: DESCRIPTIVE DESIGN: INSTRUMENTS AND PROCEDURE

Hello learner, you are welcome to this session. Having outlined the nature, types and relevance of sampling, we will now proceed to the next step of the research process, namely the method of data collection.

In this chapter, we shall begin this discussion by looking at data collection as a stage in the research process and the techniques/tools that can be used to collect data in a descriptive study.

Objectives

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

(a) explain the term data; and data collection; and
(b) list and explain the most frequently used data collection tools/techniques in descriptive research.

Now read on…

3.1 Explanation of Data and Data Collection

According to Gay (1992), all research studies involve data collection. Since all studies are designed to either test hypotheses or answer research questions, they all require data with which to do so. Let's now look at what data is. The data of a study are the pieces of information obtained in the course of investigation.

It is important to note that data collection is the stage in the research process whereby a researcher gathers any relevant information or data for the solution of the research problem under study.

What then is data collection? Data collection refers to obtaining relevant information regarding the major ideas of the hypotheses or research questions for the purpose of answering them.

3.2 Data Collection Techniques

In a descriptive research data may be obtained through a variety of techniques. Can you name these techniques? Write any two in your jotter. Compare what you wrote to the following.

The tools or techniques for data collection include:

i. Observation
ii. Questionnaire
iii. Interview
iv. Tests
v. Attitude Scale

DESCRIPTIVE DESIGN: INSTRUMENTS AND PROCEDURE

We shall discuss the most frequently used techniques. Let's start with observation.

3.2.1 Observation

Observation is one of the oldest methods of data collection. Literally, observation means a method of data collection that employs vision as its main means of data collection. What do the researcher/data collector does in observational study? In observational studies researchers collect data on the current status of subjects by watching them and listening and recording what they observe rather than asking questions about them. An observation may take many forms/types.

3.2.2 Types of Observation

There are several types of observation; some are more popular than others. Although, basically, the various types are similar, they do differ from each other in the degree or extent of the observers' participation in the environment, in the setting in which it occurs and in the manner in which it is organised.

Some types/forms of observation are Participant and Non Participant observation.

Write in one sentence each, how you understand participant and non-participant observation. Now read on.

In general, the degree of the observers involvement in the observation varies from no participation to full participation. In non-participant observation, observers study their subjects from outside the group without becoming a part of the environment of the observed. In participant observation they actually become members of the group they are supposed to be studying. They observe from inside the group and, ideally, their identity as a researcher is not known.

By participating actively in a group, one may gain insight into the structure of the group and obtain certain types of information not accessible in any other way. On the other hand, by becoming emotionally involved the researcher may lose objectivity. Can you think of other merit and demerit of this form? Write one advantage and disadvantage each from participation and non-participation in your jotter for FTF discussion.

1. **Structured and Unstructured**
   Structured observation employs a formal and strictly organised procedure, with a set of well-defined observation categories. It is subject to high levels of control and differentiation. It is organised and planned before the study begins. Unstructured observation is loosely organised and the process of observation is largely left up to the observer to define.

2. Natural and Laboratory Observation

The main difference between these two techniques lies in the type of setting in which they unfold. In the natural observation, observation takes place in natural settings. In the laboratory, they are performed in the laboratory.

3. Open and Hidden

This distinction refers to the degree to which the identity of the researcher as an observer as well as the purpose of the study is known to the participants. In the case of the open observation, the participants are well informed of the nature of the study and the identity of the researcher but in hidden observation they are not.

4. Active and Passive Observation

This type of observation refers to the degree to which the observer is involved in the process and purpose of observation. Active observation presupposes full engagement of the observer in the course of the study. In passive observation, the role of the observer is seen as being just a strict recording of data. In this case observation is a job to be done in an objective and neutral fashion.

5. Direct and Indirect Observation

Direct observation studies the subjects it intends to explain, for example, if the study intend to explain the patterns of conflicts in marital homes, and observation involves named couples, this is a direct observation. Indirect observation does not involve the subject of study, either because the subject refuses to take part in the study, a direct observation is not possible, or the subject is deceased. Instead, the observer/researcher observes the physical traces the phenomena under study that the subject has left behind and make conclusions about the subject.

3.2.3 The Process of Observation

Steps in Observation

What form does observation take in descriptive research?

Observation takes place in the same form as the general research introduced earlier in this book. The content, however, depends on the nature of observation. The following is a brief summary of the basic steps of research as employed in the area of observation.

1. Selection of Topic

This step includes the issues to be studied through observation.
This must be an observable social phenomenon of any level.

2. Formulation of the Topic

This involves a specific definition of the topic, development of observation categories, establishment of the observer-subject relationship, the type and explanation of what is to be observed.

3. Research Design

Here, the researcher will determine the subjects to be observed, select the setting for observation, that is, the time when observation will be carried out, place in which observation will be conducted, type of event to be studied-the researcher observing every thing, some events, routine events and subjects or persons to be observed.

4. Collection of Data

This involves familiarisation with the setting and subjects, initial interaction, observation and recording. Recording of data is an issue that must be considered during the planning stage of the research. This included three issues, namely what will be recorded, when and how. This refers to the methods of recording, the events to be recorded and the coding.

The method of recording varies from one type of observation to another. The most common methods of recording are:

i. Writing down information verbatim in summary or in key words
ii. Tape recording conversations
iii. Video recording events
iv. Taking photographs

5. Auditing of Data

At this stage, the researcher will undertake data reduction, presentation (e.g. in tables and graphs), cross tabulation and interpretation.

6. Report Writing

This involves the writing of the reports to be published in some form.

3.2.4 Characteristics of Good Observation

Best and Kahn (1993) maintain that observation as a research data-gathering process demands vigorous adherence to the spirit of scientific inquiry. The following standards, they indicated, should characterize observers and their observation.

1. Observation is carefully planned, systematic and perceptive. Observers know what they are looking for and what is irrelevant in a situation. They are not distracted by the dramatic or the spectacular.

2. Observers are aware of the wholeness of what is absent.

3. Observers are objective. They recognize their likely biases, and they strive to eliminate their influence upon what they see and report.

4. Observers separate the facts from interpretation. They observe the facts and make their interpretations at a later time.

5. Observations are carefully and expertly recorded.

6. Observations are collected in such a way as to make sure that they are valid and reliable.

3.2.5 Advantages of Observation

a) It provided information when other methods are not effective.
b) It employs a less complicated and less time-consuming procedures of subject selection.
c) It can offer data when respondents are unable and/or unwilling to correlation-operate or to offer information.
d) It approaches reality in its natural structure and studies events as they evolve.
e) It offers first hand information without relying on the reports of others.
f) It is relatively inexpensive.

3.2.6 Limitations of Observation

a) It cannot be employed when large groups or extensive events are studied.
b) It cannot provide information about past, future or unpredictable
c) It cannot study opinions or attitudes directly
d) It is a relatively laborious and time-consuming method
e) It cannot offer quantitative generalizations on the results

3.3 Questionnaire

Dear learner, we are now going to look at questionnaire as a data collection instrument. The use of questionnaire is very common in the social sciences. It most cases questionnaires are employed as the only method of data collection. A Questionnaire consists of a list of questions or statements relating to the aims of the study, the hypotheses and research questions to be verified and answered, to which the respondent is required to answer by writing.

DESCRIPTIVE DESIGN: INSTRUMENTS AND PROCEDURE

3.3.1 Forms of Questionnaire

(i) The Close-Ended Form

Questionnaires that call for short, check-mark (list) responses are known as restricted, structured or close-ended type. Here you mark a Yes or No, rank alternatives provided based on how one feels about the issue, check an item from a list of suggested responses or scale responses. The following is an example that illustrates a close-ended question.

How would you rate the adequacy of textbooks in your school library?

1. Excellent
2. Good
3. Fair
4. Poor
5. Others – please specify

(ii) The Open-Ended Form

The open form question or the unstructured or unrestricted question calls for a free response in the respondents' own words.

Example: What is the textbook situation in your school library?

The open form generally provides for greater depth of response. The respondents reveal their frame of reference and possible the reasons for their responses. But because they require greater effort on the part of the respondents, returns are often meager. Also, an open-ended item can sometimes be difficult to interpret, tabulate and summarise in the research report.

Many questions include both open and close-ended type items.

3.3.2 Types of Questions and Response Modes

What types of questions are used in a questionnaire construction?

Different types of questions, statements and response modes can be used in a questionnaire. Questions asked in a questionnaire may be:

- direct or indirect questions
- specific or non specific questions
- fact or opinion eliciting questions or statements

Direct questions ask the respondents to offer information in a straightforward manner. It also asks respondents to offer information about him or her self. An example of a direct question is: Do you believe in God?

An indirect question asks the respondent to offer information about other people assuming that in this way the respondent will indirectly tell about himself or herself. An example of an indirect question is: Do you think that people of your status and age believe in God nowadays? Indirect question is mainly used when the question deals with sensitive, embarrassing or threatening issues.

A specific question elicits information on a specific issue. (e.g. how are you?) In a non-specific form the question is posed to seek more or less general information from the respondent. For example, instead of asking the respondent the number of years of teaching experience, the researcher can provide intervals of years range of respondents from which they indicate the intervals in which their years of experience fall.

3.3.3 Rules of Questionnaire Construction

It is common practice for questionnaire to be constructed according to set rules and standards. Why is it so? Write your response for FTF discussion.

Many writers, Amedahe, (2002); Sarantakos, (1998); Best and Khan, (1993) refer to the rules listed below.

a. Layout

- Questions must be well presented in the questionnaire to make it easy to read and easy to follow.
- Questions and response categories must be easy to identify and distinguish from other questions and response categories. For this reason, sufficient space should be provided between the questions.
- Clear instructions regarding the way of answering the question must be given. For example, the respondent may be asked to circle the appropriate number or tick the right box.
- Sufficient space should be left or the respondent to make relevant remarks if required.

b. Content of the Questions

- Every question must be relevant to one or more aspects of the study.
- Ambiguous, non-specific and hypothetical questions are to be avoided.
- Leading, double barrelled and presuming questions should not be employed.
- Embarrassing, personal or threatening questions should be avoided.
- Vague words and academic jargons should not be used.

- The language of the respondent should be employed. If possible, a simple language should be used, without jargon, slang or complicated expressions.
- Easy flow and logical progression in the questionnaire should be assured.
- Each question should ask what it is supposed to ask.

c. Questionnaire Format

- The questionnaire must have a professional appearance and should give the impression of a document that deserves respect and invoke feelings of responsibility.
- The questionnaire should be presented in a way that encourages the respondent to complete and return it.
- Writing on one side of the page is, for smaller questionnaires, preferable to writing on both sides.
- Print and colour of paper and ink must correspond with the preference of respondents.
- The questionnaire should be presented as a complete document with an inviting and reassuring introductory cover letter and a concluding note containing instructions regarding the return of the questionnaire.
- The questionnaire size should be kept to a minimum, and restricted to as few as possible.
- Sufficient instructions and probes should be provided where necessary.
- Pre-coded questions should be checked for possible bias and ethical adequacy.

3.3.4 Questionnaire Administration

Questionnaire administration involves sending or presenting the questionnaire to the prospective respondents and following it up. Amedahe (2002) identified two main ways of administering questionnaire. These are:

i. through mail – mail questionnaire and
ii. personally delivered to the respondent – non-mail questionnaire.

Table 1 presents the characteristics underlying assumptions, advantages and disadvantages of the two types as presented by Amedahe (2002).

Table 1: Characteristics of Mail and Non-Mail Questionnaire

Mail Questionnaire	Non-Mail Questionnaire
1. It is sent by post to the respondents. The success of the administration depends on the existence of an efficient postal system.	It is sent personally by the researcher or the assistant to the prospective respondent.
2. The questionnaire is filled in the absence of the researcher. It therefore presupposes that all respondents can read and write. Also it assumes that there will be no need for explanations and translations.	It may be filled in the presence of the researcher or his assistant. When it is filled in the presence of the researcher or the assistant the explanation of issues of the respondents is possible.
3. The administration is rather impersonal in the sense that the researcher will not have any personal contact with the respondent beyond the cover letter. This can be advantageous in that the respondent's responses will not be influenced by presence of the researcher.	The administration is personal to some extent since the questionnaire will be delivered personally to the prospective respondent. The personal delivery can be advantageous depending upon how the presence of the researcher can influence the response of the respondent.
4. The administration is liable to non-response. The non-responses accounts for the difficulty in obtaining a high return rate in mail questionnaires. This is partly due to the impersonal nature of the administration even though intensive follow-ups may be done.	Non-responses can be controlled to some extent by the researcher by making appointment with the respondent to collect the questionnaire.

3.3.5 Advantages and Disadvantages of Questionnaire

Questionnaires as methods of data collection have strengths and weaknesses and thus advantages and disadvantages that the researcher must be aware of.

Strengths and weaknesses are factors that have a significant impact on a researcher's decision about whether or not to use questionnaires in the study. The advantages and limitations, which most researchers and writers consider as significant are listed below.

- **Economy**
  Questionnaires are less expensive than other methods – interview and observation. It can be sent through mail, interview and observation cannot hence the expenses and time involved in training interviewers and observers as well as time spent on interviewing and observation are not involved in the use of questionnaire.

- **Reach ability**
  The use of questionnaires promises a wider coverage since researchers can approach respondents more easily than other methods. They are not affected by problems of no-contacts.

- **Uniformity in Questions**
  Questions are a stable consistent and uniform measure, without variation.

- Can be completed at the respondent's convenience.

- They offer greater assurance of anonymity.

Limitations

- **Limitation to Literate Population**
  The questionnaire as a tool for data collection cannot be used/administered on illiterates, and people who are too young to read and write.

- **Motivation of the Respondents**
  The use of questionnaire does not offer opportunities for motivating the respondent to participate in the survey or to answer the questions.

- **Sampling**
  The characteristics of non-response associated with questionnaire especially the mail-questionnaire is likely to affect the representativeness of the sample. This may result in a biased final sample.

- **Lack of Opportunity to Collect Additional Information**
  Questionnaires do not provide an opportunity to collect additional information through observation, probing, prompting and clarification of questions while they are being completed.

3.4 Interviewing

What is interviewing? Write your response in our jotter for FTF discussion. Compare your answer to the following:

An interview is a form of questioning characterized by the fact that it employs verbal questioning as its principal technique of data collection. It involves posing questions to respondents for answers in a face-to-face situation or by phone. It also represents direct attempt by the researcher to obtain reliable and valid measures of characteristics, behaviours, attitudes, etc. in the form of verbal responses from one or more respondents.

3.4.1 Types of Interviews

There are many types of interviews, each of which differs from the others in structure, purpose, role of the interviewer, number of respondents involved in each interview, and form and frequency of administration. These types, however, fall under two main categories. These are structured and unstructured. Now let's consider the two types.

1. **Structured Interview**

   Structured interviews are interviews in which the specific questions to be asked and the order of the questions are predetermined and set by the researcher. They are based on a strict procedure and a highly structured interview guide, which is no different from questionnaire. A structured interview is in reality a questionnaire read by the interviewer as prescribed by the researcher. The rigid structure determines the operations of this research instrument and allows no freedom to make adjustment to any of its elements, such as contents, wording or order of questions. The instrument of predetermined questions is known as an interview schedule. The interview is based on this schedule, and strict adherence to the questions and the instructions is paramount. The process of interviewing, using this type of interview, is referred to as scheduled interview.

2. **Unstructured Interview**

   Unstructured interviews, in contrast, have no strict procedures to follow of the kind described above. There are no restrictions in the wording of the question, the order of question or the interview schedule. Thus, the interviewers have the discretion to form questions on the spot, probe into issues and in some cases follow the order dictated by the situation. The structure of these interviews is flexible and the restrictions minimal. An instrument used in such an interview is called **an interview guide**. The guide is not as detailed as the schedule. It merely outlines the kind of information required.

3. **Individual versus Group Interview**

   When individual interviews are employed the researcher interviews one respondent at a time. This is the most common form of interviewing. The interviewer asks the various types of interview questions, - direct and indirect follow up questions, probing questions, structuring questions and interpreting questions, - to the individual/one respondent who in turn answers these questions.

In group interviews, more than one respondent is involved in the interview situation. They are also addressed by the interviewer simultaneously. In a small scale group two people are interviewed concurrently. On a large scale a group of about 20 persons might be interviewed. For example, a husband and a wife might be interviewed together on a small scale whiles a class of students might be interviewed together on a large scale.

3.4.2 Skills and Qualities of Interviewers

The interviewers must posses certain skills and qualities to be able to conduct a successful interview. List any 4 skills that the interviewer must possess to be able to function effectively. Write your answer in you jotter for FTF discussion. Now read on.

Amedahe (2002) has identified the following skills and qualities to be followed for a successful interview session.

- **Knowledgeable**
  The researcher must be knowledgeable on the topic/theme he/she is working on. Why is this so? This will enable the interviewer to pursue relevant issues.

- **Structuring**
  An interviewer should be able to structure the interview – introduction, process and closing. He/she should be able to give an introduction that will capture the attention of the interviewees. In the process of the interview he/she should be lively and not boring in order to sustain the interview throughout the session.

- **Clear**
  The interviewer should pose clear, simple, short and straightforward questions. He/she should be able to speak distinctly and understandably and avoid academic and professional jargons.

- **Gentle**
  Allows subjects to complete what they are saying and tolerate pauses and accept unconventional and provocative opinions.

- **Sensitive**
  Listen attentively to the content of what is said. Be empathetic, if need be.

- **Steering**
  The interviewer should control the course of the interview and should not be afraid of interrupting digressions from the interviewee.

- **Open**
  Approach the interview with an open mind. Must be open to others' opinions. Accept whatever opinions and interviewee expresses on an issue once he/she has not digressed.

- **Critical**
  Does not take everything that is said at the face value but questions critically to test the reliability and validity of what the interviewees tell.

- **Remembering**
  The interviewer should be able to retain and recall what interviewees tell and must be able to relate them.

- **Interpreting**
  An interviewer must throughout the interview session try to clarity and extend the meanings of the statements made by the interviewee for confirmation or disconfirmation.

