Universal Basic Education Commission, Abuja

Field Guide to Research

Methods for Teachers and Administrators

Abuja, 2010

EDUCATION FOR ALL IS THE RESPONSIBILITY OF ALL

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Foreword

The manual 'Field Guide to Research Methods for Teachers and Administrators' was developed for staff in the Technical Departments of the UBE Commission. The manual covers vast topics in research methods not only in the Educational field but also statistical methods that can be used in day-to-day research. It was developed to provide capacity building for staff and to further encourage staff in the Commission to be proactive in research and research methodology to enhance delivery of quality basic education in the country.

The research manual was produced using examples and illustrations from various statistical scenarios. The strategy for developing the research manual was adopted by UBEC since it is obvious that research is the most appropriate approaches used in addressing some educational challenges.

This manual is a guide not only to staff in the technical department, statisticians, researchers, etc, but also can be used as a training manual by teachers, educational administrators, students and various educational stakeholders.

I am delighted therefore to present and recommend the use of this manual for all staff in Universal Basic Education Commission, State Universal Basic Education Boards, LGEAs and other stakeholders for a better understanding of research methods and procedures of conducting research for quality education delivery.

Dr. Ahmed Modibbo Mohammed
Executive Secretary
UBEC Abuja

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Module 1
What is Educational Research?

Introduction

In this module, the concept, process and functions of Educational research are dealt with. The Module has **four** units. Concepts are clarified in Unit 1, characteristics of scientific investigations are in Unit 2, the educational research process in Unit 3, and types of educational research in unit 4. The module ends with an activity and a task.

Unit 1 – Concepts Clarification

This unit will attempt to explain the meaning of:

- Research
- Educational research

Meaning of Research

Research is the orderly investigation of a subject matter for the purpose of adding to knowledge. Research can mean‘re-search’ implying that the subject matter is already known but, for one reason or another, needs to be studied again. Alternatively, the expression can be used without a hyphen and in this case it typically means investigating a new problem or phenomenon.

In broad terms, research is generally concerned with the study of relationships among variables. A variable is a characteristic that can take on a number of values. Height, for example, is a variable that can take on a number of values, depending on the stature of the individual being measured. Achievement, attitudes, interests, and aspects of personality are all variables because they can take on a number of values, depending on the individual being measured. Variables do not refer only to characteristics of individuals. Variables can also refer to ‘treatments’ that might be applied to a group of individuals. For example, school subjects such as mathematics can be taught in very different ways to classes of students in schools. Thus, ‘method of teaching mathematics’ is a variable and each different way of teaching mathematics is a different value of this variable. ‘Type of school organization’ is also a variable since students can be grouped in many different ways for learning. Each way of organizing students would then represent a different value of ‘type of school organization’. Many educational research studies are concerned with studying the relationship between a variable that describes a particular instructional intervention or method of organization and a student outcome variable, such as achievement, attitudes and behaviours developed length of job search, etc.

Within the realm of educational planning, many things are always changing: the structure of the education system, curriculum and textbooks, modes of teaching, methods of teacher

training, the amount and type of provisions to schools such as science laboratories, textbooks, furniture, classroom supplies, and so on. These changes may lead to an improvement, or a worsening, in the quality of an educational system. Sometimes they may result in no impact upon quality – in which case major government expenditures on such changes have been wasted. The educational planner working within this kind of environment must be able to undertake assessments of the effects of major changes and then provide policy advice that will consolidate and extend the post productive courses of action, and also intercept and terminate existing practices that are shown to be damaging and wasteful.

Meaning of Educational Research

According to Nworgu (2006), educational research is a systematic process of finding solutions to educational problems. It involves the application of the 'scientific method' in trying to understand and interpret issues about teaching and learning.

There are five major objectives of educational research:

1. *Exploration*. This is done when you are trying to generate ideas about something.

   For example, linking birth order with certain class behaviour of children. Are "last born" children more well-behaved or more stubborn"?

2. *Description*. This is done when you want to describe the characteristics of something or some phenomenon.

   For example, what are the types and categories of teaching styles employed by teachers in our primary schools?

3. *Explanation*. This is done when you want to show how and why a phenomenon operates as it does. If you are interested in causality, you are usually interested in explanation.

   For example, how does the provision of wooden furniture impacted on the retention of children in schools?

4. *Prediction*. This is your objective when your primary interest is in making accurate predictions. Note that the advanced sciences make much more accurate predictions than the newer social and behavioral sciences.

   For example, involving pupils' mothers in decision-making can have an impact on retention of female pupils in Muslim areas of northern Nigeria.

5. *Influence*. This objective is a little different. It involves the application of research

results to impact the world. A demonstration programme is an example of this.

For example, identifying topics of learning difficulties in an Action Research setting can improve teacher delivery.

Unit 2: Characteristics of Scientific Investigations

This unit discusses seven important characteristics of scientific investigations. These are:

- Systematic
- Empirical
- Theoretical
- Cumulative
- Control
- Replicative
- Non-ethical

Systematic

Scientific investigation is systematic in the sense that it is usually well planned and organized with sequential steps with definite and logical procedure.

Empirical

Scientific investigations are usually empirical in nature that is to say it involves the use of objective data collected from natural phenomena or observation.

Theoretical

The results of any scientific investigation should contribute or lead to the building of theories in the particular discipline.

Cumulative

Scientific investigations build upon previous investigations in order to avoid unnecessary duplications.

Control

Scientific investigation involves the control of important variables. It attempts to manipulate the variables involved in the investigation as well as eliminates the influence of certain variables not directly concerned with the investigation. Control is necessary in order to establish cause and effect. It is used to eliminate the influence of variables not directly being tested.

Replicative

Scientific investigation is replicative in nature. This is to say that the steps or the procedure of any scientific investigation should be reproducible and applicable to any similar research

situation. For an investigation to be scientific, it ought to be capable of being replicated by other researchers so that the earlier finings could be confirmed or refuted.

Non-ethical

This means that scientific investigations do not deal with issues of morality i.e. whether actions are right or wrong

Unit 3: Educational Research Process

The quality of educational planning decisions depends, in turn, on the quality of the information upon which they are based. This information provides the best possible guidance for decision making when it is based on sound educational research combined with expertise derived from a comprehensive knowledge of the innermost 'workings' of the education system.

While educational research reports provide an essential source of information for making decisions, there are other sources of information that educational planners need to consider. These are: costs, local customs and tradition, the views of various individuals who have a stake in an educational enterprise, governmental policies, laws, and the like. In making almost any decision, an educational administrator will need to consider research results alongside issues associated with some or all of these other sources of information.

Using the results of research in decision making is not an easy task. First, the educational planner needs to be able to distinguish good educational research from bad educational research. Currently, a great deal of research is being carried out all over the world. Some of them are of extremely high quality while some, unfortunately, are unquestionably poor. The educational planner needs, first of all, to be familiar with the key characteristics of research design and execution that will permit valid judgments to be made about research quality. Much of this guide is directed towards developing an understanding of these characteristics.