3.4.3 Training of the Interviewers

Once the researcher decides to gather data through the interviews, he/she has to decide whether he/she could conduct the interview alone. If the researcher has so many respondents to interview that he/she cannot conduct it alone, then the need to select and train interviewers.

Both telephone and face-to-face interviewers need to be trained beforehand.

Why is it necessary to train these interviewers? It is necessary to train the interviewers because the purpose of conducting an interview is to obtain the desired information with maximum efficiency and minimum bias. In fact the accuracy of the data obtained depends on the level of skill of the interviewers and their knowledge on the type on questions to be asked and when to ask the appropriate question, hence the need for training.

What should be the content of the training of the interviewers?

- At the training, the interviewers need to know how to explain quickly the purpose of their call and why it is important to obtain information from the respondent.

- They also need to learn how to question in a way so as to encourage those they call to respond honestly.

- The need to know how to establish rapport that is, friendly and cordial relationship with their interviewees and to put them at ease. The interviewer needs to know when and how to 'follow up' on the unusual answer or one that is ambiguous or unclear.

- Interviewers also need training in gestures, manners, facial expression, and dress.

- Procedure for contacting respondents and introducing the study. All interviewers should have a common understanding to the purpose of the study.

- Procedure for recording answer/response to open ended and closed ended questions.

- Rules and guidelines for handling the interpersonal aspects of the interview in a non-biasing way. Interviewers should be taught on how to focus on the task at hand and to avoid expressing their personal views on any of the questions being asked.

3.4.4 Recording the Responses

The answers to questions asked during the interview can be secured against the time the results will be analysed in three modes/ways namely:

a. by making a mental note of the answers
b. by making a written record of the answers
c. by making a tape or video tape recording of the interview.

i. Mental Note

This is the process where research workers rely on the power of their memory for storing the information obtained during an interview.

How do you find the usefulness of this practice? Write any 2 limitation of this practice for FTF discussion. Under what conditions/situations would its use be appropriate? State any one for FTF discussion.

ii Written Records

Nwana (1992) identified two forms of written records that can be made for the responses. In the first form, to which he referred to as data-blank, the questions to be asked are listed on paper with blank spaces provided for the answers to be written in by the investigator or interviewer whiles the interview is in progress.

In the second form of recording which he referred to as checklist, the questions are listed on paper and alongside each question, a set of most probable responses are supplied. The interviewer records the responses of the respondent merely by ticking off the appropriate responses as they are made.

iii. Tape Recording

This may be sound tape recording which employs a conventional tape recorder to record on magnetic tape only the sounds i.e. the questions posed by the investigator and the answers given by the respondent.

It could also be videotape recording which records on magnetic tape both sounds and the pictures of the interview.

It must be noted that the respondent need to be informed during the time of familiarization that you intend to record the conversation between you and him/her and his/her permission sought for doing so. The mode of recording should also be made known to the respondent.

3.4.5 Advantages and Limitations of Interviewing

The popularity of interview is often justified in terms of several of its qualities which give it an advantage over other methods of data collection. The advantages of interviewing include the following:

- Flexibility – interviews can be adjusted to meet many diverse situations.
- High response rate – interviewing attracts a relatively high response rate.
- Easy administration – interviews do not require respondents to have the ability to read.
- Opportunity to observe non-verbal behaviour – such opportunities are obviously not available when questionnaires are used.
- Capacity for correcting misunderstanding by respondents. More complex questions can be used because the presence of the interviewer can assist in correcting any misunderstanding as well as assisting in answering the questions.

Limitations

Despite its advantages, interviewing is limited by a number of factors. The following are the most important:

- Interviews are more costly and time consuming than other methods such as questionnaires.
- They are attacked for the "interviewer factor" and the possible bias associated with it.
- They are more inconvenient than other methods such as using questionnaires.
- It is less effective than other methods when sensitive issues are discussed. For example many people prefer to write about sensitive issues than to talk about them.

- It offers less anonymity than other methods since the interviewer knows the identify, residence, type of housing, etc.

Dear student, we have discussed instruments and the procedure for developing and administering them. Specifically, we looked at the questionnaire, observation and interview as data collection techniques. We also discussed the types of these techniques as well as their strengths and limitations.

Self-Assessment Questions

Exercise 3.3

1. The stage in the research process whereby a researcher gathers any relevant information for the solution of the research problem under study is known as
   a. data collection.
   b. questionnaire.
   c. instrument development.
   d. descriptive research.

2. Observers will vary in the degree to which they
   a. are trained for conducting the study.
   b. are involved with participants in the setting.
   c. interact with the participants.
   d. are influenced by experimental bias.

3. Which of the following describes an observer who is a member of the group being observed but maintains some distance as a researcher?
   a. Compete participant
   b. Complete observer
   c. Observer participant
   d. Participant observer

4. It is advisable to record an interview of a subject with the tape recorder carefully hidden by the interviewer
   a. True
   b. False

5. Which data collection technique would be most appropriate when one is dealing with young children in a study?
   a. Questionnaire
   b. Observation
   c. Interview

6. Which of the following is NOT a purpose for which interviews and questionnaires are used?
   a. Finding out what a person things and believes.
   b. Finding out what a person likes and dislikes.
   c. Finding out how a person behaves.
   d. Finding out what experiences a person has had.

7. Which of the following is not a shortcoming of a questionnaire or interview? The respondent may
   a. not know anything about the interviewer.
   b. not know the information requested.
   c. try to show himself or herself in a good light.
   d. try to help by telling you what you want.

DESCRIPTIVE DESIGN: INSTRUMENTS AND PROCEDURE

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 4: CORRELATIONAL DESIGN

You are welcome to Session 4 of Unit 3. In Session 3 we looked at the types of instruments that could be used to gather data from the field or on any researchable problem. We also considered the procedure for using these instruments. List the main instruments that were discussed. Compare your response to the information given in session three. I hope you did very well. That is good. Now let's continue.

In this session, we are going to look at correlational research. I hope you are going to enjoy reading this interesting topic.

Objectives

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

(a) Describe briefly what is meant by correlational research;
(b) State and explain the major purposes of correlational research;
(c) State and explain the steps involved in conducting a correlational study;
(d) Interpret correlational coefficients of different magnitude; and
(e) Give few examples of studies which involve correlational research.

Now read on…

4.1 The Nature of Correlational Research

Human behaviour at both the individual and social level is characterised by great complexity. Given the present state of social research, man understands very little about this complexity. One approach to a better and fuller understanding of human behaviour is to begin by leasing out simple relationships between those factors and elements deemed to have some bearing on the phenomenon in question. The value of correlational research is that, it is able to achieve this end.

Before we attempt to describe correlational research, it would be useful to begin by examining correlation and its related terms, then indicate the purpose they fulfill in statistical analysis. We said in the introduction that the primary purpose of this is to discover relationship and in some situations control their occurrence. You have read above that must of social science research, in general and educational research in particular, is concerned with establishing interrelationships among variables. For example, we may wish to know, how delinquency is related to social class background; or whether an association exists between the number of years spent in fulltime education and subsequent annual income; or whether there is a link between personality and achievement. Correlation includes all such research projects in which an attempt is made to discover or clarify relationships through the use of correlation coefficients.

4.2 Definition of Correlation Research

Correlation research attempts to investigate possible relationships among variables without trying to influence those variables. In simplest form, correlational research attempts to determine whether and to what extent or degree a relationship exists between two or more quantifiable variables. Correlational research is sometimes referred to as a form of descriptive research because it describes the relationship between variables. The way it describes the relationships, however, is quiet different from the descriptions found in other types of studies. A correlation study describes the degree to which two or more quantitative variables are related and it does so by the use of correlation coefficient. Do you understand correlation coefficient? Don't worry, the term is explained in the sub session under Data Analysis.

If a relationship exists between two variables, it means that scores within a certain range on one variable or measure are associated with scores within a certain range of another measure.

Correlation does not necessarily establish cause-and-effect relationship. In other words, it must be noted that, the fact that there is a relationship between variables does not imply that one is the cause of the other. Correlation studies provide an estimate of just how related two variables are. However, regardless of whether a relationship is a cause-and-effect relationship, the existence of a high relationship permits prediction.

4.3 Purposes of Correlational Studies

From what you have learnt so far, and your own understanding of correlational research, list any one purpose of undertaking correlational research. Write your answer in your jotter for FTF discussion. Let's now continue.

a) To explain important human behaviours and characteristics in quantitative terms and how they relate.

   Correlation studies help to classify our understanding of important phenomena through the quantification of relationships among variables. For example, correlations found between the rate of language acquisition and the type of language of the child (i.e., first language or second language) had taught researchers much about how language is acquired.

b) Correlational research help in prediction of events.

   A second purpose of correlational research is that of prediction. If a relationship of sufficient magnitude exist between two variables, it becomes possible to predict a relationship on either variable if a score on the other variable is known.

Researchers have found, for example, that a student's grade at the BECE is highly related to the grade of the SSSCE. Hence, BECE would be used to predict SSSCE grades. We would predict that a person who has a high grade at BECE would be likely to have a high grade at the SSSCE.

The variable that is used to make the prediction is the predictor variable. On the other hand, the variable about which the prediction is made is called the criterion variable. In the example above, the BECE grade would be the predictor variable whiles the SSSCE grade is the criterion variable.

4.4 Basic Steps in Correlational Research

1. Problem Selection

The first step in planning a correlational study is to identify specific variables that appear to be important determinant(s) of the complex characteristics or behaviour pattern being studied. What is the basis on which the variables included in a correlational research chosen? Don't answer. Read on

The variables to be included in a correlational study according to Fraenkel & Wallen (2000) should be chosen based on a sound rationale growing out of experience or theory. Generally, three major types of problems are the focus of correlational studies.

a. Is the variable X related to the variable Y?
b. How well does variable E predict variable C?
c. What are the relationships among a larger number of variables and what predictions can be made that are based on them

Almost all correlational studies would evolve around one of these types of questions.

2. Sample Selection

The sample for a correlational study and in any type of study, should be selected carefully and, if possible randomly. Identify the steps in selecting the sample for a study. Compare your response to the following. The first step in selecting a sample is to identify an appropriate population. What is an appropriate population? Read on. An appropriate population is the one that is meaningful and from which data on each of the variables of interest can be collected. The minimum acceptable sample size for a correlational study is considered by most researchers to be no less than 30. Data obtained from a sample smaller than 30 may give an inaccurate estimate of the degree of relationship that exists. Samples larger than 30 are much more likely to provide meaningful results.

3. Instruments

The instruments used to measure the two (or more) variables involved in a correlational study may take one of a number of the forms discussed in the previous session of this unit (i.e., questionnaire, test, checklist, etc). They must, however, yield quantitative data. What is a quantitative data? Do you remember our explanation of quantitative research? If not, go back and revise it. Now read on.

4. Design and Procedure

The basic design used in correlational research is quite simple and straightforward. It involves collecting data on two or more variables on the same group of subjects and computing/calculating the correlation coefficient(s). The correlation coefficient obtained indicates the degree of relationship between two variables.

5. Data Collection

In correlational study, the data on both variables will usually be collected within a fairly short time. The instruments used are often administered in a single session, or in two sessions immediately after each other. Data for relationship study can be collected by various methods including tests, questionnaire, interviews or observational techniques.

6. Data Analysis and Interpretation

In correlational study, data analysis involves computing the correlation coefficient between or among the variables of interest. When two variables are correlated, a correlation coefficient is produced. The coefficient is an index of relationship. Depending on the data collected, the researcher can compute the following using the computer or manually.

a. Pearson's Product Moment Correlation (r)

By far the most common correlation coefficient in educational research is the Pearson's Correlational Coefficient (Heiman, 1996). The Pearson's Correlational Coefficient is used to describe the linear relationship between two variables that are both interval or ratio variables. The symbol for the Pearson's Product Moment Correlation is r. The statistical basis for r is that it compares how consistently each value of Y pairs with each value of X in a linear fashion. The Pearson's Product Moment Correlation Coefficient can be computed using the computer. The manual computation would be treated in the mathematics.

b. Spearman Rank Correlation Coefficient (r_{ranks})

The Spearman rank-order correlation coefficient describes the linear relationship between two variables measured using rank scores. That is the Spearman Rank Correlation Coefficient is used for data involving ordinal or rank-order (first, second, third, etc.)

c. The Biserial Correlation Coefficient

The point-biserial correlation coefficient is used when we want to correlate the scores from a continuous interval, or ratio variable with the scores from a dichotomous variable (scores which has only two categories are dichotomous variables). The point-biserial correlation coefficient describes the linear relationship between the scores from one continuous variable and one dichotomous variable.

4.5 Interpreting the Correlation Coefficient

Once a correlation coefficient has been computed, the next step is interpreting it. In other words, we must understand what the correlation coefficient tells us, once we have computed it.

Correlation techniques are generally intended to answer three questions about two variables or two sets of data.

First, is there a relationship between the two variables or set of data? If the answer to this question is "Yes" then the two other questions follow. What is the direction of the relationship, i.e., if there is a correlation, is it negative or positive? and, What is the magnitude or strength of correlation? i.e., whether the existing correlation is strong or weak. Existence, direction and strength of correlation are demonstrated in the coefficient of correlation. When a correlation is found to exist between two variables, it means that scores within a certain range on one variable are associated with scores within a certain range of other variables. Where the two variables (or set of data) fluctuates or change in the same direction i.e. as one increases so does the other, or as one decreases so does the other, a positive relationship is said to exist. Correlations showing this pattern are prefaced with a plus (+) sign to indicate the positive nature of the relationship. Thus, +1.0 would indicate perfect positive correlation between two factors as with the radius and diameter of a circle and +0.8 a high positive correlation as between academic achievement and intelligence, for example.

A negative correlation or relationship on the other hand, is found when an increase in one variable is accompanied by a decrease in the other variable.

Thus, when high scores in one variable are associated with low scores in the other variable. Negative correlations are prefaced with a minus (-) sign thus –1.0 would represent a perfect negative correlation as between the number of errors children make on a spelling test and their score on the test (i.e., the higher the score the lower the mistakes and vice-versa). A correlation coefficient of –3.0 would also imply a low negative correlation as between absenteeism and intelligence, for example. If a coefficient of zero (0) is obtained, the two variables are not related.

Correlation, a measure of relationship between variables introduced in this unit is very popular, very useful in research. It is also very easy to compute and interpret. We learnt that in correlational research, the relationship between two or more variables is examined. The strength of the relationship and the direction of the relationship are determined.

Self-Assessment Questions

Exercise 3.4

1. Research projects in which an attempt is made to discover or clarify relationships among variables involves correlation research.
   a) True
   b) False

2. A correlation study describes the degree to which two or more variables are related by the use of …….
   a) the correlation co-efficient
   b) co-efficient alpha
   c) a cause-and-effect relationship

3. In correlation research, the relationship that is established between variables implies that one is the cause of the other.
   a) True
   b) False

Use the statement below to answer questions 4 & 5.

A researcher conducted a study and concluded that students who obtain aggregates 8 – 12 in the SSSCE obtain a GPA of 3.00 – 4.00 at the first year in the University.

4. The predictor variable in the statement is
   a) University GPA
   b) SSSCE grades
   c) Correlation coefficient

5. The criterion variable is
   a) University GPA
   b) SSSCE grades
   c) Correlation coefficient

6. When planning a correlation study, the researcher must first
   a) select a sample
   b) design a very good questionnaire or interview guide
   c) select a problem

7. The basic design used in correlational research involves collecting data on
   a) only one variables
   b) only two variables
   c) two or more variables

CORRELATIONAL DESIGN

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 5: CASE STUDIES

We discussed what the correlation design is all about in the previous session

Do you remember some of the main points discussed in each sub session under the correlational research? I hope you do, that is very good.

In this session we shall look at case studies as a design. I hope you will enjoy reading this important research design.

Objectives

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

(a) explain the term, case study as on a research design;
(b) discuss the purposes of case study;
(c) identify the steps in planning a case study;
(d) list and explain the skills needed by a case study investigator;
(e) analyse case study data; and
(f) discuss some issues in case study approach.

Now read on …

5.1 Case Studies

What does the term case studies mean to you? Does it involve studying just an individual, one school, one decision or one district, etc? Your response may be correct. Read and you will find more about case studies. Case study has a long history in educational research and has been used extensively in such areas as psychology and sociology of education. For example, both Frend and Pioge typically used case studies to develop their theories. Do you remember some of these theories.

Case studies are investigations of an individual group, institution or other social unit. The social unit may be a person, a family, a social group, a solid institution of a community. In other words, case studies mostly involve the observation of individual unit e.g. a student, a delinquent clique, a family group, a class, a school, a community, an event, or even an entire culture, etc.

The researcher conducting a case study attempts to analyse and understand the variables that are important to the history, development, or care of the subject or the subjects' problems. For example, there are some students who learn a second language rather easily. In an attempt to gain insight into why this is the case, one such student could be observed on a regular basis to see if there are any noticeable patterns or regularities in the student's behaviour. The student, as well as his/her teachers, counsellor, parents and friends might be interviewed in-department. A similar series of observation and interviews could also be conducted with a student who finds learning a second language very difficult. The hope here is that, through the study of somewhat unique individual, insights can be gained that will suggest ways to help other language students in future.

Similarly, a detailed study might be made in a single school as a way of conducting/undertaking a case study in the school that is noted for its successes in the BECE examinations.

From the above examples, it can be noted that a case study can be simple and specific, complex and abstract. A case study should also focus on bounded subject or unit that is either very representative or extremely typical i.e. different from all others of its type.

5.2 Purpose of Case Studies

Now I believe you know what a case study is about. However, it is important that we discuss the rational/purposes of case studies.

The purposes of case studies include the following:

1. Preliminaries to major investigations. Case studies are a useful way to explore/examine/bring to light variables, phenomena, processes and relationships that have not been thoroughly researched and as such deserves more intensive investigation. The information obtained in case studies can be extremely useful in the production of hypothesis in research questions to be tested or answered more carefully in subsequent research. Case studies could be a pilot study where methods, approaches or policies are tried out to see what the difficulties are that need to be dealt with before a main study is undertaken.

2. Provision of anecdotal evidence. A case study may provide anecdotal evidence i.e. a short, interesting or amusing information about the phenomena under study; that illustrates more general findings.

3. A case study is mostly used when the relevant behaviours cannot be manipulated of respondents physical characteristics, social qualities or behaviours, recorded data on respondents from newspapers, schools, courts, clinics etc.

4. Intensive probing and analysis of interactions between factors under study. The primary purpose of a case study is to determine the factors, and relationships among the factors that have resulted in the current behaviours or status of the subject of the study. The case study thus determines why and not just what.

   The case study therefore probes deeply and analyses interactions between the factors that explain present status or that influence change or growth. This intensive probing that characterises case studies often leads to insights concerning previously unsuspected relationships.

5. In-depth case studies serves as important role of clarifying concepts and variables or clarifying ways to measure them.

5.3 Types of Case Studies

Four types of case studies would be looked at.

1. **Historical Case Study**: These studies involve the tracing of the development of an organisation/system overtime. Considered under the historical case studies is oral history. Oral history involves first person narratives that the researcher collects using extensive interviewing of a single individual retired educationist recounting how he/she was taught during the era of the Accelerated Development Plan (ADP) in 1951.

2. **Observational Case Study**: These studies often focus on a classroom, group, teacher and pupil often using a variety of observation and interview methods as the major research tools.

3. **Situational Analysis**: Situational analysis is a form of case study where special events are studied. For instance, events like students unrest/strikes, teachers/workers strike, etc. could be studied by interviewing the students, parents, teachers, workers headmasters and other witnesses concerned.

4. **Clinical Case Study**: This approach aims to understand indepth a particular individual, such as a child having problem with reading, a teacher with disciplinary difficulties, or a headteacher/manager with poor interpersonal relationship, etc.

5.4 Planning Case Study

Case studies, like other research design, need to be planned before they are carried out. Can you think of the components that must go into these planning? Write your response in your jotter for FTF discussion.

Osuala (2001) has identified four main components to the research design in case studies.

1. Initial case study questions: Questions with regard to who, what, where, when and how the case study would be undertaken must be clarified and stated in the right form. It must be noted that without the initial questions, to which the researcher wishes to find answers, no start can be made.

2. Study Propositions: There is the need to state clearly and shortly suggestions or propositions that will enable the question(s) to be answered.

3. Unit of Analysis: This component is concerned with defining clearly and in unambiguous terms the exact case we want to investigate. Without this the investigator will not be limited to any defined area/scope. He/she would, thus, be tempted to collect everything that randomly may have a bearing on the issue.

4. Linking Data/Data Analysis and Interpretation: This is the means to linking data to proposition using it as a criterion for interpreting findings.

5.5 Principles of Case Study Data Collection

What should the investigator do so that case studies would yield good and reliable results? Write your response in your jotter. Compare your response to the following.

1. **Use multiple sources**: Most case studies are capable of producing several sources. The use of multiple sources is the major strength of case study approach. Multiple sources allow for the use of different approaches/methods – observation, interviews/questionnaires, etc. This helps to improve the reliability and validity of data findings. Corroboration of all these approaches makes a case study report more convincing.

2. **Maintain a chain of evidence**: In a case study evidence should be built up from multiple sources if possible and shown to be in line/suitable with the conclusion.

3. **Record data**: There should be an on-site recording of every data the researcher obtains. On-site recording can range from sketchy notes to the minute detail encoded on a tape. It is also important that full notes be written up as soon as possible after the observation in view of the fallibility of human memory. The investigator should also be more concerned with remembering the substance of conversations rather than a perfect reproduction. The actual content of any observation should include verbal descriptions of setting, the respondents and the activities, the observed comment, feelings, reactions and interpretations.

5.6 Skills Needed by Case Study Investigator

Why should the investigator require special skills in carrying out a case study design? Write your response in your jotter. Now lets compare the written response to the following.

The quality of a case study data depends to a great extent on the experience and skills of the investigator. These skills as enumerated by Osuala (2001) include the following.

1. Formulation of relevant and precise questions. The investigator needs to be able to formulate or prepare relevant and exact questions that would enable data to be extracted from the subject.

2. Ability to use all the sense organs. The investigator needs to be a good listener, observing, sensing and if possible touch and feel as a means of obtaining the right data.

3. A grasp/in-depth knowledge of what is being studied. The investigator must have a firm grasp of the issues he/she is studying. Why should it be so? Without this, important points and issues can be misled or misrepresented.

4. Lack of bias. Another important skill to be exhibited in undertaking a case study is to avoid being bias. The investigator should be fair and present and interpret issues exactly as he/she has observed. Do not interpret to support a preconceived position.

The investigator must know how to observe, allowing the subject to talk freely and at the same time be alert for something definitive that may relate to a hazy hypothesis which they are seeking to check. Minimise direct questions and use non-directive probing questions. Example, "What happened next?" " What do you think?" Use words, terms and structures used by the respondent.

5.7 Analysing Case Study Data

How do you take notes for case study? Write your answer in your jotter. Compare your response to the following.

Notes for case study may be derived from:

1. interviews

2. observations

3. documents

They may be in various forms. List the forms that you know. Now read on.

Case study notes may be in the form of written or typed notes in a pad, diary or index card, audiotapes, computer disks, video/film. According to Osuala (2001), these notes should be organised on an ongoing process so that as the study progresses the investigator has some sense of the direction in which it is going and the confirmation and contradictions that are arising. As part of the analysis, all the observation and data should be organised chronologically or by topic, and they should be closely perused i.e. read/look in a relaxed and not very detailed and the main aspects of the data isolated. Through this activity the data would be organised. Other approaches of analysing the case study data involves creating flow charts and diagrams, tabulating frequency and sorting information into chronological order i.e. ordering the events by the time at which they happened.

The session continued with a presentation on the type of research designs that researchers have used to address a variety of problems. The case study was that type that was discussed. We have realised that case studies are intensive investigations of a single entity or a small number of entities. We also learnt that, typically that entity is a human, but groups, organisations, families or communities may sometimes be the focus of the concern. Other aspects of the case study discussed included the steps in planning a case study, skills needed by a case study investigator and how case study could be analysed.

Self-Assessment Questions

Exercise 3.5

Answer the following questions as a way of assessing what you have learnt in this session.

1. Case study typically involves the observation of individual units
   a) True
   b) False

2. In a case study evidence should be built up from a single source so that conclusions drawn could be reliable.
   a) True
   b) False

3. Which of the following is NOT a skill needed by a case study investigator?
   a) The investigator should not be flexible
   b) He/she must have a grasp of the issues he/she is studying
   c) Lack of bias
   d) Needs to be a good listener and observer.

4. A means of reducing the chance of having the individual tell what the investigator wishes to hear is to minimise direct questions and use non-direct probes.
   a) True
   b) False

5. Case studies provide very strong evidence for scientific investigation.
   a) True
   b) False

CASE STUDIES

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 6: EXPERIMENTAL AND CAUSAL COMPARATIVE DESIGN

Hello learner, good morning/afternoon/evening and welcome to this session. We just want to congratulate you on coming this far in this course. We have no doubt that you have found it quite challenging but we have the certainty of conviction that you have enjoyed every bit of it. We have dealt with lots of information and we are sure that you have tried to understand all the new things you have met in this course of educational research. We are looking at research designs. The descriptive designs as well as correlation and case studies have all been treated in this unit.

In this session, however, we shall learn about the experimental and causal comparative designs. We are convinced you will find this session very interesting.

Objectives

By the time we go through this entire session, you will be able to:

(a) identify and discuss the steps in experimental and causal comparative research; and
(b) state and discuss the types of experimental design.

Now read on…

6.1 Definition of Experimental Research

Dear student, have you met the term experimental research? Do you remember meeting the term in the session in which we classified educational research? Can you explain what the term means? Now read on.

Experimental research is one of the most powerful research designs researchers use. Amedahe (2002) maintains that in an experimental study, the researcher manipulates at least one independent variable, controls other relevant variables and observes/ or sees what will happen to the subjects as a result. The researcher determines which group of subjects gets a particular treatment. According to Compbell and Stanley (1963), this is the kind of research in which variables are manipulated and the effect of the manipulation upon the variables are observed.

The earliest assumptions of experimental research were based upon what was known as the law of the single variable. In its simplest form, the law of the single variable states that: If two situations are alike in every respect, and one element is added to one and not the other, any difference that develops is the effect of the added element, or if two situations are alike in every respect and one element is removed from one but not from the other, any difference that develops is would be attributed to the subtracted element.

Experimental research is unique in two very important respects: It is the only type of research that directly attempts to influence a particular variable. Also, it is the only type that can really test hypotheses about cause and effect relationship.

6.2 Characteristics of Experimental Research

McMillan (1996) identified two essential characteristics of all experimental research.

- Direct manipulation of the independent variable(s) and
- Control of extraneous variables.

6.2.1 Direct Manipulation of Independent Variables

In an attempt to explain this, we would like you to explain in your own words "Direct manipulation" and independent variable(s). Write your explanation down. Now read on.

Direct manipulation of the independent variable(s) means that the investigator/researcher has a direct control of when the subjects receive the independent variable and how much of it each subject receives. In an experimental research, the investigator has control over one or more factors in the study that may influence the behaviour of the subjects. That is, the research can manipulate a factor and see what will happen to the responses of subjects as a result. The experimenter does something to at least some of the subjects in the study. Manipulation also means varying conditions for different people and determining the their effect.

Why do investigators manipulate factor(s)? Write your response in your jotter for FTF meeting.

According to McMillan (1996), the purpose of manipulating a factor is to investigate its causal relationship with another factor. For example, some investigators may be interested in studying the causal relationship between time on task and achievement. These investigators would then manipulate "time" by having one group of children spend a small amount of time on the subject and a second group a large amount of time. The investigators determine (manipulate) whether children are engaged a small or large amount of time. If, for instance, the children who are engaged a longer amount of time show higher achievement than the other children, time on task may be causally related to achievement.

In educational research, the method of instruction, type of grouping, amount of learning time and assignments are common independent variables manipulated in experiments.

6.2.2 Control of Extraneous Variables

A second characteristic is control of extraneous variables. In an experiment the researcher seeks to keep constant for all subjects all variables, conditions, events and procedures except the independent variable. Why is this done? Do not answer. Read on.

Such factors are kept constant to eliminate them as possible explanations for the cause-and-effect relationship. In other words, the effect, which is measured by differences on the dependent variable, should be produced only by variations in the independent variable.

Control refers to efforts on the part of the researcher to remove the influence of any variable (other than the independent variable), which might affect performance on the dependent variable. Here the experimenter introduces one or more control over the experimental situation, including the use of control group. Why is control of extraneous variable(s) necessary? Read on.

Control of extraneous variables is necessary to conclude that the independent variable is causally related to the dependent variable.

Amedahe (2002) maintains that two different kinds of variables need to be controlled.

- The first kind is subject variables – these are variables on which subjects in the different groups might differ. An example is reading ability of students.
- The second kind is environmental variables. Examples are established by either eliminating a possible extraneous variable constant for all groups. In controlling variables, the researcher wants the groups to be as similar as possible, so that the only major difference between them is the independent variable.

Some extraneous variables can be eliminated. For example, in an experiment to investigate which of two methods of instructions is most effective, teachers with similar experience and teaching competence and enthusiasm would be selected. Similarly, the academic ability of pupils should be similar.

6.3 Steps in Experimental Research

The steps of the experimental research are, in principle, no different from that employed/used in other areas of research. The steps are:

- Selection and definition of a problem
- Definition and selection of population, subjects and measuring instruments
- Selection of a design/drawing up the experimental design

- Data collection
- Analysing and interpreting of data
- Drawing up the conclusion
- Reporting the result

6.3.1 Selection and Definition of Problem

Experiments begin with the selection of the problem/topic to be researched. Any problem that can be put under experimental conditions lend itself to experimentation. The problem amenable (lending itself) to experimentation generally should be converted into a hypothesis. The hypothesis can be verified or refuted by the experimental data. The variables to be investigated should be defined in operational terms.

6.3.2 Defining the Population, Selecting the Subjects/Sample and Measuring Instruments

It is important to define the population precisely so that there can be no questions about the population to which the conclusions are to apply. The sampling procedure/technique for obtaining the sample for the study must then be selected having defined the population.

6.3.3 Selection of a Design

Experiments are designed in a number of ways. This has resulted in several types of experiments. Basically, experimental designs include decisions related to the selection of the subjects and arrangements of the experimental conditions that will guide the execution of the experiments.

The selection should place primary emphasis on the question of control, randomisation and replication. It should include a clarification of such basic aspects of the design as the place and duration of the experiment. It is generally advisable to conduct a pilot study, because of the complexity of an experiment, in order to ensure the adequacy of the design.

6.3.4 Collection of the Data

Collection of the data in experimentation differs from that of the other designs. It includes a number of steps that ultimately consists of subjecting the respondents to certain conditions and ascertaining the effects that resulted from that procedure.

6.3.5 Analysing and Interpretation of Result

The researcher is concerned with the operation of the factors under investigation. He/She must be especially sensitive to the possibility that the results of his/her study arouse through the operation of uncontrolled extraneous factors/variables. Do you remember extraneous variable? Turn to Unit 1 Session 5 in this book.

An extraneous variable affects the dependent variable but is unknown or not controlled by the researcher. The methods of analysis employed in experiments are quantitative and concentrate on experimental conditions on assessing the differences between pre-test and post-test results and on statistical techniques. Have you met "quantitative analysis"? Now read on. Quantitative analysis emphasises numbers, measurements, deductive logic, control and experiments.

6.3.6 Drawing up the Conclusion

The conclusion of the study must be based on the findings of the study. Care must be taken not to over-generalise the results obtained. The results also pertain only to the conditions under which they were obtained, and since control may have distorted/changed the natural situation, care must be taken to restrict the conclusions to the conditions actually present in the experiment.

6.3.7 Reporting the Result

The study must be reported in sufficient detail so that the reader can make an intelligent judgement as to its validity. Validity would be looked at later.

6.4 Experimental Sampling

Characteristics of a sampling

Selection of the subjects in an experimental design is usually undertaken by means of probability sampling discussed earlier on this session, precisely session 2. The experimental sample demonstrates the following characteristics.

- It includes two sub-samples namely the **experimental group** and the **control group**.

  What is the experimental group? Do not answer, read on. It is the group that will be exposed to the independent variable.

- The two groups must be checked for any systematic differences.
- The subjects in the experimental and control groups must be the same or similar.
- The selection of the subjects should be free from sampling bias.

These criteria indicate that sampling in experimental designs has to meet at least two conditions namely,

1. That it produces a representative sample free from bias and distortion
2. That it establishes two similar sub-samples

6.5 Types of Experimental Design

Researchers use several types of experimental designs to establish relationships between variables. The type one could depend upon the problem being investigated. The differences between these designs lie mainly in the number of experimental and control groups employed in each experiment in the use of pre-tests (i.e. in the experimental group or in both groups), and in the way in which the independent variable is treated.

Amedahe (2002) notes that selection of a given design is dictated by such factors as whether

- there will be a control group
- subjects will be randomly assigned to groups
- each group will be pre-tested
- how resulting data will be analysed

6.6 Major Classes of Experimental Design

Gay (1992) has identified two major classes of experimental designs. These are:

1. single variable designs and
2. factorial designs.

In single variable designs one independent variable is manipulated whiles in factorial designs two or more independent variables are manipulated.

6.6.1 Simple Variable Designs

Single variable designs are classified as pre-experimental, true experimental or quasi-experimental design depending upon the control they provide for sources of internal and external validity. Internal and external validity is explained under experimental validity.

Which of the three classifications of single variable designs is best and hence must be preferred? Do not answer, read on.

Pre-experimental designs do not do a very good job of controlling threats to internal validity and should therefore be avoided. The true experimental designs represent a very high degree of control and are always to be preferred. Quasi-experimental designs do not control as well as true experimental designs but do a much better job than the re-experimental designs.

6.6.2 Factorial Designs

When more than one independent variable is included in a study, whether true experiment or a quasi experiment, a factorial design is necessary. Factorial designs are basically elaboration of true experimental designs and permit investigation of two or more variables, individually and in interaction with each other.

The basic designs in each category as presented briefly by Gay (1992) are given below.

Here is a research riddle for you. Can you do an experiment with only one group? Do not respond. The answer is … Yes, but not a really good one.

Two of the pre-experimental designs involve only one group.

(a) **The One-shot Case Study**: The one-shot case study involves one group which is exposed to a treatment (x) and the post tested (o). There is not pre-test. None of the threats to validity that are relevant is controlled by this design. A high score by subjects on the post test cannot be attributed to the pressure of the treatment since the researcher does not even know the subjects before the treatment was administered.

(b) **The One-Group Pre-test – Post-test Design**: The design involves one group which is pre-tested (o), exposed to a treatment (x0, and post-tested (o). The success of the treatment is determined by comparing pre-test and post-test scores. History and maturation as a threat to validity are not controlled.

(c) **The Static-Group Comparison**: The static-group comparison involves at least two groups. One group receives a new unusual treatment while the other receives a traditional or usual treatment. Both groups are post-tested. This design too does not control for maturation, selection mortality and selection interactions.

6.6.3 True Experimental Design

The true experimental designs provide completely adequate controls for all sources of internal and external validity. One common characteristic of all the true experimental designs is the random assignment of subjects to groups. To qualify as a true experimental design, there must be random assignment of subjects. In addition all the true designs involve a control group.

The true designs include:

(a) The Pre-test – Post-test Control Group Design.

The pre-test – post-test control group design can be diagrammed as shown

R O_1 X O_2
R O_3 O_4

Two groups, both of which are formed by random assignment, are employed in this design.

Both groups are administered a pre-test of the dependent variable (O_1 and O_3) One group, the experimental group, receives a treatment X while the second group, the control group, does not. Both groups are then post-tested (O_2 and O_4). The use of a pre-test, random assignment and a control group are the main difference between this design and the design to be discussed after this one. The combinations of these activities serve to control all threats of internal validity except pre-test treatment reaction. Thus, by use of a control group which has all the same experiences as the experimental group other than the experience of the treatment itself, this design controls for history, maturation and regression. By randomising the control and experimental groups, both selection and maturity are controlled. The design, therefore, controls many threats to validity or sources of bias. Hope you are bothered with the terms "history", "maturation". "regression", "selection", "mortality" and "threats to validity", do not worry. We shall discuss this in the latter part of this unit.