Second, just as most people have increasingly recognized the complexity of education, so have educational researchers. Accordingly, educational research has become more and more complex. This can easily be seen when one compares current research reports with those that were produced thirty or forty years ago. Contemporary educational research studies generally consider far more variables in a single study and employ more complex analytic procedures than their counterparts of a generation or two ago. This makes the task of reading and extracting information from research reports much more difficult for the reader. While one welcomes the more extensive understanding that has arisen from the increasing sophistication of much modern educational research, the problems that this sophistication creates for the reader must also be acknowledged.

Unit 4: Types of Educational Research

There are many types of educational research studies and there are also a number of ways in which they may be classified. In this manual, educational research studies are classified according to the kinds of information that they provide. Accordingly, the following types of educational research are discussed in this unit:

- Historical research
- Descriptive
- Experimental
- Ethnographic
- Case study
- Correlational
- Causal-comparative
- Action
- Research and development

Historical research

Generates descriptions, and sometimes attempted explanations, of conditions, situations, and events that have occurred in the past.

- *For example, a study that documents the World Bank intervention in Nigerian Primary Education since civilian era, with the aim of explaining the historical origins of the content and processes of current programmes.*

Descriptive research

Provides information about conditions, situations, and events that occur in the present.

- *For example, a survey of the physical condition of school buildings in order to establish a descriptive profile of the facilities that exist in a typical school.*

Correlational research

This involves the search for relationships between variables through the use of various measures of statistical association.

- *For example, an investigation of the relationship between teachers' satisfaction with their job and various factors describing the provision and quality of teacher housing, salaries, leave entitlements, and the availability of classroom supplies.*

Causal - Comparative research
This aims to suggest causal linkages between variables by observing existing phenomena and then searching back through available data in order to try to identify plausible causal relationships.

In other words, ex-post facto is a design which investigates the cause and effect relationships by simply accessing the existing state of effects without manipulating any of the possible (independent variables). Literally the design is like a post mortem phenomenon – investigating an event after it had happened e.g. investigating the conditions of high rate of failure of a group of students by reflecting and reconstructing factors which might have contributed to such failure. One may also wish to account or study the causes of high rate of administrative born –out or inefficiency of staff members by assessing and analyzing conditions under which such members perform their administrative duties. None of such conditions would have not been and were not manipulated by the researcher prior to the born-out. In this case the researcher starts with the dependent variable. Results of ex-post facto design are suggestive and exploitative and to some extent yield some measures of association.

In ex-post facto research design, therefore, the independent variables are identified and analyzed not manipulated to explain or account for an observed event (dependent variable).

- *For example, a study of factors related to student 'drop out' from secondary school using data obtained from school records over the past decade.*

Experimental research
This is used in settings where variables defining one or more 'causes' can be manipulated in a systematic fashion in order to discern 'effects' on other variables. Basically, two groups are involved.

- *For example, an investigation of the effectiveness of two new textbooks using random assignment of teachers and students to three groups – two groups for each of the new textbooks, and one group as a 'control' group to use the existing textbook.*

True Experimental design
In true experimental design, the subjects are randomly assigned to treatment conditions. Randomization ensures that the two groups- the experimental and control are equated ***ab initio***. This makes it valid for the researcher to attribute any observed difference between the two groups to the effect of the treatment or independent variable. An example of one of the specific designs under the true experimental design is shown below. This is called the *Pretest-Posttest Control Group design*.

Experimental	R $\underline{O_1 \quad x \quad O_2}$
Control	R $O_3 \quad x \quad O_4$

Quasi-Experimental design
Quasi-experimental design is sometimes referred to as a compromise design because the subjects are not randomly assigned to the experimental and control groups. Rather pre-existing or intact groups are used. These groups and not the subjects are randomly assigned to treatment groups. This is referred to as random assignment and not randomization. The lack of randomization implies that the groups are not equivalent. One of the specific quasi-experimental designs is shown below. It is called the non-equivalent control group design.

Experimental	$\underline{O_1 \quad x \quad O_2}$
Control	$O_3 \quad x \quad O_4$

Randomization or random assignment of subjects is an essential ingredient of a true experimental design which distinguishes it from the quasi-experimental design. In a quasi-experimental design, the groups **and not the subjects** are randomly assigned to treatment groups.

Case study research
Generally refers to two distinct research approaches. The first consists of an in-depth study of a particular student, classroom, or school with the aim of producing a nuanced description of the pervading cultural setting that affects education, and an account of the interactions that take place between students and other relevant persons.

- *For example, an in-depth exploration of the patterns of friendship between students in a single class. The second approach to Case Study Research involves the application of quantitative research methods to non-probability samples – which provide results that are not necessarily designed to be generalizable to wider populations. For example, a survey of the reading achievements of the students in one rural region of a particular country.*

Ethnographic research
Usually this consists of a description of events that occur within the life of a group – with particular reference to the interaction of individuals in the context of the socio-cultural norms, rituals, and beliefs shared by the group. The researcher generally participates in some part of the normal life of the group and uses what he or she learns from this participation to understand the interactions between group members.

- *For example, a detailed account of the daily tasks and interactions encountered by a*

school Head Teacher using observations gathered by a researcher who is placed in the position of 'Head Teacher's Assistant' in order to become fully involved in the daily life of the school.

Action Research
This is a research type involving a very intensive observation in a natural setting. The data collected from this type of research are usually of descriptions, narrations and quotations of acts that happened during the investigation. Action research does not use hypotheses, neither does it use statistical tests, but rather it uses charts, tables, percentages and other descriptive statistics. Action research is primarily meant to solve a particular and an immediate educational problem calling for urgent attention.

Examples of issues that lend themselves to action research include:

1. rampant examination malpractices
2. secret-cult activities in universities campuses and schools
3. low enrolment into teacher-education programmes.

Research and development research (R & D)
This type of research differs from the above types of research in that, rather than bringing new information to light, it focuses on the interaction between research and the production and evaluation of a new product. This type of research can be 'formative' (by collecting evaluative information about the product while it is being developed with the aim of using such information to modify and improve the development process).

- *For example, an investigation of teachers' reactions to the various drafts and redrafts of a new mathematics teaching kit, with the information gathered at each stage being used to improve each stage of the drafting process. Alternatively, it can be 'summative' (by evaluating the worth of the final product, especially in comparison to some other competing product). For example, a comparison of the mathematics achievement of students exposed to a new mathematics teaching kit in comparison with students exposed to the established mathematics curriculum.*

ACTIVITY
The following exercise is concerned with examining the general aims of an education system, establishing specific and operationalized aims, and then proposing research activities that will assess to what extent the education system is achieving its stated aims.