How can we analyse data collected using this design? Do not answer. Now read on. The best procedure to analyse data collected using this design is to simply compare the pre-test scores of the two groups. If the pre-test scores of the group are essentially the same, post-test scores can be directly compared using a t-independent test. If the pre-test scores are not essentially the same then the researcher should use analysis of covariance (ANCOVA) which adjusts the post-test scores based on any initial differences. Data analysis involving the t-test would be treated later in this book.

(b) Post-test – Only Control Group Design

The design is exactly the same as the pre-test – post-test control group design except that there is no pre-test. The post-test – only control design is potentially the most useful true design. It can be diagrammed as follows

R X O_1
R O_2

The post-test – only control group design is ideal in that it controls all threats to validity and all sources of bias. The design utilises two groups, one of which experiences treatment while the other does not, thus controlling for history and maturation. Group assignment is made on random basis, which controls for selection and mortality. In addition, to control for a simple testing effect and the interaction between testing and treatment no pre-test is given to either groups. Subject attrition is not controlled because of the absence of pre-test data on subjects.

The appropriate analysis for dealing with data from the post-testing – only control group design would be a comparison between the mean for O_1 and the mean for O_2.

(c) The Solomon Four-Group Design

When data are collected both before and after an intervention, the pre-test (initial) measure sometimes has the potential to distort the results. That s, the post-test measures may be affected not only by the treatment but also by exposure to the pre-test. For example, in an intervention in the form of a workshop to improve nurses' attitudes towards AIDS patients, a pre-test attitudinal measure may in itself constitute a sensitising treatment and could affect an analysis of the workshop effect. Such a situation might call for the Solomon for-group design. What then is the Solomon four-group design? Now read on. According to Amedahe (2002), the Solomon four-group design involves random assignment of subjects to one of four groups. It consists of two experimental groups and two control groups. One experimental group and one control group would be administered the pre-test and the other groups would not, (thereby allowing the effect of the pre-test measure and intervention to be segregated). All four groups are post-tested. The figure below illustrates the Solomon four-group design.

Group	Data Collection	
	Before	After
Experimental – with pre-test	X	X
Experimental without pre-test		X
Control with pre-test	X	X
Control without pre-test		X

As the figure above indicates, the Solomon four-group design is a combination of the pre-test – post-test control group design and the post-test –only control group design.

(d) Quasi Experimental Designs

Quasi-experimental designs are partly, but not fully, true experimental designs. They control some but not all of the sources of internal validity. Although they are not as adequate as the true experimental designs, because the sources of bias are not simply controlled, they are substantially better than the pre-experimental designs with regard to control of the threats validity.

Quasi-experimental, like true experiments, involve the manipulation of an independent variable, that is, the institution of an experimental treatment. Quasi-experimental designs lack at least one of the other two properties that characterises true experiments, randomisation or control group.

Quasi-experiment, in sum, is a study in which subjects cannot be randomly assigned to treatment conditions, although the researcher manipulates the independent variable and exercises certain controls to enhance the internal validity of the results. They exist for situations in which complete experimental control is difficult or impossible. Examples of Quasi-experimental designs are:

(a) Time sense design
(b) Equivalent time-samples design
(c) Non equivalent control group design
(d) Counter balanced design

The above designs are higher-level designs and would not be discussed.

6.7 Experimental Validity

To make a significant contribution to the development of knowledge, an experiment must be valid. Any uncontrolled extraneous variables, which affect performance on the dependent variable are threats to the validity of an experiment. According to Sarantakos (1998), validity of experiments is considered in two forms. These are internal and external.

6.7.1 What is Internal Validity?

Imagine the results of a study show that SSS students taught by the inquiry/discovery method score higher on a test of science on the average, than do students taught by lecture method. The question, then is, "is this difference in scores due to the difference in method to the fact that the two groups have been taught differently? Don't answer.

The researcher who conducted the study would like to conclude like this. His/Her first inclination may be to think same. However, this may not be a legitimate interpretation. The following possibilities might have existed.

Students who were taught the inquiry method may be good in the sciences. Some of the students in the enquiry group might have been taken a related course during this time. Teachers of the inquiry group might have been better teachers than the other method. These and other factors might explain why the inquiry group scored higher on the science test. In such a case, the researcher may be mistaken in making any conclusions.

Many studies that describe or test relationships always have the possibility that the relationship shown in the data is, in fact, due to or explained by somebody else. Many alternative hypothesis may exist to explain the outcomes of a study. These alternative explanations are referred to is threat to internal validity.

Internal validity is therefore the degree to which observed differences on the dependent variable are directly related to the independent variable and not to some other uncontrolled variable. Thus where a study has internal validity, it means that any relationship observed between two or more variables should be meaningful in its own right rather than being due to **something else**. The "something else" might be one of a number of factors. Can you name some? Write your response down. Compare to the following: The validity of a study is threatened by certain factors. We proceed to discuss them briefly.

6.7.2 Threats to Internal Validity

True experiments possess a high degree of internal validity because the use of control procedures (manipulation and randomization) enables the researcher to rule out most alternative explanations for the results. With quasi-experimental, pre-experimental or ex-post facto designs the investigator must always contend with competing explanations for the obtained results. These competing explanations referred to as threats to internal validity has been discussed by Campbell and Stanley (1966) and Bracht and Gles (1968). They include:

1. **History**
   In research, the term History refers to events occurring in the environment at the same time that the experimental variable is being tested. Frequently, in educational research, events other than the experimental treatments occur during the time between pretest and post-test observations. Such events produce effects that can mistakenly be attributed to differences in treatment. Events like lost of a dear one, an important event taking place at the time of testing, mood of testee etc can affect the performance of participants/ respondents.

2. **Maturation**
   The change in the dependent variable may not be caused by the independent variable but rather by maturation of the subjects. What is Maturation? Read on.. Maturation refers to the processes of change that take place within the subjects of an experiment over a period of time. These changes can be physical/biological or mental which may occur within the subject over a period of time. The views of subjects may change over time and/or subjects may by the time they come to the post-test be tired, hungry or influence by others. Such changes can produce differences that are independent of the experimental treatment.

The problem of maturation is more acute in studies that are extended for periods of time than in brief studies. The researcher cannot control the occurrence of maturation but can control for its occurrence.

3. Pretesting

A pretest is a measure of the independent variable given before the treatment begins. What is the use of pretest in experiment(s). Write your response in your jotter. Now read on …

Many experiments use a pretest to determine the initial stage of the subject with regard to some particular variable. The effect of taking this pretest may be to increase the likelihood that the individual will do better in the subsequent post-test, particularly when it is identical to the pretest. A pretest can cause differences between experimental and control groups to disappear by providing the control group with an experience more relevant to the post-test than in the experimental treatment. In fact, pretesting might sensitise subjects and predispose them to develop an interest in the experiment and respond atypically to experimentation.

4. Instrumentation

Another threat that is related to the researcher's measurements is referred to as the threat of instrumentation. Amedahe (2002) refers to instrumentation as "unreliability or inconsistency in measuring instrument which may occur in several different ways. This bias reflects changes in the researcher measuring instruments between an initial point of data collection (pretest) and a subsequent point (post-test). For example, if two different tests are used for pretesting and post testing and the nature of the test (including scoring, administration procedure time allotted etc) is changed in some way or another, instrumentation threat may occur. Can you think of other ways where instrumentation threats could occur? Write your response in your jotter? Compare to the following: Instrumentation affects can occur even if the same instrument/test is used. For example, if people taking the pretest data, especially in observation and interview, are more experienced than those who took the second data (post-test) and vice-versa. Similarly, if subjects or test takers become bored or fatigued in any of the administration, then these differences could bias the results.

5. Mortality (Loss of Subject)

No matter how carefully the subjects of a study are selected it is common to "lose" some as the study progresses. This is known as Mortality threat. Mortality as a threat to internal experimental validity, does not necessarily mean less of subject through death/or subject die. Mortality rather refers to the differential loss of subjects (attrition) from the different groups that are being compared.

Mortality occurs when subjects systematically drop out of the study or are lost and their absence affect the results of the study. For one reason on another such as illness, family relocation, lost of interest, motivation etc some individuals may dropout of a study. In any study, it is desirable to obtain post-test data from all of the subjects who were originally included in the study. When a large number of subjects withdraw from an experimental study, those who remain to take part in the study may be unrepresentative of the group as a whole.

The threat of attrition is apt/likely to be especially high when the length of time between points of data collection is long. A 12 month fellow-up of subjects, for example, is likely to produce higher rates of attrition than a one month fellow-up.

It must, however, be noted that if attrition is random (i.e. those dropping out of the study are highly similar to those remaining in the study with respect to characteristics that are related to the dependent variable), then the risk of mortality biases is low. However, attrition is rarely total random. In other words it is not likely to obtain the situation described above. Generally the higher the rate of attrition, the greater the likelihood of bias.

One may then ask, what is the standard for acceptable attrition rates? Now read on …

Although there is no absolute standard for acceptable attrition rates biases are generally of concern if the rate exceeds 20%.

6. Selection

The selection of people for a study may result in the individuals or groups differing from one another in an unintended ways that are related to the variables to be studied. This is what is referred to as "selection bias" or a subject characteristics threat.

To explain this further, in most experiments two or more groups of subjects are compared. One group receives one level of the independent variable, and the other groups receive other levels of independent variable. In studies that compare groups, subjects are randomly assigned to levels of the independent variables. This procedure ensures that the different groups of subjects are comparable on such characteristics/ variables as age, gender, ability, socio-economic background, motivation attitudes, interest and the like. However, in some experiments the random assignment of subjects to groups may not be done properly. In these circumstances it is possible that the groups to be compared may differ so much on such variables mentioned above. If not controlled, these variables may "explain away" whatever differences between group are found.

Can you give a list of such subject characteristics that might affect the results of a study? Write any four. Compare your answer to the following: Some examples of subject characteristics that might affect the results of a study include:

- Age
- Strength
- Maturity
- Gender
- Socio-economic status
- Ethnicity
- Coordination
- Speed
- Intelligence
- Religious belief
- Vocabulary
- Attitude
- Reading ability
- Fluency
- Political beliefs etc

7. Regression (Statistical Regression)

A regression threat may be present whenever change is studied in a group that is extremely low or high in its pre-intervention performance. In other words statistical regression refers to the tendency of subjects who score extremely high or low in a pretest to score closer to the mean of both groups on the post-test, regardless of the effect of the treatments. That is, very low pretest scores are likely to be higher on the post-test and very high pretest scores are likely to be lower on the post-test. Studies in special education are particularly vulnerable to this threat, since the students in such studies are frequently selected on the basis of previous low performance.

The issue of regression can be explained statistically, but for our purposes it simply describes the fact that a group selected because of unusually low (or high) performance will, on the average, score closer to the mean on subsequent testing, regardless of what transpires in the meantime. In other words a class of students of markedly low ability may be expected to score higher on post-tests regardless of the effect of any intervention to which they are exposed. How do we handle this threat? Don't respond, read on …… Like maturation, the use of an equivalent control or comparison group handles this threat.

Some examples of a possible regression threat are as follows:

- Those students who score in the lowest 20 percent in a maths test are given special help. Two weeks later, their average score on a test involving similar problems has improved.

- The University Athletic coach selects the members of his team from those who have the fastest times during the final trials for various events. He finds that their average time decreases the next time they run, however, which he attributes to differences in track conditions.

Hello student, we have come to the end of a lengthy unit where we considered experimental and causal comparative design. We have thoroughly discussed the definition and characteristics of experimental research. This was followed with the types and major classes of experimental research. The later part of the session was devoted to experimental validity, highlight of which was internal validity. The common threats to internal validity have also been discussed.

Self-Assessment Questions

Exercise 3.6

1. In this type of study, the researcher manipulates at least one independent variable, controls other relevant variables and observes what happens to the response of subjects. The study is …
   a) causal comparative study
   b) es post facto study
   c) experimental study
   d) internal validity

2. In direct manipulation of independent variables, the investigator has a direct control of when subjects receive the independent variable but has no control of how much of it each subject receives.
   a) True
   b) False

3. In an experiment, the researcher seeks to keep constant for all subjects, all variables, conditions, events and procedures except the
   a) independent variable
   b) dependent variable
   c) extraneous variable
   d) environmental variables

4. Selection of subjects in an experimental design is usually undertaken by means of ……..
   a) convenient sampling
   b) non-probability sampling
   b) quota sampling
   d) probability sampling

5. When a researcher employs a specific design to control for extraneous variables, the …… of the design is strengthened.
   a) external validity
   b) internal validity
   c) experimental validity
   d) generalisability

6. Control of extraneous variables is achieved by
   a) making sure none of the extraneous variables and plausible
   b) random assignment
   c) making groups homogeneous on the extraneous variables
   d) using experimental design

7. In the single-group pretest-posttest design, the most significant threat to internal validity is usually ……
   a) selection
   b) statistical regression
   c) history
   d) experiment bias

8. A 'true' experimental design is distinguished by ……
   a) stronger internal validity
   b) strong external validity
   c) researcher control over most extraneous variables
   d) random assignment of subjects

9. Establishing the reliability or consistency of test scores over items and over time, thus showing that the test measures something consistently is a means of controlling the biases introduce by ……
   a) statistical regression
   b) selection
   c) mortality
   d) instrumentation

10. The processes of change that take place within the subjects of an experiment refers to ……
    a) mortality
    b) maturation
    c) instrumentation
    d) history

UNIT 4: ANALYSIS OF DATA AND REPORT WRITING

Unit Outline

Session 1: Preparation and Organization of Data
Session 2: Statistical Data Analysis – Descriptive Statistics
Session 3: Statistical Data Analysis – Hypothesis Testing
Session 4: Research Report: General Issues And The Preliminary
Session 5: Research Report: The Introduction, Literature Review and Methodology Chapters
Session 6: Research Report; The Results and Conclusion Chapters and Reference Materials

You are welcome to the last unit of this course. You have done well to come this far in the course. This Unit, like the earlier Units is equally important in the research process. In an earlier Unit we explained that every scientific inquiry involves data collection of some sort. The data collected in conducting a study must be organised and analysed to obtain the meaning, patterns and trends in the data. This is important because collecting a hundred separate pieces of interesting information will mean nothing to you as a researcher or to a reader, unless you have placed them into categories and interpret them. In research, as mentioned in earlier units, we are constantly looking for similarities and differences, for groupings, patterns and items of particular significance in an attempt to understand things. Things become clear to us when we organise and analyze the data collected on them. Once the analysis is completed and the related results are obtained, the researcher must produce a report to communicate his or her findings.

This Unit is made up of two main sections. The first section discusses data analysis while the second section discusses issues regarding writing the research report.

Unit Objectives

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

(1) prepare and organise research data;
(2) compute descriptive statistics for quantitative data;
(3) test hypothesis using inferential statistics; and
(4) write a good research report;

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 1: PREPARATION AND ORGANIZATION OF DATA

Dear learner, you are welcome to Session 1 of Unit 4. In the last Unit (Unit 3) you learnt about various research designs for doing educational research. In addition to the designs, you learnt about various tools or instruments for data collection. These include interview schedules and guides, questionnaires and observation guides. We mentioned earlier that research is not data collection per se. In research we have to collect data and the data collected must be analysed to enable us solve a problem or explain and describe a phenomenon under consideration. As researchers, whatever decision we reach after analysing data should have conclusion validity. Conclusion validity is the degree to which conclusions you reach about relationships and patterns in your data are reasonable (Trochim, 2001). Conclusion validity is important because in a study such as the relationship between two variables, a researcher can conclude that there is no relationship when in fact there is or he/she can conclude that there is a relationship when in fact there is not. The problem of a researcher concluding that there is no relationship when in fact there is is of concern to researchers. In order to avoid error in our conclusions, that is, to achieve conclusion validity, there is the need to take appropriate steps to analyze and interpret our data and the results.

Objectives

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

(a) edit research data;
(b) code research data; and
(c) organize research data into categories.

Now read on…

1.1 Preparation and Organization of Data

From the discussions in Unit 3, it is clear to you that you can use several tools to collect data for your project work or research. You may use a questionnaire, an interview guide or observation guide or schedule. The data collected in a study must be prepared before it is analysed. Data preparation involves editing, scoring, coding and entering the data into the computer, if a computer will be used to analyze the data. Even if the data will be analysed manually, it must be prepared before it is analysed. We now proceed to discuss the process or activities involved in data preparation and organization.

1.1.1 Editing

What do you understand by editing something? Think about the question for a moment. Read on and find out whether the ideas regarding editing agrees with your thought.

Editing of research data involves (a) correcting mistakes in the data if possible and (b) deciding whether some of the data collected should be deleted from or kept for data analysis later.

Editing of data is intended to detect and as far as possible eliminate errors in the data to ensure conclusion validity.

For instance, data collected using questionnaires may be incomplete. They may contain inaccurate information which you the researcher must examine before proceeding to analyze it. It is at the editing stage that you do this examination. Similarly, the best interviewers are liable to make errors, omit to ask certain questions or to record answers to some questions. Thus, interview responses must be edited before proceeding with the analysis of the data. Such editing can be done by the interviewers immediately after they have completed each interview. In the same vein, before the completed questionnaires can be regarded as ready for coding, tabulation and analysis, they should be checked for completeness, accuracy and uniformity.

For completeness, you must check and ensure that there is an answer to every question. Sometimes, you have to fill the gap, if any, by deducing from other data on the questionnaire. With regard to accuracy, you must try to check whether the answers are accurate. You must look for inconsistencies.

Inaccuracy may be due to carelessness or to a conscious attempt to give misleading answers by respondents or even the interviewer. Remember that some of the ways of data collection are self-report procedures.

You also have to edit your data in terms of uniformity. This process helps you as a researcher to find out whether in interviewing, for example, questions and instructions have been followed uniformly, if different people administered the instruments.

1.1.2 Scoring

The next activity in data preparation is scoring. When a study is quantitative in nature, all instruments administered should be scored accurately and consistently. For self-developed instruments such as questionnaires, you must develop a scoring procedure to guide you. Steps for scoring each item and for arriving at a total score must be delineated and carefully followed. For instance, if a study uses an attitudinal scale, the negative and positive statements should be scored properly. For example, when “strongly agree” to the statement “I enjoy school work” is scored 5 on a five point scale the statement “I find school work boring” should be scored 1, if an individual “strongly agree” with it. Scoring is usually not applicable to qualitative data.

1.1.3 Coding

Coding is one other activity at the data preparation stage. Coding does not mean the same thing in qualitative and quantitative research.

In qualitative research, coding refers to the process of categorizing data. That is, coding in qualitative research means the process by which the researcher makes sense out of text data, divides it into text or image segments, labels the segments, examines codes for overlap and collapses these codes into themes. The codes are just labels to describe a segment of text. Examples are "poor learners", "problem children", "disruptions during the class", "students talking to each other". Teach (1990) and Creswell (1994) recommend the following steps in coding qualitative data.

(1) Read through all of the transcriptions carefully and jot down in the margins some ideas based on the text
(2) Pick one document (e.g., one interview) and go through it, asking the question "what it is about?" Write down in the margin in two or three words and draw a box around it.
(3) Begin the process of coding the document by identifying text segments, placing a bracket around them and assigning a code word or phrase that accurately describes the meaning of text segment.
(4) After coding an entire text, make a list of code words. Cluster together similar codes and look for redundant codes. The objective is to reduce a long list of codes to a smaller, more manageable number.
(5) Take this list and go back to the data and circle specific quotes from participants that support the codes
(6) Reduce the list of codes to get 5 to 7 themes or descriptions of the setting or participants. Themes are similar codes aggregated together to form a major idea in the database.
(7) From the coding and the themes, construct a narrative description and possibly a visual display of the findings for your research report.

You have, probably, realised from the steps of coding qualitative data that, the coding is an integral part of the analysis of data.

Coding in quantitative research is different from coding in qualitative research. In quantitative research coding may involve:

(a) assigning each subject an identification number,
(b) assigning non numerical or categorical data numbers or
(c) assigning designated words (labels) to represent certain variables.

For instance, if there are 100 participants in a study, the subjects may be numbered from 001 to 100. This is an example of assigning each subject an identification number. With regard to assigning non-numerical or categorical data numbers, the experimental and control groups in a study may be coded "1" and "2". Similarly, the variable sex may be coded female = "1" and Male = "2".

Another example is that, if the options to the question:

How many hours of classroom time do you spend per week in teaching activities? Are as follows:

(a) 0 – 5
(b) 6 – 10
(c) 11– 15
(d) 16 – 20
(e) 21 – 25

The categories (a) to (e) can be coded as a = 1, b = 2, c = 3, d = 4 and e = 5.

The variable "pretest reading comprehension scores" May also be coded (labelled) as PRC. This is an example of assigning designated words to represent certain variables in quantitative research.

How will you code educational level attained by subjects of a study? Jot it down.

Well, the coding of the educational attainment of a group of people can take various forms. However, one way of coding the educational level attained by a group of people is to say Basic level = 1 Secondary level = 2 Teacher/Nurses Training (Post Secondary) = 3 Polytechnic = 4 University = 5.

Was your thought along this line? Good.

For you to be effective in using the codes for a particular study consistently, there is the need to prepare a codebook to which you can refer to if you are in doubt. The codebook shows what numbers or labels have been assigned to different variables and categorical data.

Coding helps the process of data analysis particularly when a computer will be used in analysing data. If a computer will be used to analyse the data, then a spreadsheet must be used to enter the data. The statistical package for social sciences (SPSS) spreadsheet is recommended.

This session discussed the essential elements of data preparation and organization before actual analysis of the data. It became clear that in qualitative research the process of preparing and organising data is an integral part of the data analysis. Essentially, data preparation and organization involve editing, scoring and coding data.

Self Assessment Questions

Exercise 4.1

1. Examining research data with the view to correcting mistakes in it is termed
   (a) coding
   (b) editing
   (c) scoring

2. What is the purpose of editing research data?
   (a) To introduce errors in the data collected
   (b) To eliminate errors in the data collected
   (c) To increase the number of respondents

3. Scoring of data refers to assigning numbers to variables consistently.
   (a) True
   (b) False

4. Coding of qualitative data is the same as coding quantitative data
   (a) True
   (b) False

5. The types of coding that involves more of text is quantitative
   (a) True
   (b) False

6. It is necessary to prepare data before proceeding to analyse it.
   (a) True
   (b) False

7. Preparation of data contributes to conclusion validity of a study.
   (a) True
   (b) False

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 2: STATISTICAL DATA ANALYSIS: DESCRIPTIVE STATISTICS

Dear learner, you are welcome to Session 2 of Unit 4 of the course on educational research methods. In the previous session, we explained the process of preparing and organising data before analysing it. This session discusses the first step in analysing quantitative research data. That is, computing descriptive statistics of the data collected. This session we hope is not new to you.

In your Mathematics course as well as introduction to educational measurement course you learnt about descriptive statistics and how to compute the various statistics. We, therefore, hope that you will enjoy reading this session and have very little difficulty understanding the content of the session.

Objectives

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

(a) explain the role of descriptive statistics in research
(b) compute the measures of central tendency
(c) use computed measures of central tendency to describe data appropriately
(d) compute Measures of spread and interpret them

Now read on…

2.1 Measures of Central Tendency

According to Glass and Hopkins (1996) descriptive statistics involves tabulating, depicting, and describing collections of data. The large masses of data that you will collect for your research must undergo a process of summarization or reduction before they are comprehensible. Thus, descriptive statistics serves as a tool to describe or summarize or reduce to manageable form the properties of mass of data. The point being made here is that, descriptive statistics provide very simple summaries about the sample of study and the measures. In other words, descriptive statistics help you summarize large amounts of data in a sensible way using a single indicator.

Descriptive statistics describe data in terms of measures of central tendency and measures of spread (dispersion). This section deals with measures of central tendency while the next section of the unit deals with measures of spread.

Measures of central tendency are measures or statistics that describe the location of the centre of a distribution. A distribution consists of scores and other numerical values such as number of years of teaching, age, income, and achievement and the frequency of their occurrence.

Do you remember the measures of central tendency from your earlier courses? List them.

Measures of central tendency are the mean, median and mode. We hope you have got them right. Good.

Read on:

The **mean** is the arithmetic average of observations, scores or values. It is symbolized as $\overline{X}$. You calculate the mean by totalling observations (scores) and dividing by the number of observations (scores). That is, to find the mean of a set of scores or observations, we add up all the scores (observations) and divide by the number of scores. Symbolically, the mean $\left(\overline{X}\right)$ is equal to $\sum X / N$, where $\sum X$ /N is the sum of all the scores and N is the number of scores.

For example, if in an experimental study involving two groups of 10 subjects each, experimental and control – the experimental group members obtained, 18, 10, 5, 16, 10, 10,12, 17 19 and the control group members obtained 2, 15, 8, 3, 12, 8, 10, 10, 15, 17, then the mean $\left(\overline{X}\right)$ score of the experimental group is 120/10 = 12. The mean score of the control group is 100/10 = 10. Verify these means for yourself.

What do these scores mean to you as a researcher? Do not answer the question. Read on. The two mean scores provide you with a summary information about the performance of the two groups. You can use them to describe the performance of the two groups. You can say, at least, that the average performance of the two groups are 12 and 10, respectively. Using the averages you can also say that the experimental group performed better than the control group. However, whether the difference in performance is statistically significant is a different matter. You must test this before you can reach that conclusion. In the next session, that is session 3, we explain the process of testing hypotheses about differences between means and relationship between variables.

The means is the most useful of the measures of central tendency. It is, therefore, used in more complex computations. You must note that the means is appropriate for describing observations measured on the interval or ratio scales. Computing the mean for categorical variables or variables measured on the nominal scale is not appropriate. For example, we cannot meaningfully say the mean religious denominations of participants in a study is, say, 10. However, it will be meaningful to say that the average age of participants in a study is 25.

The **median** is the middle observation in a distribution of observations arranged in order from lowest to the highest or vice versa. In other words, the median is the point that divides a distribution into two parts such that an equal number of scores fall above and below that point. It can be said to be the midpoint in a set of ranked observations or scores.

The median of the scores 3, 6, 6, 7, 9, 13, 17 is 7 because half of the scores are below 7 and half are above. Verify this assertion for yourself. For an even number of observations (scores) the two middle scores of ordered scores are summed and divided by 2 to obtain the median. Thus, the median of the following distribution of scores: 16, 16, 17, 18, 19, 19, 21, 22 is 18.5 (i.e. $\frac{18+19}{2}$).

The median is a middle value in a distribution which can also be used to describe the distribution. It is, unlike the mean, not sensitive to extreme values. That is, the median is not affected by very high or low values. So, if you have a few extreme observations (outliers) in the distribution, you will probably want to use the median. In fact, when a distribution is extremely skewed, it is not appropriate to compute and use the mean to describe the observations, rather the median should be used. The median is also not appropriate for describing categorical data. Note that the median can be found for any distribution that can be ordered, that is, it requires only an ordinal scale of measurement.

The **mode** of a distribution is the value of the observations that occurs most frequently. It is used when you want to show the most "popular" value in a distribution. The mode for the scores 60, 65, 60, 67, 63, 60 is 60. That is, 60 is the most occurring score in the set of scores. Verify this for yourself.

The modal letter grade given in a social studies course may be "B". The mode can be employed even with qualitative categorical variables – data that represent only a nominal scale of measurement. For example, if there are 100 females to every 95 males in a study the modal sex is female. When observations have been grouped into classes, the midpoint of the class with the largest frequency is used as an estimate of the mode.

So far we have discussed the three measures of central tendency which are descriptive statistics. Which measure is the best to use to describe data? Write your answer down in your jotter.

Dear learner, there is no single answer to the question of which measure is best. It depends on the variable or characteristic under consideration. If the variable under consideration represents only a nominal scale, only the mode is meaningful. The mean is not appropriate for describing scores of extremely skewed distributions. In such cases the median is often preferred to the mean. For estimating the population mean the sample mean is more precise than the sample median.

2.2 Measures of Spread (Dispersion or Variability)

In the previous section we described the measures of central tendency which indicate the location of the centre of distributions. Measures of central tendency do not give any indication of the spread of the observations or scores. This is to say that, the measures of central tendency do not give us that total picture of a distribution.

STATISTICAL DATA ANALYSIS DESCRIPTIVE STATISTICS

If one has an indication of the spread or variability of a distribution of scores as well, much more information is obtained. As an illustration, let us consider the following distribution of scores:

(i) 24, 24, 25, 25, 26, 26
(ii) 16, 19, 22, 25, 28, 30, 35

In both distributions, the mean $(\overline{X})$ scores is 25. Verify this for yourself. Now closely examine the spread of the scores in the two distributions. What do you notice? Write it down in your jotter. Now read on.

We hope you have noticed that the scores in distribution (i) are much more homogeneous (uniform) than those in distribution (ii). As a result of the differences in the spread of scores, in describing the performance or observation of these two distributions, we need more than the average score for each one.

In statistics, several indices are used to indicate the spread or variability of observations/scores. The four most commonly used measures are the range, standard deviation, variance and the interquartile range.

The **range** is the simplest of all measures of dispersion. It is the difference between the highest and the lowest scores in a distribution of observations. Thus, it is found by subtracting the smallest value from the highest in a distribution. In the following distribution of scores; 24, 24, 25, 25, 25, 26, 26; the range is 2 (i.e., 26 – 24 = 2). The range as a measure of dispersion is useful as a quick indication of spread of scores. It has a limitation of depending on only two observations in the distribution – the highest and the lowest.

In analysing your data you can compute the range of the scores to determine the spread of the scores.

The **standard deviation** is a measure of the spread of data about their mean. It is, perhaps, the most useful measure of dispersion. The standard deviation is the square root of the mean value of the squares of all deviations from the distribution mean. The standard deviations depends on calculating the average distance that the average score is from the mean. The definitional formula is SD $\sqrt{\sum (X - \overline{X})^2 / (n - 1)}$

Suppose you had the following 10 scores on the survey of compassionate behaviour: 7, 10, 8, 5, 4, 8, 4, 9, 7, 8, the standard deviation will be 2.05. Verify this for yourself. If you have a problem obtaining the result, consult your educational measurent or statistics course module on the steps involved. Make sure that you obtain the answer before your continue.

The standard deviation as a measure of spread is useful in describing data. As an average measure of spread, the greater the variability of scores around the mean, the larger the standard deviation. When a distribution has identical scores, the standard deviation is zero. As a researcher, you can use the standard deviation to decide whether observations in distributions are homogeneous or heterogeneous in addition to finding their appropriate means. The standard deviation also plays an important role in calculating many statistics.

The **variance**, we hope you remember, is the standard deviation squared. Unlike the standard deviation, the variance is in square units. However, it gives information on the spread of scores. It is used in calculating other statistics.

The **inter quartile range** is the central 50% of a set of observations or the difference between the 75^{th} and the 25^{th} percentile. Do you remember the meaning of percentile from your educational measurement course? Well, read on. A **percentile** is a number that indicates the percentage of a distribution that is equal to or below that number. To say that a person scored in the 95^{th} percentile means that 95% of others scored the same or below that person.

Now let us return to the inter quartile range. We said it is the difference between the 75^{th} and the 25^{th} percentile. That is it contains 50% of the observations.

For example, suppose pupils at the 25^{th} percentile in your mathematics examination have an average score of 30 and those at the 75^{th} have a score of 90. The central 50% of the scores, or the interquartile range, is the difference between 90 and 30. In other words, 50% of the pupils achieved scores between 30 and 90. This is clearly an indication of spread. For the computation procedure refer to your statistics or educational measurement course module. In addition to the above descriptive statistics, you can compute proportions and percentages to describe your data.

In this session, we discussed measures of central tendency and spread or variability. These are the mean, median, mode on the one hand and the range, standard deviation, variance and inter quartile range, on the other hand. The measures of spread when used in addition to measures of central tendency give a more clearer picture in terms of describing observations or scores in a distribution.

Self-Assessment Questions

Exercise 4.2

1. The role of descriptive statistic in research is to provide the researcher with
   a. the computations of data
   b. the meaning of his/her observations
   c. a summary of the pieces of information collected

2. Which of the following is a measure of central tendency?
   a. Mode
   b. Range
   c. Standard deviation

2. It is appropriate to use the mean to describe the numbers on the jerseys of football players
   a. True
   b. False

3. Which of the following measures of central tendency is appropriate for describing observations that are measured on the interval scale but not skewed?
   a. Mean
   b. Median
   c. Mode

4. When is it appropriate to use the median to describe data?
   a. When the data is categorical
   b. When the data is measure using the ordinal scale
   c. When the data is measured using the nominal scale

6. The mean is the best measure of central tendency.
   a. True
   b. False

7. Which of the following measures of spread is dependent on the two extreme scores in the distribution?
   a Inter quartile Range
   b. Range
   c. Standard deviation

8. The standard deviation of the scores 10, 10, 10, 10, 10, 10 is
   a. positive 1
   b less than negative 1
   c zero

9. Suppose you had two distributions A and B. Suppose further that you computed the standard deviation of the two distributions and obtained a value of 5 for distribution A and 10 for distribution B. Which of the two distributions is more uniformly distributed?
   a. Distribution A
   b Distribution B
   c Both are equally distributed

STATISTICAL DATA ANALYSIS DESCRIPTIVE STATISTICS

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 3: STATISTICAL DATA ANALYSIS: HYPOTHESIS TESTING

Dear learner, we hope you enjoyed the previous session on descriptive statistics. This present session is a continuation of analysing data statistically. The focus here is to introduce you to how to test your hypotheses. The section is a bit technical, so we advise you to read slowly with concentration to be able to get the necessary understanding. If you have any question, put it down for your FTF discussion.

Objectives

By the end of the session, you should be able to:

(a) choose a statistical test; and
(b) conduct hypothesis testing

Now read on…

3.1 Choosing a Statistical Test

In the previous session the use of descriptive statistics as part of the analysis of data has been presented. Although some research questions are answered in the preliminary analysis, more complex questions often need to be addressed by making inferences from a sample to a population. This is called inferential statistics. Inferential statistics, enable a researcher to draw conclusions, inferences or generalizations from a sample to a population of participants. This involves hypothesis testing. In doing this, you have to choose the appropriate statistical test to use. This section introduces you to choosing a statistical test.

For many quantitative researchers, the use of descriptive statistics is only the beginning of their data analysis. Generally, as researchers we are interested in comparing responses of groups or relating two or more variables from a sample drawn from a population. Do you remember what you learnt in Unit three about sampling? If not, then go back and read the section on sampling.

Since the scores or observations from studying a sample are only an estimate of a larger population, researchers conduct hypothesis testing. Do you remember how to formulate the null and research hypotheses? If not go back to the section in Unit 2 that explains the formulation of hypothesis.

Hypotheses are explained as educated guesses or conjectures. Such educated guesses must be tested. Hypothesis testing is a procedure for making decisions about results by comparing an observed value with a population value to determine if no difference or relationship exists between the values. Because the intent of much quantitative research is to draw inferences or conclusions about a population from a sample, inferential statistics are used. To understand inferential statistics, you need to learn about the decisions that go into the selection of an appropriate statistical test.

STATISTICAL DATA ANALYSIS-HYPOTHESIS TESTING

Generally, inferential statistics are divided into two types: parametric and non-parametric. The terms may appear to be new to you. Do not worry we will explain them. Read on.

Parametric statistics are statistical tests based on the premise that the population from which samples are obtained follows a normal distribution and the parameters of interest to the researcher are the population mean and standard deviation. These statistics apply to hypothesis testing which we shall discuss in the next section.

Parametric statistics have certain assumptions about the observations/scores. These assumptions are:

a. The variables are measured in interval scales
b. Scores from any two individuals in a study are independent of each other
c The variables that distinguish each population are similarly distributed
d The variables that distinguish each population are similarly distributed among each population, in the case of two or more groups.