Five general aims are taken from a small publication *Planning for Successful Schooling* which was prepared by the Ministry of Education in the State of Victoria in Australia during 1990:

1. To expand educational opportunities for all students.

2. To encourage excellence in all areas of learning and to assist all students to develop their full potential.
3. To strengthen community participation in and satisfaction with the state school system.
4. To develop and improve the skills, potential and performance of school principals, teachers, and administrative and support staff.
5. To manage and control financial and physical resources in ways which maximize educational benefits for all students.

If you notice, these aims are quite similar to those in Nigerian educational structure.

Task

- Select one of the five general aims above that you believe would probably receive a high priority in your country. For that general aim write five specific research questions. For each of the five specific research questions, prepare several operationalized research aims that focus on the performance of the education system in meeting these aims. Then, write down a broad outline of the sequence of activities that would need to be undertaken in order to assess the system's performance with respect to these aims.

Module 2

Selecting and Stating a Research Problem

Introduction

In the previous module, we dealt with the concept, process and functions of educational research. Educational research is essentially concerned with solving problems in education. It therefore follows logically, that selecting and stating a research problem should be the first step in the educational research process. Put differently, it is imperative for anyone involved in educational research to develop a proper understanding of what constitutes an educational problem and how to select and state such a problem in clear and precise terms. This module will therefore deal with the nature of educational problems, how to select educational problems and how to formulate a statement of problem. It will also consider research questions and hypotheses.

Unit 1: Concepts Clarification

In this unit, effort has been made to explain or examine two basic concepts, namely;

- Nature of problems in Education, and
- Characteristics of an educational Problem

Nature of problems in education

What is a problem? The Oxford Advanced Learner's dictionary defined a problem as:

1. A thing that is difficult to deal with or understand;
2. A question to be answered or solved, especially by reasoning or calculating.

From the above definition, we can deduce that a problem in education is any condition or situation that:

- poses some difficulty and which would therefore adversely affect the education system
- creates dissatisfaction or inconvenience
- is puzzling such that our understanding of it is limited
- can be dealt with through the application of a logical process.

Nworgu (2006) has identified five distinct forms such problems may take. These include:

- An unsatisfactory state of affairs
- An unanswered question

- A missing link or gap
- A need
- An imbalance.

Unsatisfactory state of affairs: This is when people are not satisfied with or feel worried over any condition or situation in education. Such a situation or condition over which people are dissatisfied constitutes a problem. Some examples would include:

- Poor achievement in public examinations such as SSCE
- Examination Malpractices in our tertiary institutions
- Poor remuneration for teachers.

Unanswered question: Any question on any aspect of educational practice or theory for which there is yet no answer poses a problem. Such questions call for answers. To provide such answers we need to seek and analyze information. Consider the following questions:

- What school-related factors can best promote access and achievement in primary schools?
- What conditions predispose undergraduate students to enroll in secret cults?
- Why do female pupils show more negative attitude to schooling than their male counterparts?

Each of the above questions represents a problem in so far as there are no known answers to them.

Missing link or gap: Educational problems may also take the nature of a gap or missing link. This may be an identified gap or missing link in our knowledge of educational phenomena or the educational process. For example, curriculum development practice may be at variance with curriculum theories or our instructional approaches may not conform to the basic tenets of child-centered pedagogy. In each of these cases, a gap exists. This gap poses a problem.

Unsatisfied need: A need may occur in the educational system due to paucity of equipment, materials or personnel. It may also occur in terms of deficiencies in certain characteristics of the equipment, materials or personnel. Consider the following:

- Lack of validity of teacher-made tests may create the need for the development of standardized instruments by experts.
- Inadequate professional preparation of personnel in any system may create a need for capacity building/enhancement.

Imbalance: An imbalance will occur whenever there is a mismatch or inequality between any two levels or components of a system. Such a situation will normally create a problem. Examples of imbalance include:

- More boys enrolling in primary schools than girls in the North
- More girls enrolling in primary schools than boys in the South
- Fewer Teachers in the rural schools than urban schools
- Less monitoring visits to rural schools than urban schools.

Characteristics of a Good Educational Problem

There are certain characteristics which any good educational problem should possess. In this regard, a good educational problem should be:

- Situated within the disciplinary field of education. In other words, it should be educational in nature in the sense that the solutions to such a problem should make a direct contribution in the field of education otherwise such a problem would not be an educational problem. Consider the following problems formulated as topics.

  1. Design and characterization of a solar cassava processing machine.
  2. Impact of Local Salt industry in Ebonyi state on employment generation.
  3. Effect of using solar-powered hand calculator on pupils' performance in word problems in mathematics.
  4. Impact of local salt industry in Ebonyi state on primary school enrolment.

  Which of these do you think is/are educational in nature? How can the ones you think are not educational in nature, be restructured to make them educational?

- Solvable or researchable. This is an important requirement for any educational problem to meet. This means that the data required for solving the problem must be available and accessible (Nworgu, 2006). For instance, problems that require classified data to solve, are not researchable because although classified data may be available, but they are not accessible to the researcher. Consider this research topic: "Impact of prayers on Academic achievement of primary school pupils". Is this problem researchable? Why?
- *Non-trivial:* A good educational problem should address an important issue. It should not be one that does not make an important or worthwhile contribution to the field of education. In other words, a good educational problem should have real significance or value.

- *Novel*: Another important characteristic of a good educational problem is that it should be novel. This means that for such a problem, there is no already-made solution. Otherwise it would not even be a problem in the first instance.
- *Within the researcher's ability*: In judging the suitability or otherwise of a research problem, the researcher's skills, interests and even resources must be brought into focus. Therefore a problem is good to the extent that the researcher's skills, interests and resources can support it. Otherwise it would not be a good problem.

Activity

1. Working in small groups of between 3 and 5 persons; identify at least two examples of educational problems under each of the five recognizable forms of educational problems in this unit.
2. Explain any four (4) characteristics of an educational problem.

Unit 2: Steps in Problem Identification

The last unit dealt with the nature of educational problems. Essentially, the unit is designed to help the participant understand the recognizable forms of educational problems. This understanding is necessary for identifying problems in education. From module One, we learned that problem identification is the first step in the educational research process. It is therefore of fundamental importance in educational research. There are three major steps involved problem identification as identified in Nworgu (2005, 2006).