Examples of parametric statistics include the t- test and Pearson Correlation Coefficient. There are other advanced statistical parametric procedures but we will limit you to the two.

The T-independent test is used when a study involves two groups with the independent variable being categorical and the dependent variable being continuous. We hope you remember these terms. If not, then go back to the session in Unit 1 which explains variables in educational research. Read on.

The Pearson correlation coefficient is denoted by (r_{xy}) and is applied when two continuous variables are related to determine their degree of relationship. We hope the term correlation is not new to you. You met the concept in Unit 3, where we discussed correlation research. You may go back and revise the session now.

Now let us explain non-parametric statistics to you. Non-parametric statistics are statistical tests that only make the assumption of independent observations of scores for each individual in the study. In these tests, the data are typically measured in categorical scores on either the independent or dependent variable. The most frequently used non- parametric test in educational research is chi-square X^2. It is used to test a hypothesis concerned with category within group comparison. In the next section of this session, we will explain the procedure of testing a hypothesis using chi-square.

Below is a few criteria to guide you in choosing an inferential statistical test.

1 Determine the type of quantitative research hypothesis you would like to analyze. If the hypothesis is to compare group means of independent groups, then the t-test may be appropriate. If the hypothesis is concerning how two variables are related and they are continuous variables then Pearson correlation coefficient is appropriate.

2. Consider the scale of measurement for your independent and dependent variable(s) in the research hypothesis. If the scale of measurement for your independent variable is, for example, categorical and the dependent variable is continuous and the hypothesis demands determining differences between two groups using their means, then the t-test will be appropriate. For categorical independent and dependent variables, chi-square test may be appropriate.

3. Determine if your scores (observations) on the variables in your hypotheses are normally distributed or whether they are skewed. If the scores are normally distributed and the other assumptions of parametric statistics are met, then apply the appropriate parametric statistics. Otherwise, you have to choose a non-parametric statistics, (e.g., X^2).

It should be clear to you from the foregoing discussion that the first major step you have to take in analyzing your data using inferential statistics is to decide the appropriate statistics to apply. Once you have selected the appropriate statistics, you go ahead to conduct the hypothesis testing.

3.2 Conducting Hypothesis Testing

We explained in the previous session that inferential statistic allow you to make inferences from a sample to a population. Since we can rarely study an entire population because of size, expense and ease of identification, we need to study samples and draw inferences to the population. Sample data that you collect can only estimate the population parameter such as the mean. Because a sample is selected from a population, any given sample may be in error. That is, the characteristics of the sample may not reflect the population characteristics/parameters, assuming that the sample is randomly chosen. Hypothesis testing allows you to test whether the sample data differ from the population values.

For example, in an experiment to establish the effectiveness of two methods of teaching a topic in mathematics, you may be interested in whether there is a difference between sample means of the control and experimental groups. Suppose you carry out this study using 20 subjects for the control and experimental group and obtain a mean score of 65 for the control group and a mean score of 70 for the experimental group. The question that arises is: Is there a statistical difference in performance between these two samples.

In other words, do the two populations differ in terms of their performance? You can only answer this question through hypothesis testing. We give an example later.

In a correlational study, you may be interested in whether there is a relationship between the scores of two variables for individuals. Again, hypothesis testing allows you to test the relationship. The rest of this session will inform you about six general steps you will take to conduct hypothesis testing. Important terms are defined. If you have any problem with any of the terms, put the term down in your jotter for discussion at your FTF meeting.

Generally, there are six steps in hypothesis testing (Cresswell, 2002):

a. Establish a null and alternate hypothesis
b. Set the level of significance or alpha level for rejecting the null hypothesis
c. Collect data
d. Compute the sample statistic, (usually using a computer programme)
e. Make a decision about rejecting or failing to reject the null hypothesis
f. Determine the degree of differences if a statistically significant difference or relationship is found.

3.2.1 Establishing a Null and Alternative Hypothesis

Dear learner, in Unit 2 Session 3, we explained and discussed what a null and research hypotheses are.

We hope you remember what you have learnt in the session. Do not worry. Here you are with the essential elements on a null and alternative hypothesis as a way of revising the ideas.

You may recall that the null hypothesis (H_o) is a statement that no difference exists between the averages or means of two groups or no relationship exists between two or more variables. Examples are:

a No difference exists between the experimental and the control programme's
b. No difference exists between privately and publicly managed schools' achievement in mathematics in the BECE;
c No difference exists between the sample of teachers chosen to be interviewed and those who were not chosen in terms of experience in teaching
d. No relationship exists between Junior Secondary School students achievement in Math and English.

We hope you have got the idea clearly. Now read on.

The alternative hypothesis, on the other hand, indicates a difference or relationship. The direction of the difference may be positive or negative (directional hypotheses) or either positive or negative (non-directional hypotheses). In the same vein, the relationship between two variables will be either positive or negative (directional hypotheses) or either positive or negative (non-directional hypotheses). The alternative hypotheses corresponding to the above null hypotheses are:

a. The experimental group's mean score is statistically higher than the control group's means score.
b A difference exists between privately and publicly managed schools' achievement in mathematics in the BECE.
c A difference exists between the sample of teachers chosen to be interviewed and those who were not chosen in terms of their experience in teaching.
d A negative relationship exists between Junior secondary school students achievement in Math and English.

We hope you are at home with establishing a null and alternative (research) hypothesis. In hypothesis testing, it is better to state both the null hypothesis and research hypothesis.

From the examples of hypotheses presented above, the researcher will test whether differences observed are real or due to chance or error in the case of hypothesis (a), (b) and (c). With regard to hypothesis (d), the researcher will test if there is real relationship or the relationship is due to chance or error. This calls for establishing a decision on the standard to use. This is concerned with setting the level of significance. We explain and discuss the level of significance in the following section

3.2.2 Setting the Level of Significance (Alpha Level)

Dear learner, this may be your first time of hearing about the level of significance or alpha level. It is an important concept in hypothesis testing. We will try to explain it here but if you do not understand any part of this section put down your questions for your FTF discussion.

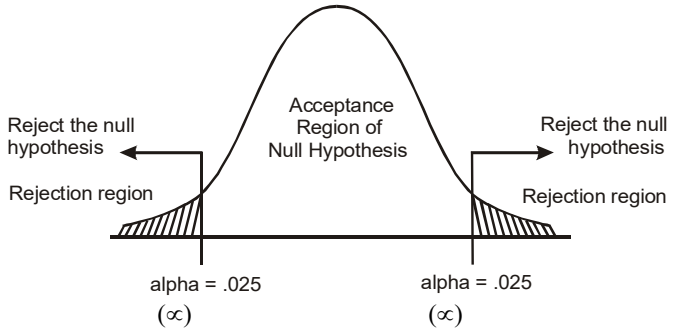
We said at the end of the previous section that we need to set a standard to determine whether there is a difference between the means of two samples or whether there is a relationship between two variables. It is the standard that we are calling significance level. A level of significance is a boundary in a sampling distribution for making this decision. The three statistics we referred to earlier, namely t-test, chi-square and Pearson correlation coefficient have their sampling distributions. The significance level helps you to establish the boundary for any one of them that you may be using.

Specifically, a significance level (alpha level) is a probability level that reflects the maximum risk you are willing to take that any observed differences are due to chance (Cresswell, 2002). It is typically set at .05 (5 out of 100 times it will be due to chance) for social science research.

In some disciplines it is set at .01 (1 out of 100 times the sample statistics will be due to chance). What a significance level of .05 means is that five out of 100 times an extremely low probability value will actually be observed if the null hypothesis is true.

In hypothesis testing, the area of the sampling distribution of the specific statistics you are using is divided into what are called **critical region** and **acceptance region** using the significance level. The area on the distribution (t-distribution or normal curve) for low probability values if the null hypothesis is true is called the critical region. If sample data (e.g., the difference between the performance of private and public schools in math at the BECE) falls into the critical region the null hypothesis is rejected. This means that instead of "there is no difference as stated in hypothesis (b) in the previous section, we find the alternative to exist. That is, "there is a difference".

The diagram below illustrates the concepts of **critical** and **acceptance regions**.



Sketch of t-distribution showing the rejection and acceptance regions

Note that the sketch showing the acceptance and rejection regions indicates the rejection regions at both ends of the curve with the alpha level of .025 each, making a total of .05. When the critical region for rejection of the null hypothesis is divided into two areas at the tails of the sampling distribution, as shown above, we have a two-tailed test of significance. On the other hand, if the rejection region is placed at one-end for rejection of the null hypothesis, we have a one-tailed test of significance. In this case the alpha level is not divided. The specific level is used at the specific tail of the distribution.

We hope you remember what you learnt in Unit 2 Session 3 on directional and non-directional hypotheses. Directional hypotheses are tested using one-tailed tests of significance while the non-directional hypotheses are tested using two-tailed tests of significance.

We want you to go back to the examples of hypotheses given in the section 3.2.1 and determine which could be tested using a one-tailed or two-tailed tests of significance. Put your answers down in your jotter for FTF discussion.

It is important for you to note that a one-tailed test of significance is more likely to reject the null hypothesis if it is false than a two-tailed test. Thus, a one-tailed test is said to have more power than a two-tailed test.

We want to continue this section by outlining the four possible out comes that could occur during hypothesis testing.

1. The researcher can reject the null hypothesis when it is actually true. In this case, we say that the researcher commits a **Type I error**. The probability of this error rate is alpha ($\propto$)

2. The researcher can fail to reject the null hypothesis when it is actually false. Here, we say, the researcher commits a **Type II error**. This is known as beta (β).

3. The researcher can reject the null hypothesis when it should be rejected because a difference exists or a relationship exists. This is a correct decision.

4. The researcher can fail to reject the null hypothesis when it should not be rejected because there was no difference or relationship. This is also a correct decision.

When you test your hypotheses you must endeavour to make a correct decision. Bear in mind that in education and social sciences, alpha level of .05 is typically used to test hypotheses.

Having set the alpha level, you must as well determine the critical value the test statistic must attain to be significant. Each test statistic, such as t and chi-square has a distribution. This distribution is called the sampling distribution. Its mean is called the **expected value** and its variability is called the **standard error**.

All test statistic distributions are divided into an area of rejection and an area of acceptance which we explained in the sketch above. The boundary between an area of acceptance and rejection has a value based on the alpha level. This is what we are calling the critical value.

Critical values can be found in statistical tables and statistics textbooks. For example, for the t-distribution with an alpha of .05 and a two-tailed test, tabular values will show that at three degrees of freedom, the critical value is 3.182. The term degrees of freedom sounds intuitively meaningful but it is, in fact, a complex statistical concept that is discussed in advanced texts and is well beyond the scope of this module. At your FTF discussion ask for explanation of degrees of freedom. With the critical value of 3.182 and calculated value higher than 3.181 or less than – 3.182 will fall in the rejection region.

Before you collect data, you have to establish a decision point. Do not arbitrarily set this point after you collect data. You may be fishing. This is not allowed.

Having set your alpha level and determined the critical value, then you perform the calculation. The calculation can be done manually or by computer. Calculating your tests using computer will give you accurate values. You could get somebody who knows about statistical testing to do the calculation for you for a fee. The manual calculation may tend to be tedious. You may not have the competencies in calculating some of the statistics.

We present below the formulae for computing the t-independent test, chi-square and Pearson correlation coefficient.

Computing the t – independent test

The t – independent test is used to test hypotheses about the difference of two means and thus requires numerical data. The shape of a t distribution approaches the bell shape of a standard normal distribution.

The formula for the two-sample t- test is a ratio and it is as follows:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where $\bar{X}_1$ and $\bar{X}_2$ = mean of group one and two respectively

S_1^2 and S_2^2 = variance of group one and two respectively

n_1 and n_2 = number of cases in group one and groups two respectively

The degrees of freedom that go with the distribution is $n_1 - 1$ plus $n_2 - 1$. In other words, the degrees of freedom for the test is $n_1 + n_2 - 2$.

Once you compute the t statistic you compare it with the determined critical value for a decision making. Note that there are a number of t tests. These include t test for one mean, two means and matched pairs. You have to choose the appropriate t test depending on your sample and other characteristics of the sample.

Computing the Pearson Correlation Coefficient (r_{xy})

You will recall that Pearson r_{xy} is used to determine the relationship between two or more variables.

The Pearson r is calculated using the formula:

$$r_{xy} = \frac{\frac{\Sigma XY}{N} - (\bar{X})(\bar{Y})}{S_x S_Y}$$ where $\sum XY$ = the sum of the multiplication of paired observation of cases

N = number of cases

$\bar{X}$ = mean of variable X

$\bar{Y}$ = mean of variable Y

S_x = standard deviation of variable X

S_y = standard deviation of variable Y

When you compute the Pearson r you have to use the appropriate degrees of freedom to determine whether to reject or fail to reject the null hypothesis. The degrees of freedom for the Pearson r is n – 2, that is the number of pairs of scores minus 2.

There are other, correlations such as the Spearman rank correlation and biserial correlation.

Computing chi – square X^2

Chi-square is appropriate when data are in the form of frequency counts in two or more mutually exclusive categories. A chi – square test compares proportion actually observed in a study with proportions expected, to see if they are significantly different.

There are two main types: one variable X^2 of goodness-of-fit and X^2 test of independence or association. The goodness-of - fit has K – 1 degrees of freedom, where K is the number of categories.

The formula for calculating the chi-square goodness-of-fit is

$$X^2 = \Sigma \frac{(fo - fe)^2}{fe}$$ where fo = observed sample count

fe = expected sample count

3.2.3 Making a Decision About Rejecting or Failing to Reject

Making a decision about rejecting or failing to reject your null hypothesis is the last step in the process of testing your hypothesis. In the previous section we mentioned that you can manually compute your statistics or use a computer. We recommend the use of a computer. Whether you perform the computation manually or by a computer, you must make a decision about rejecting or failing to reject the null hypothesis.

We first explain the process of making a decision after the computation and then follow it up with one example.

STATISTICAL DATA ANALYSIS-HYPOTHESIS TESTING

You need to take three steps in making a decision about rejecting or failing to reject the null hypothesis.

1. Look at the value of the statistical test computed.
   That is, the t statistics, Pearson correlation coefficient or chi-square statistic for example. If the computer is used to do the analysis, then look at the associated p-value (probability value).
2. Determine if the statistic computed is less than or greater than the critical value you established earlier. Remember that you can find these values in many statistics books. Or if the analysis is done using a computer, determine if the observed p – value is less than or greater than the alpha level you have chosen at appropriate degrees of freedom.
3. Decide to reject or fail to reject the null hypothesis. You need to decide if your statistic is statistically significant to reject or fail to reject the null hypothesis depending on the critical value or in the case of computer analysis, the p-value.

Example: The t Independent Test

Suppose we have the following sets of post test scores for two randomly formed groups in an experiment.

Group I ={3, 4, 5, 6, 7} Group II = {2, 3, 3, 3, 4}

If we want to test whether a significant difference exists between the two groups, then our hypotheses symbolically will be:

Ho = $\overline{X}_1 = \overline{X}_2$ (That is, there is no difference between the two means).

Ha = $\overline{X}_1 \neq \overline{X}_2$ (That is, there is a difference between the means).

Suppose the alpha level for testing the hypotheses is .05, then we state it.

$\propto = .05$

Note that by our research hypothesis the test is a two-tailed one.

We now proceed to determine the critical value at which we reject or fail to reject the null hypothesis. Since the degrees of freedom for this test is $n_1 + n_2 - 2$, the df = 5 + 5 – 2 = 8. At this degrees of freedom for a two tailed test, the critical value is found to be 2.306. Look up this in any statistics book.

We now proceed to compute the t – statistic – using the formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{5 - 3}{\sqrt{\frac{2.5}{5} + \frac{5.5}{5}}}$$

$$= \frac{2}{\sqrt{.5 + 1.1}}$$

$$= \frac{2}{1.26}$$

$$= 1.58$$

From the result of the analysis, the computed t statistic is less than the critical value of 2.306. We, therefore, fail to reject the null hypothesis (Ho). This means that the difference between group one and two is not statistically significant. The difference is due to chance or sampling error.

In this session, we explained the process of choosing a statistical test and how to conduct hypothesis testing. Important concepts associated with hypothesis testing are explained.

Admittedly, the session is technical and you may find some of the contents difficult to understand. Note down your difficulties for FTF discussion.

Self-Assessment Questions

Exercise 4.3

1. Which type of statistics makes use of the assumption of normality?
   a. Non-parametric
   b Parametric
   c Variability
2. If in a study you "measure" some categorical variables which of the three statistics will be appropriate?
   a Chi-square test
   b Pearson correlation coefficient
   c t – test
3. A hypothesis testing concerning the degree of relationship between two variables will involve the use of the Pearson correlation coefficient.
   a. True
   b. False
4. Which of the following is a research hypothesis?
   a. A difference exists between the control group at experimental group in their performance in science
   b. There is no difference between the performance of the experimental and control group in science.
   c. What is the difference between the experimental and control group in performance in math?
5. In a one – tailed test, the alpha level ($\propto$) is divided into both tails of the distribution
   a. True
   b. False
6. A two – tailed test is more likely to reject the null hypothesis, if it is false, than a one-tailed test
   a. True
   b. False
7. Suppose you analyze data using X^2. Which of the following degrees of freedom will be applicable?
   a. k –1
   b n – 1
   c n – 2
8. Suppose you analyze data using the t independent test and the test is one-tailed. Suppose further that you obtain a t statistic greater than the critical value. What will be your decision?
   a. Accept the null hypothesis
   b Fail to reject the null hypothesis
   c Reject the null hypothesis

SESSION 4: RESEARCH REPORT: GENERAL ISSUES AND THE PRELIMINARY

Dear learner, you are welcome to this session. We are happy that you have successfully completed session 3 which might appear a bit technical to you. Congratulations!

This session begins the three sessions on research report writing. In this session, you will learn about how to get started with writing your project report with regard to planning how to write, general writing skills in report writing and the approved structure of a project report of the Faculty of Education, University of Cape Coast. We also explain the contents of the preliminary section of a research report in this session.