In the first step, the researcher tries to identify or choose a broad area where he senses a problem (i.e. an anomalous situation). At this stage the researcher has not developed a clear and precise idea of what the exact problem is. Examples of broad problem areas include:

- Assessment of achievement in primary schools
- Supervision of instruction in primary schools
- Management of primary education

In the second step, the researcher tries to sharpen his/her focus on the problem to enable him/her reach a precise definition or formulation of the problem. This is the stage of narrowing down the broad problem area to a specific problem. This is important because within a broad problem area, there may be so many specific problems. This makes it imperative for the researcher to clarify his/her problem in a manner that leaves no one in doubt. Consider one the broad problem areas stated above - "Assessment of achievement in primary schools". This problem area can be narrowed down to any of the following specific problems:

- Quality of Assessment tools
- Primary school teachers' assessment competencies
- Policies on assessment of achievement in primary school

The third step will entail stating or formulating the problem. Usually the problem is stated or formulated in two ways- as a topic and as a statement of problem. The topic should reflect as much as possible the problem. To this extent, it should contain the major variables of the study (independent and dependent). It is recommended that the topic should not exceed 21 words. From the specific problems above, the following topics could be formulated respectively:

- Determination of the validity and reliability indices of teacher-made tests
- Qualification and gender as factors in assessment competencies of Nigerian primary school teachers
- Evaluation of Assessment policies in Nigerian Primary schools.

Activity

a. **Identify a broad problem area in education.**
b. **From the broad problem area, state at least three (3) specific problems.**
c. **For each of the specific problems stated in (b) above, formulate an appropriate topic**

Unit 3: Sources of Educational Problems

This unit is concerned with where to find problems in education. The major sources from which educational problems can be found include:

- *Experience:* The researcher's or practitioner's own personal experience as well the experience of other researchers or practitioners working in the system, constitute a very valuable source of educational problems. Teachers, education officers, supervisors, monitoring officers or any other individuals who operate within the education system on a daily basis, will no doubt become familiar with the problems in the system. By reflecting on their experiences, such individual's can identify meaningful problems in education.
- *Policy:* Educational problems can also be identified from government policies. From time to time, the government formulates policies to give direction to her agencies and organs on what to do. In the course of implementing such policies, problems will naturally arise. Ordinarily too, one should be worried about the implementation of such policies and the associated constraints.

- *Literature:* A very veritable source of problems is the literature. This is made up of books, journals, magazines, newspapers, project reports, etc. A careful study of these materials will enable the researcher identify what issues had been resolved as well as what issues still remain unresolved.
- *Theory:* Educational problems could also be derived from relevant educational theories. According to Nworgu (1991, 2006), "a theory is a set of propositions that can account for or explain certain phenomena or events. It is a system for providing explanations about phenomena". A researcher can make a certain deduction from a given theory and the need will then arise for him/her to test the workability or viability of such a deduction. In this way, deductions from theories do constitute problems that could be investigated.

Activity 3

Working in groups,

a. discuss the recent policy reforms in education in the country and identify at least three (3) problems that arise from these policies.

b. state any educational theory you are familiar with and try to make two (2) deductions from it that could be tested empirically.

Unit 4: Stating the Research Problem and Objectives

In the last unit, we discussed the steps involved in problem identification. It was pointed out that the last step in identifying an educational research problem is stating the problem. This takes three forms – formulating a topic, statement of the problem and the research objectives. Having treated the formulation of research topics in the preceding unit, the present unit (unit 3) will concern itself with statement of the problem and research objectives.

Statement of the Problem

The statement of problem is normally a one or two paragraph prose that captures all the ramifications of the problem in a concise form. The statement of problem should reflect all pertinent variables and conditions that constitute the problem without being unnecessarily lengthy. The main thrust of the statement of the problem is to achieve a clear, sharp and yet concise description of the problem. Therefore it should neither be ambiguous nor superfluous.

In stating your problem, you should be guided by the following considerations:

1. All the dimensions of the problem should be properly articulated
2. The statement of problem should not be ambiguous. In other words, the statement should not leave the reader in doubt as to what the problem is.
3. It should be short – one or two paragraphs not exceeding one half of a page (Nworgu, 1991 and 2005a).

Research Objectives (or Purpose)
Another way of further clarifying the problem is to sate in clear terms what the research is intent on achieving. This is usually referred to as the **purpose of the research or research objectives**. The researcher may first state the overall purpose of the investigation and then follow this up with more specific statements of the investigation will accomplish. Below are two examples of research objectives:

Example 1
In a study on " Principals' and Teachers' Perception of Unethical behaviours in secondary schools in…', Nwangwu (2008) stated the research purpose (objectives) as follows:

The purpose of the study generally was to determine principal' and teachers' perception of unethical behaviors in secondary schools. Specifically, the purpose of the study was to:
(a) Identify the types of unethical behaviours in secondary schools;
(b) determine principals' perception of unethical behaviours among secondary schools teachers;
(c) determine teachers' perception of unethical behaviours among secondary schools teachers.

Example 2
The second example is provided by Yallams and Paiko (2008) in their sudy on " Enhancing the teaching and learning of sand casting through audio-visual technologies in the information age", thus:

The purpose of this study is to determine the level of efficiency of the sand casting package developed for learning sand casting among NCE technical students in Colleges of Education.

Activity
1. Choose a research problem or topic and write a one-paragraph "Statement of Problem".
2. For the topic, state a general objective and specific objectives.
3. What factors should guide you in stating your problem?

Unit 5: Research Questions and Hypotheses

After identifying the problem, the next thing is for the researcher to initiate the process of solving the problem. Following the scientific approach, the researcher begins by making certain informed guesses or conjectures about the likely solutions to the problem. These guesses or conjectures may be formulated as questions or statements. When formulated as questions, they are referred to as research questions. On the other hand when they are formulated as statements, they are referred to as hypotheses.

Research Questions

These are informed questions formulated by a researcher as a guide to the likely solutions to the problem. The investigation is supposed to provide answers to the questions. Such answers will indicate what may or may not constitute likely solutions to the problem. Let us consider one of the research topics we encountered in unit 2: "Validity and reliability of teacher-made mathematics tests used in primary schools in Bauchi State." Some of the research questions that can be formulated from this topic include:

1. How valid are the mathematics tests used by primary school teachers in Bauchi State?
2. How adequate are the tests in terms of reliability?
3. To what extent does the validity of the tests depend on the qualification of the teacher?

Hypotheses

A hypothesis is an informed or intelligent assumption or conjectural statement considered to be a likely solution to the problem. It has a tentative status in the sense that its truth or otherwise is yet to be established. This implies that a hypothesis will normally be subjected to a statistical test in order to confirm its veracity or otherwise.

The general function or purpose of a hypothesis is to provide the necessary direction or guide for the investigation. In specific terms, they define

1. the major factors or issues involved in the investigation which should therefore constitute the researcher's mains focus;
2. what data the researcher should collect therefore curtails the collection of irrelevant data;
3. how to analyze the data; and
4. what inference or conclusion to draw from the data.

Types
There are two types of hypotheses. These are *research or substantive hypotheses* and *statistical hypotheses.*

A research or substantive hypothesis is a statement or postulation about the relationship between two or more variables expressed in non-statistical terms. Because research or substantive hypotheses are stated in non-statistical terms, they are not testable statistically. For instance, a researcher investigating the research topic: "Validity and reliability of teacher-made mathematics tests used in primary schools in Bauchi State" may posit that:

> Teacher-made mathematics tests used by primary school teachers lack validity due to poor training received by the teachers.