While we hope to present to you the essentials of a project work report, you must endeavour to obtain the Faculty of Education brochure on project and thesis writing to familiarise yourself more with how you would be expected to present your report.

Objectives

By the end of the lesson, you should be able to:

(a) State the importance of planning a project report
(b) Describe the writing skills necessary for writing a good research report.
(c) State the general structure of a project report approved by the Faculty of Education, U.C.C.
(d) List and state the main elements in the various sections of a report.

Now read on…

4.1 Getting Started

4.1.1 Planning Writing The Project Report

In the previous session, we explained the process of analyzing data, particularly, quantitative data. When all the hard work of gathering and analyzing data is complete you will need to write the final report. A study is not finished until it is written up. Time has to be allowed for writing. The report is the document that tells others, apart from the researcher, all that was done and its outcome. It is, therefore, important to be able to communicate the report in the most effective way possible.

Report writing is not or should not be a frantic activity carried out at the end of the project. It is a process of varied stages all of which need to be recorded at the time they are completed. Your first drafts will almost certainly need to be revised and in some cases completely rewritten. The foundation for the report should be established at the proposal stage of the study. To be able to write the report well and to be on schedule, you need to plan the report writing by doing the following:

(i) Set deadlines. It is useful to set deadlines and completion dates for different sections and for the whole report and keep the dates in mind. The project report, generally, has five chapters. You must set yourself deadlines for completing each chapter.

(ii) Write regularly. For most people writing is a difficult exercise. Because of this most people procrastinate in writing. It is advisable to keep regular hours for writing and to work in the same place. This advice is very pertinent to you as a distance learner because you have been working and studying at the same time.

(iii) Write up a section of the report as soon as it is ready. That is, some sections of the research will be ready for writing before others. For example, the introduction chapter and the literature review chapters will be ready before the other chapters. This is to advise that, you should write your report as you go along, when possible.

4.1.2 General Writing Skills in Research Report Writing

An important aspect of writing a research (project) report is being able to communite your ideas well to the reader. Indeed, the tools of communication that a writer employs are words. They should be so selected and ordered as to inform the reader about the research rather than to impress him/her with flowery language and other forms of verbal gymnastics. The rest of this section explains some of the general writing skills you need to bear in mind as you embark on writing a project report.

(a) The Use of Appropriate Terms and Concepts: Writing a report is different from writing a non-technical composition. You must, therefore, use appropriate terms and concepts in research in your writing. However Jargons which are not understood by some people should be avoided when writing a research report.

(b) Sentence Structure: In a research report, long sentences should be avoided. A sentence is long if it is more than three lines or uses more than two dependent clauses. Usually, when sentences are long writers tend to lose the trend and grammatical errors occur in the sentences. It is, therefore, advisable to write short and clear sentences to express your ideas.

(c) A, B, C's of writing: You must apply the A, B, C's of writing when writing your research report. These are accuracy, merit and clarity that go with critical adherence to the laws of grammar. Accuracy involves precision of expression.

Any account must be given in simple and straightforward manner so as to forestall problems of misinterpretation by readers. It also has to do with the reliability in reporting the finding(s) of the data. Broad generalisations and dogmatic expressions should be avoided. It is better to use qualifications such as tends, more likely, appears, seems and probably than to use the unmodified words.

(d) Emphasis should be on the data rather than the investigator. In writing a research report, your emphasis should be on the work rather than on you the investigator. In general, references to the investigator are to be kept to a minimum. Consequently, personal pronouns of the first person (I, me, we, us, our) and of the second person (you, your) are not to be used.

(e) Generally, a research report is written in the past tense. Thus, in writing your report you have to say, for example, the purpose of the study was … This, generally, follows from the fact that in research or project report, the investigator reports what he or she had done. However, there are some exceptions. Conclusions that apply to more than a single instance are written in the present tense. The present tense is also used when referring to general truths and well established principles as well as tables presently before the reader.

(f) Avoid one-sentence paragraphs in the report. They do not convey complete ideas.

(g) Be logical in your presentation. The logic of the argument should flow from one idea to the next in sentences, paragraphs and chapters. One point should be fully treated before going to the next.

(h) Spellings, punctuations and numbers must be correct. Simplified spellings are not acceptable in research writing. The use of the abbreviation, e.g., for example, is only appropriate in parentheses ( ). This equally applies to i.e., Avoid the use of etc. It creates doubt in the mind of some readers. Abbreviations are also not to be used in the report, except they are acceptable, generally, in writing. The expression “percent” is spelt out in a sentence. Numbers of less than 10 that do not represent precise measurement, are spelt out. Round numbers and numbers that begin sentences, titles and headings are also spelt out.

That is, you should not begin a sentence, title or heading with a number. Fractions should also be spelt out except when they are part of a larger number. Decimals should be rounded to the nearest percent. If small and large numbers appear in a series, figures must be used for them.

Note that a project report is type written and double spaced including quotations. Quotations that are more than 40 words are inducted rather than put in quotation marks. The pages of all quoted materials should be indicated against the materials in parentheses (e.g. p. 18)

We hope you will stick to some of the suggestions given in this section to improve your report writing.

4.2 The Structure of a Project Report

So far we have been discussing ways by which you can write a good report and be on time too. In this section, we present to you the general structure of a project report as approved by the Faculty of Education, University of Cape Coast. You should note that universities or academic institutions tend to adopt styles and formats in writing research reports, depending upon the type of research and subject area. Thus, specific rules and formats of reports vary from institution to institution. Most of the work depends on the individual style of the researcher and those required by the institution. The structure presented here are suggestions to guide you towards effective report writing but with emphasis on the style and format approved by the Faculty of Education, University of Cape Coast. We earlier on advised that you should obtain the Faculty's brochure for writing projects and thesis. This is important in the sense that when you read through the brochure, you become more familiar with how you should do certain things with regard to the report writing.

The entire research report has three major parts. These are:

(1) The preliminary section
(2) The main body of the report
(3) The reference materials

Each of these major parts contains sub-sections. We present the outline of the three major parts of the research report here. In subsequent sections of this unit we explain and describe the sub-sections.

4.2.1 Outline of the Structure of a Report

(a) Preliminary Section of a Project Report

The essential elements of the preliminary part of a project report are:

(i) The title page

(ii) The declaration
(iii) The abstract
(iv) Acknowledgement
(v) The table of contents
(vi) List of tables and figures

(b) The Main Body of the Report

The main body of the report follows immediately after the preliminary materials. Generally, it consists of five chapters. These are:

(i) The Introduction
(ii) Review of related literature
(iii) The Methodology
(iv) Results/Findings
(v) Summary, Conclusion and Recommendations

(c) The Reference Materials

The reference materials are in two parts, namely:

(i) The References
(ii) The Appendixes

4.3 The Preliminary Section of the Research Report

In the foregoing section we outlined the contents of the preliminary section of the report. In this section, we describe in detail the preliminary materials of the report and how to present them.

4.3.1 The Title Page

The title page presents the title of the project plus other relevant information. The title page has the following information, all written in capital (block) letters.

(a) The title of the study. This should be as concise and clear as possible. The number of words should not exceed 18, generally. Ambiguous words should be avoided.
(b) Full name of the student (author) (e.g., JOHN KOFI AMEH).
(c) Name of the department/faculty and institution to which the project is being submitted as well as the degree for which the project is being presented.
(d) The month and year when the degree is to be conferred (e.g., JUNE, 2004).

We produce an example on the next page.

RESEARCH REPORT: GENERAL ISSUES AND THE PRELIMINARY

Example of Title Page

UNIVERSITY OF CAPE COAST

THE INFLUENCE OF ACADEMIC EXPECTATIONS ON RECREATION PERSUITS AMONG GHANAIAN UNIVERSITY STUDENTS

BY

SAMUEL KWASI ACHEAMPONG

PROJECT SUBMITTED

TO THE DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION OF THE FACULTY OF EDUCATION, UNIVERSITY OF CAPE COAST IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DIPLOMA

JUNE, 1996

4.3.2 The Declaration

The declaration is concerned with the authenticity of the study and it is signed by the student and the supervisors(s) of the research/project. There is, therefore, a section for the student to sign and another section for the supervisors(s). The declaration by both the student and the supervisor(s) is available in the Faculty of Education brochure. We reproduce it below.

SAMPLED-DECLARATION (Undergraduate Project Work)

CANDIDATES DECLARATION

I hereby declare that this project work is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Name:…… Signature: …… Date: …….

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of the project work was supervised n accordance with the guidelines on project work laid down by the University of Cape Coast.

Supervisor's Name: …… Signature: …… Date: ……..

4.3.3 The Abstract

The abstract is a concise description of the study. It is usually not more than one-and-a-half pages. Generally, it indicates the purpose of the study, the population, the sample used and the sampling procedures, the instruments used to collect data, data collection procedures as well as how data was analyzed. It also indicates the results of the study and the conclusion drawn. In effect, the abstract is a brief summary of the study.

4.3.4 Acknowledgements

Acknowledgements are expressions of gratitude to those who contributed in diverse ways to the success of the research, including supervisors, assistants, data analysts, typists and any other person the researcher thinks warrants acknowledgement.

4.3.5 The Table of Contents

This, like all the earlier materials, occupies a separate page or pages as the case may be. The table of contents is the list of all items covered in the report and their pages. It serves the only means by which a reader can locate any material within the report, since a project report does not have any index (see the example on the next page).

4.3.6 List of Tables and Figures

The table of contents is followed by separate pages for List of Tables and List of Figures, respectively. The items on the lists have their respective number, exact titles as they appear in the text and the pages in the text on which they appear.

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RESEARCH REPORT: GENERAL ISSUES AND THE PRELIMINARY

It is important to note that the pagination of the preliminary section uses Roman numbers rather than Arabic numbers. The Arabic numbering begins with the main body of the report. In numbering the pages of the preliminary section, the first page which is the inside page is not numbered (i). The numbering starts from (ii) that is, the declaration page. In placing the page numbers, you are advised to place the numbers of the title pages at the bottom of the pages at the centre. For all other pages, the numbers should be placed at the right top corner of the pages.

In this session, you have learnt about planning how to write a project work, the important general writing skills you must exhibit in your writing and the structure of a project report. You also learnt about what should be presented in the preliminary section of the report. Examples have been given to illustrate some of the materials.

Self-Assessment Questions

Exercise 4.4

1. It is important to plan a project report writing because it will help the researcher to:
   (a) discover very important findings.
   (b) complete the writing on time.
   (c) test good hypothesis.

2. A research report should be written after the study is completed.
   (a) True
   (b) False

3. A research report should be written using technical terms that the researcher alone understands.
   (a) True
   (b) False

4. Which of the following sections of a project report is likely to be written in the past tense?
   (a) The Introduction
   (b) The Literature Review
   (c) The Methodology

5. A project report can be divided into three major sections.
   (a) True
   (b) False

6. In the presentation of the preliminary section of a project report, the order of the materials are
   (a) the title page, the abstract and acknowledgements
   (b) the title page, the acknowledgements and the abstract
   (c) the title page, the declaration and the abstract

7. The preliminary pages of a project report should be numbered using Arabic numerals.
   (a) True
   (b) False

8. A brief summary of study is the
   (a) abstract
   (b) literature review
   (c) problem statement

RESEARCH REPORT: GENERAL ISSUES AND THE PRELIMINARY

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 5: RESEARCH REPORT: THE INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY CHAPTERS

You are welcome to the last but one session of your course in educational research methods. You have really gone far in this course and you must be congratulated on that. This session discusses what should go into the first three chapters of the main report, namely the Introduction, Literature Review and Methodology chapters. The presentation here will follow the outline developed in the previous section (i.e, Session 4). We hope you will enjoy this session as you learn more about writing a research report.

Objectives

By the end of this session, you should be able to

(a) write a good introductory chapter of a project report;
(b) describe how the literature review should be written;
(c) state the essential elements of the methodology chapter; and
(d) explain how the methodology chapter should be written.

Now read on…

5.1 The Introduction Chapter

In Session 4, we outlined the main headings and sub-headings of the Introduction chapter. In this section, we explain the various headings in the chapter and how to present them in your report.

What are the main headings and sub-headings of the Introduction chapter? Do you remember them? List them. Read on!

The Introduction chapter has the following headings/subheadings:

(i) The Background to the Study
(ii) The Problem Statement
(iii) The Research Questions/Hypotheses
(iv) The Significance of the Study
(v) The Delimitation and Limitations of the Study
(vi) Definitions of Terms (in any)

We hope you have got most of the above listing of the essential elements in the Introduction chapter of the research report.

Generally, the introduction chapter presents the problem investigated and the context within which the study was done. This chapter is pertinent to understanding the later chapters and, therefore, it must be written well. The chapter begins with the background to the study.

RESEARCH REPORT: THE INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY CHAPTERS

5.1.1 Background to the Study

This is the first major section under the first chapter. It provides the context for the research. That is, the background to the study provides background information relating the study to broader areas. It also indicates briefly the development of the research problem.

The role of the background statement is to help the reader understand the nature of the problem statement which comes immediately following it. In writing the background section of your report, you need to provide all the necessary information to help any reader to appreciate and understand your research problem. The approach can be historical, developmental, contextual or mixed. Once your background statement provides an understanding of the problem by a reader then your work is done. To learn to do this, you must read completed projects to see how others have gone about it. The background to the study can be as long as three to five pages.

5.1.2 Statement of the Problem

The statement of the problem is a concise statement of the issue or perplexing situation under investigation. You will recall that the statement has been explained in Unit 2 Session 1.

In effect, the problem statement can be said to be stating the purpose of the study. It should succinctly state what you the researcher investigated. It should provide a framework to which details have been added later in the report. An example of such a statement is:

The purpose of this study was to determine factors that are perceived by stakeholders in education as accounting for the high dropout rates of girls at the Junior Secondary School in …….. district.

In writing your research/project report, make sure you make the issue under investigation clear to the reader. The problem statement should be about a paragraph or at most a page. It is important for you to note that some people will state the problem and go ahead to state the purpose of the study also. In fact, if the problem statement is specific and clear there will be no need for the purpose statement separately.

5.1.3 Research Questions or Hypotheses

Immediately following the statement of the problem are the research questions or hypotheses investigated in the study. The questions or hypotheses must have a direct bearing on the research problem. You will recall that generally research hypotheses are used for studies that are quantitative in nature.

As pointed out earlier, it is advisable to state both your null and research hypotheses.

5.1.4 The Significance of the Study

This section of the first chapter is the justification for the study. Here you must make clear why this particular issue or problem is important to be investigated. You must present an argument for the "Worth" of the study. This should include how the results would be useful.

You are, however, advised that you should not claim anything for the study beyond what it could achieve.

5.1.5 The Delimitation and Limitations

Many people tend to misunderstand the two concepts in research and therefore, do not use them well.

The delimitation of a study is concerned with defining the boundaries of the study. That is you delimit the study. A problem may have several aspects but your study might have considered only certain aspects within certain contexts. The delimitation section provides you the opportunity to tell the reader what you included in the study and what you did not include. The delimitations is, essentially, part of the problem statement.

The limitations, on the other hand, are concerned with several factors that limited he results of the study, particularly factors that need to be considered regarding the findings and their use. Such limitations may be related to (a) subject characteristics, (b) situational characteristics (the setting and context), (c) when the research is conducted, (treatments in the case of experimental research) and (d) measures (instruments). All these can affect the results in one way or the other and therefore tend to have implication for the generalizability of the results.

Any of the above factors that might affect the interpretation of the results of the study by readers should be pointed out or explained by the researcher under limitations.

5.1.6 Definition of Terms

In this section of your report you have to define all key terms. The purpose of defining all key terms is to make the meaning of the terms as clear as possible.

Essentially, these will be in the form known as operational definitions. Operational definitions specify the actions or operations necessary to measure or identify terms. The definitions are necessary to make clear to a reader how you used the terms in the study and how certain variables have been measured. Common terms that are used by almost everybody in the same way need not be defined.

For example, the term teacher may not require definition, if it is used in the usual way that most people understand it. But if the term is used to refer to a special category of teacher(s) then the term must be defined. Note that the clearer the terms used in a study are the better the report. The key question you must ask yourself when you prepare the section of definition of terms is: Have I defined all the key terms clearly?

5.2 Review of Related Literature

Dear learner, we devoted Unit 2, Session 6, to this topic, that is, the review of related literature. You need to go back and review that whole session now! In addition, we want to point out the following for your guidance:

(i) In writing up your review you have to make a selection of materials in books and journals which relate directly to the topic (problem) being investigated.

(ii) Your literature review can be written first and if you have managed to discipline yourself sufficiently well to write up sections and sub-sections, much of the work of this section will be ready for revision before you begin to collect data.

(iii) When you complete the write-up for the literature review, read over it to ensure that the review is comprehensive and relevant. Ask yourself the following important questions:
   (a) Have I surveyed and described relevant studies related to the problem?
   (b) Have I surveyed existing expert opinion on the problem?
   (c) Have I summarised the existing state of opinion and research on the problem? (Fraenkel and Wallen, 2000).

Once you answer the above questions frankly and your responses are 'yes' to each of them, then your review is good.

(iv) End the review with how your work will extend the current body of literature

(v) Use the APA style

The review of related literature is Chapter 2 of the project report.

5.3 The Methodology Chapter

The methodology chapter describes the procedures followed in carrying out the study. The description of the procedures should be detailed enough for anybody in doubt to follow and it and replicate the study.

The chapter has several parts (sub-headings) that must be covered. These are (a) research design, (b) population, sample and sampling procedures (c) instrumentation (d) procedures used in collecting data and (e) data analysis. Each of these aspects is discussed briefly below.

5.3.1 Research Design

In this section of the methodology chapter, you should describe the basic design used in the study and its application to the study. In most studies, the basic design is fairly clear-cut and fits one of the designs we presented in Unit 3. The design, therefore, may be descriptive survey, correlational or experimental.

It is important to mention the strengths and weaknesses of the basic design used in the study.