This is an example of a research or substantive hypothesis. As you can see, this statement does not contain any statistical quantity and therefore is not testable in this form.

Statistical hypotheses
A statistical hypothesis differs from a research or substantive hypothesis in the sense that it is expresses the relationship between variables in statistical terms (i.e. using statistical indices e.g. Mean, standard deviation, correlation coefficient etc.) It is in this form that hypotheses are tested and not in the form of research hypotheses (Nworgu, 2006).

There are two types of statistical hypotheses – *null hypotheses* and *alternative hypotheses.* A null hypothesis is a statistical hypothesis that specifies a 'no effect' or 'no difference' condition whereas an alternative hypothesis is a statistical hypothesis that specifies any of the conditions that is not included in the null hypothesis. The null hypothesis is usually tested against the alternative hypothesis. In other words, when the null hypothesis is rejected, the alternative hypothesis is upheld. Below are examples of the two kinds of hypotheses.

Examples of Null Hypotheses:

1. There will be no statistically significant difference between the mean ratings of trained and untrained primary school teachers in Nigeria with respect to their assessment competencies.
2. There will be no significant difference in the proportion of teachers in the urban and rural primary schools in Oyo State.
3. The proportion of children enrolled in primary schools in Borno state will not differ significantly due to sex.

Examples of Alternative Hypotheses

1. There will be a statistically significant difference between the mean ratings of trained and untrained primary school teachers in Nigeria with respect to their assessment competencies.
2. There will be statistically significant difference in the proportion of teachers in the urban and rural primary schools in Oyo State.
3. The proportion of children enrolled in primary schools in Borno State will be significantly higher for males than females.

Considering the three examples of alternative hypothesis presented above, we can identify the two forms of alternative hypothesis- non-directional and directional alternative hypotheses. The non-directional alternative hypothesis specifies no direction in the difference whereas the directional alternative hypothesis specifies a direction in the difference.

Guidelines for formulating a good hypothesis

In order to formulate a good hypothesis, the researcher should consider and adhere to the following principles or guidelines:

The proposition should be such that it:

- can be tested empirically.
- clearly shows the expected relationship between the variables in statistical terms.
- put in another way, it should clearly identify the groups or subgroups being compared as well as the statistical parameter on which the comparison is to be based.
- can be seen as a plausible or reasonable solution to the problem.
- should be in agreement with what is currently believed to be accurate representation of knowledge in that field.
- is stated in clear and unambiguous terms

Activity

1. Distinguish between a research question and a hypothesis.
2. Explain the different types of hypothesis with one example of each.
3. Why do we need research questions or hypotheses in a research study?
4. State any three (3) guidelines useful in formulating hypotheses.

Module 3

Reviewing Research Literature

Introduction

Those who know how and where to look for the pertinent clues can solve problems. Only trained persons can do this. The untrained person is not likely to know where the necessary information could be found let alone how to classify and analyze the information when it is found. This principle shows that a trained scholar, first of all, must be familiar with all important sources of information in his or her own field. It also means that he or she must be able to use the tools of research, which are available to him or her. This module would present the principles that would ensure that the scholar is trained to be able to identify necessary information and understand how to classify and analyze such information.

Unit 1: Concepts Clarification

This unit deals with

- What is literature?
- What is literature review?
- Sources of literature

What is Literature?

Selecting a research problem requires that students have some familiarity with what previous investigations have found. Many supervisors have had the experience of students selecting research problems that reflect a serious lack of understanding of what other investigators have done. This lack of understanding may exhibit itself in a number of ways. The student may be unable to justify the need for a proposed investigation. He may select a particular hypothesis to test that has already been confirmed or disconfirmed. Or he may use techniques which previous research has invalidated for his particular purpose. In any of these instances, a review of literature might have pointed out the need for specific studies and suggested those techniques, which might be most useful for some given problem. The review of literature is useful in:

- Helping to select a research problem.
- Delimiting its size and scope.
- Showing the relationship of the research topic to previously completed research.
- Seeking new approaches.
- Avoiding sterile approaches.
- Determining which methods and tools can be used in a given area of research.

Literature review refers to the collection of literary works or writings on subjects that may be relevant to a subject being considered in a study. It may go beyond written materials. Sometimes, oral traditions and interviews not written down are used. Hence, literature may be considered primary or secondary. A primary source is the direct observation of the evidence at its original source. Note, moreover, that it is the relation of the material to the problem, rather than the nature of the material itself, that determines whether it is to be classified as a primary or a secondary source.

Unit 2: Steps in Reviewing Literature

The first step in conducting a review of the literature is to list the key words in the title of your work. In most sciences basic reference books are available that cover most material published in the science in question. In education most useful sources are Resources in Education, Current Index to Journals in Education, Psychological Abstracts and Educational Index. These sources are organized by subject. Therefore, it is necessary that the researcher identify key words related to his or her topic. So that he or she may look up these key words in the index to locate sources of information related to his or her topic. For example if one is interested in the studies of changes in racial attitudes that have occurred recently, the keywords are attitudes, attitude change, civil rights, desegregation, integration, prejudice, race relations, racial prejudices, segregation, tolerance.

The second step in conducting the review is to check preliminary sources. Preliminary sources are references such as indexes and abstracts, which are intended to help one identify and locate research articles and other primary sources of information. Important primary sources available in education are:

- **Education Index**- provides up to date listing of articles published in hundreds of educational journals, books about education and publication related to the field.
- **Psychological abstracts**- contains abstracts of articles appearing in over eight hundred and fifty journals.
- **Educational Resources Information Centre (ERIC) -** It transmits the findings of current educational research to teachers, administrators, researchers and public.

Other useful preliminary sources are:

- The **Citation Index**- If a review has uncovered a controversial article, you can gain valuable insights by reaching by reading what later authors say in support or opposition. An easy way to location later works that have cited such an article is to look up each key author in science citation index (SCI) or **Social Science Citation Index** (SSCI).

Abstracts and Indexes in subject areas, which could serve as preliminary sources, are:

- Child Development abstracts
- Sociological abstracts
- Resources in Vocational Education
- Exceptional Child Education
- State Education Journal Index
- Business Education Index
- Educational Administration Abstracts
- Physical Education Index.

Bibliographic and Reviews of research literature could also serve as preliminary sources and typical examples are:

- Bibliographic Index
- Review of Educational Research
- Review of Research in Education
- Encyclopedia of Educational Research
- National Society for the Study of Education (NSSE) Year book
- Hand book of Research on Teaching
- Annual Review of Psychology.