5.3.2 Population, Sample and Sampling

The three elements in the above sub-heading can be dealt with separately. They can also be combined. In this section, you must indicate those who were studied (the population). Their characteristics must be described in detail. Indicate whether the subjects studied were selected from a larger group (population) and describe how they were selected. Indicate the sample size and specify the specific sampling procedure(s) used to select them. You will recall that in Unit 3, Session 2, we explained the various sampling procedures.

The basic sampling procedure(s) you employed in carrying out the selection of the subjects must be described here. At the end of these section on the three sub-headings ask yourself the following questions as a way of evaluating the quality of the write-up.

(a) Have I described the population studied?
(b) Have I described the sample and the way it was selected in detail?

If your answer to the above questions is 'yes' then the description of your population, sample and sampling procedure(s) is good.

5.3.3 Instrumentation

The section on instrumentation focuses on the description of the instruments used to collect data from the subjects. In a study you may use an existing instrument (e.g., a questionnaire) or if no existing instrument is available, you have to develop one for your study.

In this section, you must describe the instrument(s) you used to collect data in detail, including the procedures you followed to develop the instrument(s). You equally, must pay attention to the validity and reliability of the results that you obtained using the instruments.

Even if you used existing instruments for which reliability and validity of scores are available you must ensure that the instrument(s) is (are) applicable to your problem. Make sure you present validity and reliability evidence regarding the use of the instrument(s). This can take the form of content validity or face validity evidence and internal consistency evidence.

In any event, in the section of instrumentation, you should describe the instrument(s) you have used and indicate their relevance to the study. You should also indicate steps you have taken to ensure the validity or reliability of your observations (scores and results).

5.3.4 Data Collection Procedures

This section is a description of how the instrument(s) was (were) administered to obtain data for the study. It should fully describe the procedures you have followed in the study including what was done, where it was done, when it was done and how it was done.

Bear in mind that the goal here is that of making replication of the study possible. That is, another researcher should on the basis of the information provided in this section be able to repeat the study in exactly the same way as you did. You must also make clear how the information you collected was used to answer the research questions or to test the hypotheses.

5.3.5 Data Analysis

In this section you must indicate how you analysed the data collected. In Sessions 1, 2 and 3 of this Unit, we explained procedures in organizing and analyzing your data. The description here should touch on how data collected was organised and how it was analyzed including statistical procedures that have been used if any. There must be a justification for using those procedures.

In this session, you learnt about how to write the first three chapters of your project report. These are the introduction, literature review and methodology chapters. Specific sub-headings of the chapters have been described and suggestions have been offered to you about how to describe each. The next session which is the last on this course examines the last two chapters in the project report and the reference materials.

Self-Assessment Questions

Exercise 4.5

1. Which is the appropriate order of the following sub-headings in the first chapter of a project report?
   (a) Background to the study, Research Questions, significance of the study.
   (b) Background to the study, Problem Statement, Definition of Terms.
   (c) Background to the study, Problem Statement, Research Questions.

2. The problem statement is more important than the background to the study.
   (a) True
   (b) False

3. Delimitation of a study refers to the
   (a) confines of the study
   (b) geographical area of the study
   (c) limitations of the study

4. It is appropriate to define all terms used in a study.
   (a) True
   (b) False

5. The review chapter can be said to be in three sections namely, introduction, main body and summary.
   (a) True
   (b) False

6. One major reason why the method employed to carryout a study must be described in detail is to
   (a) ensure reliability of the study
   (b) ensure validity of the study
   (c) make sure that others can repeat the study

7. Which section of the methodology chapter describes the validity or reliability of the measures?
   (a) Data analysis
   (b) Instrumentation
   (c) Sampling Procedures

RESEARCH REPORT: THE INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY CHAPTERS

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

SESSION 6: RESEARCH REPORT: THE RESULTS AND CONCLUSION CHAPTERS AND REFERENCE MATERIALS

Dear learner, you are welcome to the last of the sessions on this course. This session presents material on the last two chapters of a project report. These are the results chapter and the concluding chapter. It also briefly discusses the reference materials – references and appendixes – and how to deal with them in a project report.

Objectives

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

(a) write the results chapter of your project report;
(b) conclude your study;
(c) prepare your references list; and
(d) appropriately present your appendixes to the report.

Now read on…

6.1 Results/Findings Chapter

This chapter (chapter 4) presents the results on the study. That is, the results chapter indicates the findings from your analysis of data. The findings of the study constitute the results of the researcher's analysis of his or her data. The chapter can be divided into two main parts: The results section and the discussion section.

6.1.1 The Results Section

The results section of this chapter presents the findings of the study in a straightforward manner. Some people tend to divide the results section into two. The first part is used to describe the characteristics of the subjects (participants) while the second part focuses on the research questions or hypotheses. It should be pointed out that if the subjects are well described in the methodology chapter, then there will be no need to describe them in the results section.

In presenting the main findings of the study, you should address or respond to each research question or hypothesis one by one in the order in which you presented them earlier in the study (i.e., in Research Questions Section). This is a must! In a quantitative study you must stay closely to the statistical findings without drawing broader implications in reporting the results. The implications must be presented later. In the results section, often tables and graphs are used to summarize large amount of data succinctly. You should not include raw data (e.g., the actual scores for individuals).

RESEARCH REPORT: THE RESULTS AND CONCLUSION CHAPTERS AND REFERENCE MATERIALS

A table in research report is a summary of quantitative data organised into rows and columns. Typically tables for reporting results contain quantitative information but they might contain text information such as summaries of key studies. In summarising your data is tabular form, you should note the following:

(a) Present one table for each central item or statistical test. However, if possible, you can combine some of them in a table (e.g. descriptive data). Make sure none of your table is busy – (i.e. contains too much information and creates confusion in the mind of the reader).

(b) Organize your tables into rows and columns in such a way that readers will find it easy to grasp the meaning of the table.

(c) The title of the table should accurately represent the information contained in the table.

(d) Follow the American Psychological Association (APA) style in presenting the tables. For example, you must underline the titles of your tables, tables should be numbered consecutively in the report using Arabic numerals. Column lines as well as horizontal lines must be avoided except the horizontal lines carrying the column headings or closing the tables. An example of a table is provided below.

An Example of a Table

Table 1
Percentage of Girls' School Attendance (1999/2000-2001/2002)

Academic Year	JSS 1 (%)	JSS 2 (%)	JSS 3 (%)
1999/2000	72	71	71
2000/2001	75	72	74
2001/2002	75	74	75

(e) You can provide footnotes to the tables to qualify or explain anything which is not clear in the table.

In addition to tables, you can use figures to summarize your data particularly quantitative data. A figure is summary of quantitative information presented as a chart, graph or picture that shows relations among scores or variables. Tables are, however, preferred to figures because tables convey more information in a simple form.

Your figures can take various forms including bar charts, line graphs and scatter plots depending on the characteristics of the variables involved. Make sure that by the end of the results section, you have answered all your research questions or you have tested your hypotheses and provided appropriate answers to them. Without these answers you cannot say your work is done!

6.1.2 Discussion Section

This is the second major part of the results section. This is the section in which you explain the results you obtained in your study. Here, data are interpreted in light of other research and possible weaknesses in the methodology of the study.

In this section, you must present the interpretation of the results you obtained in terms of the implications for theory and/ or practice. You must also in this section place your results in a broader context. In fact, you must go beyond the data to place the findings in a broader perspective sometimes relating it to the literature.

This is a section in which you can prevail on the results of the study and show the reader your understanding of the issues you have investigated and how the issues relate to other issues as found in the literature. You must write this section logically to reflect the issues investigated.

6.2 The Conclusion Chapter

This chapter has the heading "Summary, Conclusion and Recommendations". As the heading implies the chapter has three main sub-headings-Summary Conclusion and Recommendations. This chapter is important in the sense that people who do not have time to read the whole report may read only this chapter. It must, therefore, be written well to tell all about the study.

6.2.1 Summary

The summary part of the concluding chapter presents a summary of the study including, the problem studied, the methodology employed and the results. As a summary, this section must be written in a concise form. No new information should be included here.

6.2.2 Conclusions

According to McMillan (1996) conclusions are summary statements that reflect the overall answers to the research questions or whether or not the hypotheses are supported. The condition of your research, therefore, is your inference derived from the results. The conclusion of your study is what you can tell somebody in a very apt way about the finding of your study. Conclusions should, therefore, be limited to what is directly supported by the findings and what is reasonable in the circumstances. The concluding section can be a paragraph or several paragraphs.

Do not drop in an opinion in your conclusion. Whatever you say here must be justifiably drawn from the findings.

6.2.3 Recommendations

This is the final section of the last chapter of the project report. In this section, you have to make recommendations relevant to the problem investigated in terms of the implication for practice. Only recommendations warranted by the findings should be made. That is, recommendations should not go beyond the findings of the study.

An appropriate way of presenting recommendations is to enumerate or list them.

6.3 Reference Materials

Reference materials are essentially the list of references cited in the report and the appendixes. These are important parts of any good report and must be dealt with care for them to provide the needed information to support the main body of the report.

6.3.1 List of References

This is a list of books and articles which have been cited or referred to in the report. The listing immediately follows the main report. It is important for you to know that there is a slight difference between a list of references and a bibliography. Bibliography unlike the list of references includes all sources consulted during the preparation of the investigation.

With the adoption of the APA style of writing research reports by the Faculty of Education, the use of references is recommended and not bibliography. The heading for this is References. All citations in the report must be included.
The reference must be accurate in terms of names, spellings and years of publication as cited in the report.

The references should be arranged alphabetically using the last name (surname) of the author(s) and their initials. Every source cited in the report must be included in the references list. In short, the sources in the report and the listed sources in the references list must correspond exactly.

Where an author's name is not given, the work must be listed under the name of the institution that prepared the report. When no clue of authorship is available the work is listed under the first important word of the title. To make the author's name stand out, entries that occupy more than one line each are indented after the first line. The full reference comprises the author(s), the year of publication, the title of the book or article, the name of the journal (if the work is an article) and the publisher (if it is a book). For journal articles, you must provide the volume and number as well as the pages. Examples are given below.

Examples of references:

Amedahe, F.K. (1994). Attitudes of basic education teachers toward the use of continuous assessment in Ghana. Journal of Institute of Education 3 (1), 8-20.

American Psychological Association, American Educational Research Association, National Council on Measurement in Education. (1999). Standards for Educational and Psychological Testing. Washington, D.C. American Council on Education.

Kolen, M.J. & Brennan, R.L. (1995). Test Equating Methods and Practices. New York: Springer-Verlag.

Note the following with regard to the examples presented above.

1. With journal articles, the title of the journal must be underlined and the volume and the number as well as the pages of the article must be indicated as in the first example.

2. With books, the title of the book should be underlined. Note that in example three, only the first letter of the first word is capitalized.

3. The year of publication is put in parentheses immediately after the author(s).

4. The items in the references list should not be numbered.

5. The references list should also be typed double-spaced as the report itself.

6.3.2 Appendixes

The appendixes contain materials that, though relevant to the study, would disturb the flow of the report if placed in the main body of the text. Thus, whereas summary tables and other materials necessary for the interpretation of the study are placed in the text, tables of raw data should be put in the appendix.

In the same way, whereas the general nature and orientation of the instrument(s) used are discussed in the text, the instrument(s) together with cover letters and follow-up letters are placed in the appendix. In the main, items placed in the appendix include questionnaires, introductory letters, evaluation sheets, interview schedules, raw data, documents and long quotations.

The items that appear in the appendix are grouped, labelled, lettered and listed in the table of contents. Note that all appendixes must be cited in the main report with the appropriate number or letter for easy reference (e.g.; see Appendix A).

Self -Assessment Questions

Exercise 4.6

(1) The results of a study should not be necessarily presented in the order of the research questions/hypotheses.
   (a) True
   (b) False

(2) As a researcher presents the findings one after the other, the implications must go with them.
   (a) True
   (b) False

(3) You can use tables in presenting the following results in the section of a report **except**
   (a) Raw quantitative data
   (b) Summary of quantitative data
   (c) Summary of text information

(4) Tables in a research report should be numbered using Roman numerals.
   (a) True
   (b) False

(5) When preparing a table, all column lines should not be allowed to appear.
   (a) True
   (b) False

(6) A figure and a table can depict the same information.
   (a) True
   (b) False

(7) The section of a research report that presents inferences derived from the findings is known as
   (a) Conclusion
   (b) Results
   (c) Summary

(8) Which of these two concepts is broader: bibliography and references
   (a) Bibliography
   (b) References

(9) The list of references should be arranged alphabetically using the first name of the author(s).
   (a) True
   (b) False

(10) Which of the following must be placed in the appendix?
   (a) Introductory letter
   (b) Questionnaire
   (c) Raw data
   (d) All of the above

RESEARCH REPORT: THE RESULTS AND CONCLUSION CHAPTERS AND REFERENCE MATERIALS

This is a blank sheet for your short notes on:

- issues that are not clear; and
- difficult topics, if any.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \qquad t = \frac{5-3}{\sqrt{\frac{2.5}{5} + \frac{5.5}{5}}}$$

$X_1 \quad X_2 \qquad = \frac{2}{\sqrt{.5 + 1.1}}$

$\bar{Y}_1 \qquad \bar{Y}_2$

$X_1 \qquad \bar{X}_2 \qquad = \frac{2}{1.26}$

τ_{xy}

$\bar{X} \qquad \bar{X}_1$

τ

$$r_{xy} = \frac{\frac{\Sigma XY}{N} - (\bar{X})(\bar{Y})}{S_x S_Y}$$

$$X^2 = \Sigma \frac{(fo - fe)^2}{fe}$$

Ha = $X_1 \neq X_2$

ANSWERS TO SELF-ASSESSMENT QUESTIONS

UNIT 1: INTRODUCTION OF EDUCATION RESEARCH

Exercise1. 1

1.	d		2.	b	3.	b			
4.	d		5.	a	6.	b			

Exercise 1.2

1.	c		2.	a	3.	b	4.	b	
5.	a		6.	b	7.	b			

Exercise 1.3

1.	b		2.	b	3.	a	4.	c	
5.	c		6.	a	7.	b	8.	c	

Exercise 1.4

1.	c		2.	a	3.	b	4.	b	
5.	a		6.	c	7.	b			

Exercise 1.5

1.	a		2.	b	3.	b	4.	b	
5.	a		6.	b	7.	b			

Exercise 1.6

1.	a		2.	a	3.	b	4.	a	
5.	b		6.	b	7.	a	8.	a	

UNIT 2: THE RESEARCH PROBLEM

Exercise 2.1

1.	a	2.	a	3.	b	4.	b	5.	a

Exercise 2.2

1.	c	2.	a	3.	a	4.	a		
5.	b	6.	a						

Exercise 2.3

1.	b	2.	c	3.	a	4.	d		
5.	a	6.	b	7.	a				

Exercise 2.4

1.	a	2.	a	3.	a	4.	b	5.	a

Exercise 2.5

1.	a	2.	a	3.	c	4.	b		
5.	b	6.	a	7.	b				

Exercise 2.6

1.	b	2.	d	3.	a	4.	b	5.	d

UNIT 3: RESEARCH DESIGN

Exercise 3.1

1.	d	2.	a	3.	b	4.	d	5.	b

Exercise 3.2

1.	a	2.	a	3.	d	4.	d
5.	b	6.	d				

Exercise 3.3

1.	a	2.	b	3.	d	4.	b
5.	c	6.	c	7.	a		

Exercise 3.4

1.	a	2.	a	3.	b	4.	b
5.	a	6.	c	7.	c		

Exercise 3.5

1.	a	2.	b	3.	a	4.	a	5.	b

Exercise 3.6

1.	c	2.	b	3.	a	4.	d	5.	b
6.	b	7.	c	8.	d	9.	d	10.	b

UNIT 4: ANALYSIS OF DATA AND REPORT WRITING

Exercise 4.1

1.	b	2.	b	3.	a	4.	b	5.	b
6.	b	7.	a						

Exercise 4.2

1.	c	2.	a	3.	b	4.	a	5.	b
6.	b	7.	b	8.	c				

ANSWERS TO SELF-ASSESSMENT QUESTIONS

Exercise 4.3

1.	b	2.	a	3.	a	4.	a	5.	b
6.	b	7.	a	8.	c				

Exercise 4.4

1.	b	2.	b	3.	b	4.	c	5.	a
6.	c	7.	b	8.	a				

Exercise 4.5

1.	c	2.	b	3.	a	4.	b	5.	a
6.	c	7.	b						

Exercise 4.6

1.	b	2.	b	3.	a	4.	b	5.	a
6.	b	7.	a	8.	a	9.	b	10.	d

APPENDIX

APPENDIX A

Standard Components of a Research Proposal
(Approved by Faculty of Education, University of Cape Coast)

Title Page

- Research study title
- Author's name
- Institutional affiliation

Chapter 1 - The Problem
(Explains what the problem is and why it is important to study)

- Introduction/Background to the study
- Statement of the problem
- Purpose of study
- Research questions/assumptions/hypotheses (where applicable)
- Significance of the study
- Delimitations
- Limitations
- Preliminary definition of terms (if any)

Chapter 2 - Review of the Literature
(Provides support for the study)

- Background to the problem
- Theoretical framework/conceptual base of the study
- Review goes from broad to focused
- Break review into sections to cover the important aspects
- Summary of major findings of the literature review (i.e., the state of the art)

Chapter 3 - Methodology
(Explains how the study will be conducted)

- Brief introduction to the chapter
- Research Design
  Describe the type of study and design (e.g., survey, experimental, action)
  Explain rationale for the design
- Population and sampling

Definition/description of population
Sample size determination and how sample will be selected
Give rationale for the selection procedure and the sample size
Was a pre-pilot test conducted (how and when)?

- Instruments
  Describe how instrument was developed
  Show evidence how face, content, and construct validity was determined
  Indicate how reliable the instrument is (provide reliability coefficient)
  How were items formats determined?
  Indicate how scoring will be done
  Describe pilot testing of instrument if a new instrument has been constructed.
- Data collection procedure
  Describe pilot study if done
  Describe how data will be collected step by step
  Indicate when data will be collected and how long it will take
  Indicate who will collect the data
- Data analysis
  Describe the scales of measurement to be used
  Indicate the statistical tools to be used for each hypothesis/research question/objective.

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