Other preliminary sources are those covering theses and dissertations and typical examples are:

- Dissertation Abstracts International
- Comprehensive Dissertation Index
- Masters Thesis in Education
- Masters Abstracts.

The third step is reading and noting selected references. The first step here, is preparing Bibliographic card – during one's search of preliminary sources, the students should prepare a bibliography card for each book or article that he believes might contain material pertinent to the review.

The next step is using the library. The library constitutes the storehouse of learning written down and arranged in some usable order. Successful research often depends on the extent and quality of the library facilities, which are available. In these days of scholarly co operation, libraries often borrow materials from each other, if a particular library does not have the book or document needed for a certain study, some other library may be willing to lend it. If not,

the student is faced with the necessity of traveling to the library which has the material he or she needs. Photo static reproduction of rare items may be made and supplied to one under some circumstances of nominal cost. A typical example of this is the British Council "contents pages" Programme.

No library can store or acquire everything that is needed for every research projects. Some books and manuscripts, for example, remain in private hands and are sometimes inaccessible. Libraries cannot afford to purchase complete files of all newspapers or all magazines or all books that have been published. The larger the library, the better the scholars chances of locating the materials one requires for one's research.

Unit 3: Use of the library and the Internet

It goes without saying that skill in the correct use of the library is highly essential in a scholarly investigation. Every library has its own arrangement and system of shelving and cataloging. Usually, there is a logical and recognizable classification of materials by subject. Books and periodicals are numbered and placed on the shelves in some understandable order.

Even though libraries differ from one another, both in methods and in details of arrangement and classification, there are two systems of classification, which every scholar should know by heart. These are the Dewey Decimal System and the Library of Congress System. The Dewey Decimal System arranges all published materials in a library under the headings as follows:

000	General Works
100	Philosophy
200	Religion
300	Sociology
400	Psychology
500	Natural Sciences
600	Useful Arts
700	Fine Arts
800	Literature
900	History

The Library of Congress (LC) arrangements has the advantage of greater diversification. Instead of ten major divisions, it has twenty, and consequently it is much more likely to be useful t o a very large library. The headings are:

A. General Works
B. Philosophy and Religion

C. General History
D. Foreign History
E. American History
F. American History
G. Geography and Anthropology
H. Social Science
I. Political Science
J. Law
K. Education
L. Music
M. Fine Arts
N. Language and Literature
O. Science
P. Medicine
Q. Agriculture
R. Technology
S. Military Science
T. Naval Science
U. Library Science and Bibliography

This discussion is not exhaustive about classification. The student would need an orientation in his or her library. The essential thing to remember is that every library needs to be studied and its particular system of classification thoroughly understood. This knowledge can save many frustrating hours of hunting for elusive source material when conducting a scholarly investigation.

To aid the scholar in learning what items may be found among the library's holdings, there is usually a card catalogue in which are filed (usually in alphabetical order) one or more cards for each book on the shelves. For most items, at least, three cards are filed: on one of these, the title of the book is mentioned first, on another, the author's name, and on the third, the subject matter of the book.

Periodicals in most libraries are kept in a separate section or room. Articles within periodicals ordinarily are not catalogued on individual cards but must be searched for by consulting an index or bibliography.

The Internet
One of the resources you would need to carry out successfully your review of the literature and also your research is the Internet.
What is the and how does it work?

What is the Internet?
The Internet is a word-wide communications network, linking thousands of computers to a network, through a mixture of private and public phone lines and microwave links. Its component networks are run by government agencies, universities and commercial organizations, working co-operatively and loosely controlled by the Internet society. These organizations bring many millions of people onto the Internet and millions more links in their home computers through one or other of the any services providers.
The Internet can be assessed and used in a number of ways. For most people, the most important aspects of the Internet are the World Wide Web, electronic mail (e-mail) and newsgroups.

The World Wide Web
This is probably the most exciting and useful aspect of the Internet for most users. It consists of hundred of millions of pages of information, stored on lost computers through to the world. The pages contain text, graphics, video clips, sounds and those importantly, hyperlinks to other pages. Clicking on a hyperlink will take you to another page, which may be in the same computer, or in one a thousand miles away.
Some web pages are excellent sources of information in their own right; some are treasure troves of links to other valuable pages, as some are simply trash. You have to be selective.

To access the web you need a browser – such as Internet Explorer, which can display the text and images, and interpret the links that will take you from one page to another.

Finding Information on the Web
Despite the massive quantity of information that is available on the Web, finding the things that interest you is not usually difficult. These are several directories, which hold large sets of organized links to Web pages – and to other parts of the Internet. Yahoo is probably the best now of these, and is an excellent place at which to short researching a subject. There are also search engines where you can hunt for pages that contain give words. They are most useful when you are looking for information on a specific as they can pick out the relevant pages form the millions on the Web.

Unit 4: Organizing the Review
The review of the literature is neither designed to prove the originality of the proposed research nor to develop on exhaustive bibliography in a guise of being scholarly. They do mean that the review must be selective rather than exhaustive and organized rather than a list of published investigations and that it should show the relationship of the proposed study to other studies.

The suggestions here are designed to help the student select the most relevant sources of information.

- The source of publication determines in part the maximum number of references, which can be included in the review of the literature. The review must be more restricted if a journal article is being prepared than if a thesis or dissertation is being written.
- In general, it is not necessary to describe similar procedures or findings obtained by a number of different investigators. A detailed study by one investigator (usually the study which has been published last, other conditions being equal) is reported, with the statement, "similar findings were reported by ……."
- It should be clear to the reader why the investigator is reporting each study referred to in the review of the literature. The purpose of this requirement is to prevent the student from including irrelevant references in his or her project.

The review of the literature is always organized; it is never a simple list of investigations that does not show the inter-relationships between them. The reader of the review deserves to be told the basis upon which it is being organized. This is most simply accomplished by providing the reader with an introductory paragraph or two describing how the review is organized. The review should end with an appraisal that should summarize the review, point out gaps in the review that would provide the basis for your own study. The review of literature is usually chapter two of most five-chapter projects.

Taking Notes on Research Articles

While reading materials, one has collected in one's search for clues which will help one solve one's problem, the investigator must be sure to compile careful and adequate notes of all statements, facts and other points one is likely to use. Since one cannot always tell in advance which clues may prove most fruitful and which will have to be discarded, one will do better to err I the direction of too much note-taking rather than too little. If notes are full and exact, all necessary materials will be at hand when the study is brought into final shape.

Notes may be rewarded in any way that is most convenient and useful for the scholar. The important thing is to have in orderly notes every thing essential to the study, so that the investigator does not have to dig back through volumes one has already read for information one neglected to write down systematically during the first ready. It is best to make a separate bibliographical card or page for each book or article on which notes are taken.

The first item written down ought to be the full name of the author as given on the title page, then the full title of the work, the date of publication, the place of publication and all other pertinent facts about the source- in a word, the complete bibliographical reference. Having carefully recorded the bibliographical reference on a card by itself, the scholar may next abstract or copy materials that will be of use to him or her. This should cover the following:

- A brief introduction
- The hypothesis to be tested
- A statement of the procedure including a description of subjects measures used and research design
- A section giving the findings; and
- Summary and conclusion.

It is important to let the beginning researcher know that it is useless to limit this aspect to the findings only.

Mistakes Sometimes Made in Reviewing Research Literature

Gall, Borg and Gall (1995) have pointed out common errors scholars make while reviewing research literature. These are:

- Carries out a hurried review of the literature in order to get started on the research project. This usually results in over looking previous studies containing ideas that would have improved the student's project.
- Relies too heavy upon secondary sources
- Concentrate on research findings when reading research articles, thus, overlooking valuable information on methods, measures and so forth.
- Overlooks sources other than education journals, such as newspapers and popular magazines that often contain articles on educational topics.
- Fails to define satisfactorily the topic limits of his review of the literature. Searching too broad an area often leads to the student's becoming discouraged or doing a slipshod job. Searching too narrow an area causes the researcher to overlook many articles that are peripheral to his or her research topic but contain information that would help him or her design a better study.
- Copies bibliographic data incorrectly and is then unable to locate the reference needed.
- Copies far too much material onto note cards. This often indicates that the student does not have a clear understanding of his project and thus separate important from unimportant information.

Unit 5: Referencing

When you write your research report, it is important that you credit the scholars and critics who have contributed to your ideas. Sing citations and bibliographic is the scholarly method to discharge this important responsibility. The following are some general examples of APA style citations and reference taken or created using the publication manual of the American Psychological Association (4th ed) and the Electronic Reference Formats Recommended by the APA (www.apastyle. Org/elecref. Html).

The discussion here would centre on the following:

- Citations
- References
- Electronic formats
- APA style Guides

Citations – A few samples

Citing a work by one author
Ogwudile (2004) indicates similar patterns for women in Nigeria.
Women also migrate to become involved in petty trade (Avwunu, 2005)

Citing one work by three or more authors
Adamu, Nworgu, Mordi, and Uwaya (2006) indicate that..

Or (after first citation)
Adamu et al. (2006) also found…

Citing work by several authors
At the inception of the Universal Basic Education Programme, scholars such as Olubodun (1999), Okpala (2000) and Wadatau (2002) pointed out that ….

Or
The subjects of this study seemed to perform their duties as determined by institutional arrangements within which they worked (Ajuar, Odili and Osadebe 2001; Buadi, Iyeke and Dada 2002; Oni, 1999).

Quotation of sources
Ogwudile (2005) raised some interesting questions concerning "examination malpractice" (p.25).

Or
She stated, "The essence of the issue is reality versus perception" (Mudia, 2002; p. 37), as … noted earlier.

Citing two or more works by the same author
According to Obielumani (2001, 2003), school location and gender play a significant role in student achievement.

References – a few samples
One reason to take care in creating a Reference list is that it makes it easy for others to find the sources you have used. When in doubt, provide more information rather than less. Italicizing the title identifies books, journals, magazines and newspapers.

Book by one author

Obanya, P. (2004). *The Dilemma of Education in Africa*. Ibadan: Heinemann Educational Books (Nigeria) PLC.

An edited book

Ogoyibo, V. (ed). (2005). *Books, what do they do?* Ibadan: Heinemann Educational Books (Nigeria) PLC.

Article or chapter in a book
Mordi, C. (2001). "Measurement and Evaluation Strategies for Teachers." In Sunday N. Agwu (Ed). *Teachings in Nigerian: A Dynamic Approach*. Enugu: Cheston Limited.

Article from a magazine

Orugboh, G. (2006, January 10). Fashion in Nigeria. *Tell*, 25, 67-69.

Article from a scholarly Journal

Oni, A. A. (2005). "Attaining democratic stability and good governance in Nigeria: A challenge to the Educational system. *Perspectives in Education*, 21: 226 – 230.

Article from a newspaper

Third term: A monster we nurtured? (2006, February 6). *Daily Independent* B4.

APA Electronic Reference Formats – a few samples
Identifying a citation from any electronic format, e.g. the California Digital Library (CDL), Internet, or CD-ROM, is only necessary when it has also provided you with the text. If you get a citation from one of these mediums but then read or quote frorm the actual hard copy, you then must cite the journal or newspaper rather than the CD-ROM, CALIFORNIA DIGITAL LIBRARY (CDL), or web page.

Individual Works

Examples of an Internet protocol:
Pi, M. (No date). Psychology with style. (Online). Available http/www. uwsp. Edu/acad/ psych/apa4.htm (1998, July 7).

Journals

Full text California digital library (CDL) article
Malmstrom, V. H. (1995, Jan.). Geographical origins of the Tarascans. Geographical Review (Online), 85, 31 10 pages). Available: CALIFORNIA DIGITAL LIBRARY (CDL) ® (MAGS). (1997, August 10).

* When citing a printout of the text in your document instead of the original journal article place (n.p.) (no pagination) since no page numbers exist.

Carranza, L.E. (1994) Le Corbusier and the problems of representation. Journal of Architectural Education (Online), 4(2). Available: http://www-mitrpess. Mit.ed/jrnls-catalog/File:jae4-2.html. (1997, September 22).

Full text CD – ROM Article
Single, S. (1996). Early marriage among women in developing countries. International family Planning Perspectives (CD-ROM), 22(4), 148+. Available: 1997 July RDS, Inc./Contemporary Women's Issues, 192-present. (1997, August 14).

Newspapers

Full text Internet article:
Ferriss, S. (1995, July 16). Latino rock –hot lie a "volcano". Mission District Label 1st to focus on trend. San Francisco Examiner (Online), p. C1. Available: Jose Mercury News, 1990 – 1996. (1997, September 2).

Encyclopedias

Full text Internet enter:
Bosnia and Herzegovina. (1997). In Britannica Online (Online). Available: http:www.eb.com:180.cgi-bin/g?DocF=micro/79/8.html. (1997, September 23).

Activities

1. (a) What is Literature Review? Identify any 5 sources of preliminary information
   (b) What purpose does a good literature review serve?

2. Identify any 5 common mistakes you could make while reviewing the literature.

3. During your review of literature you used the following
   * Book for one author
   * A chapter in a book edited by you
   * A journal article you wrote
   * An electronic material

Reference them using the American Psychological Association (APA) format.

Module 4
Choosing Research Designs

Introduction

In the three previous modules, the concept of educational research, selecting and stating a research problem and reviewing research literature have been covered. In this module, choosing research designs is dealt with. The units covered are concepts clarification, purposes and types of research designs.

Unit 1: Concepts clarification

What is Research Design?

Kerlinger and Lee (2000) defined research design as the plan, structure and strategy of investigation conceived so as to obtain answers to research questions and to control variance. The plan is the overall scheme or programme of the research. It includes an outline of everything the investigator will do from writing the hypotheses and their operational implications to the final analysis of data.

The structure of the research is the outline, the scheme, and the paradigm of the operation of variables. When we draw diagrams that outline the variables and their relation and place them side by side, we build structural schemes for accomplishing operational research purposes. For example, the following diagrams.

(a) $X_1 \longrightarrow X_2 \longrightarrow Y$

and

(b) X_1, X_2 $\searrow$ Y

The diagram 'a' shows that X_1 has no direct effect on Y, whereas 'b' shows that X_1 and X_2 have direct effect on Y. The diagrams so drawn show how the variables (X and Y) are related.

Strategy as used here includes the methods to be used to gather and analyze data. In other words, strategy implies how the research objective will be reached and how the problems encountered in the research would be tackled.

From the foregoing discussion, research design goes beyond the research type to cover the statement of the hypothesis, sampling procedure, method of data collection, method of organization of data to method of data analyses.

Unit 2: Purposes of research designs

Research design has two purposes:

- To provide answers to research questions and
- To control variance.

It is important to point out that the design does not do these things, but the investigator does. The design helps the investigator obtain answers to the questions earlier raised and to control extraneous and error variances on the investigator's research problem under study. It helps the investigator to answer research questions as validly, objectively, accurately as possible. Research problems are stated in the form of hypotheses. At some point in the research, they are stated so that they can be empirically tested. There is a wide range of possibilities of testing, theoretically at least, as many designs of research exist, as there are possibilities. Designs should be carefully worked out to yield dependable and valid answers to the research question. In choosing a design for our study, it is important to point out what should be uppermost in our minds:

- We should choose the design that would help us accurately solve the problem.
- The investigator should fully and clearly understand the method he or she has hit on to solve his or her problem.
- In collecting one's data, one should ensure the adequacy of the data, the data should be handled properly to minimize errors, investigator should be careful not to derive wrong conclusions from data collected.

Unit 3: Types of Research Designs

Various research designs are available; these are also referred to as research methods, since our introduction on design shows it to be wider than methods. The methods available are Historical, Descriptive, Ethnographic, Experimental and Ex-Post Facto. The roadmap for identifying types of educational research is presented by McCall and Wergin (2002) and is reproduced here.

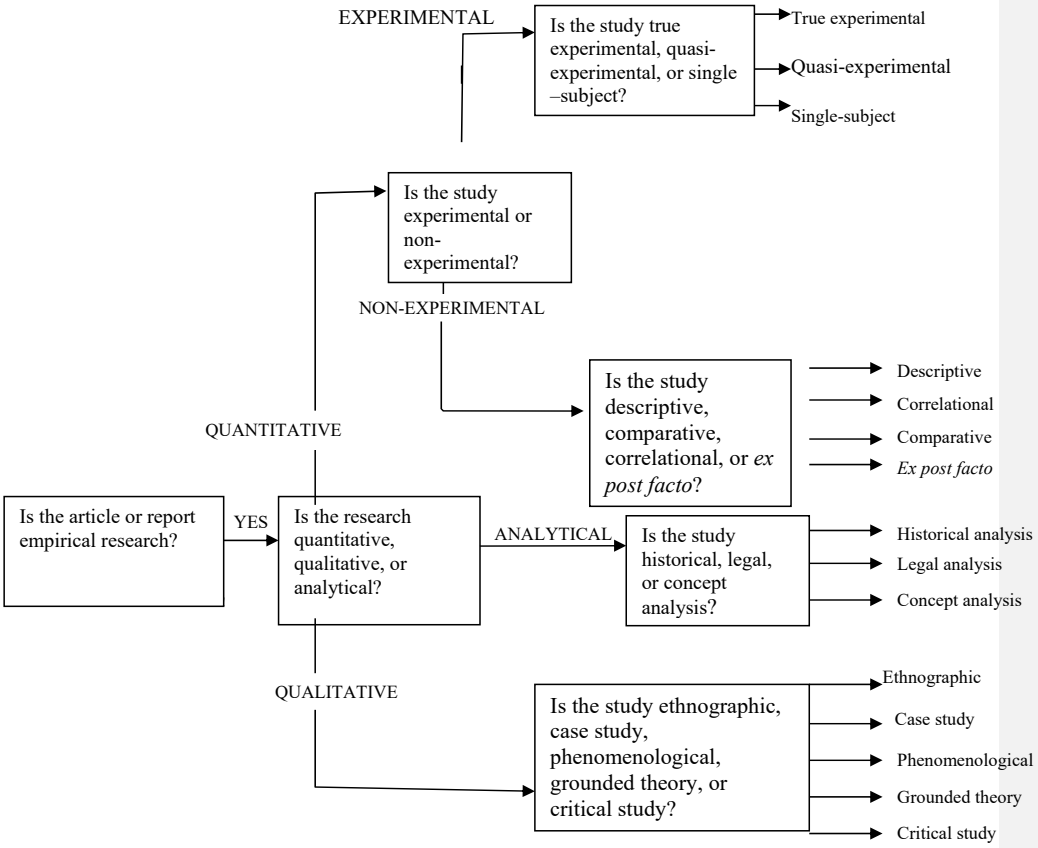

Fig. 4.1: Roadmap for identifying types of educational research

Historical Research

It is a systematic examination of the past in order to understand the present and look at the future wisely. This method of collecting and analyzing data can probably be considered the oldest form of true research. Basically, historical research consists of putting together in a logical way the evidence derived from documents and records and from that evidence forming conclusions which either establish facts hitherto unknown or offer sound generalization with respect to past or present events, human motives, characteristics, and thoughts. The data gathered in historical research may be drawn from many sources. Chief among these are: Official records, Newspaper accounts, Eye-witness accounts of events, Letters and personal diaries, Biographies, autobiographies and memoirs, Historical writings and studies, Descriptive studies made in the past, Literary and philosophical writings, Archeological and geological remains.

The documents used in Historical studies do not as a rule fall by chance and haphazardly into a scholar's hand. The scholar must search them out. Therefore, the first step in Historical research must be the location of all documents necessary. One can hardly stress too much the importance of getting, as near to the original documents as possible, these are primary sources. The scholar should never use a copy of a document if he or she can see the original. The document which constitutes a primary source of information is , in most cases, the written record of what its writer actually saw and heard or the first-hand expression of his or her idea. The newspaper account may be a primary source if the reporter himself witnessed the event he describes.

Materials quoted by an author from the writings of another author, on the other hand, can never be considered a primary source, the investigator, before using such data, should go back to the original published or unpublished form of the quoted materials. Textbooks, almanacs, encyclopedias, and similar summaries of information cannot qualify as primary sources (except in a study where a scholar is examining them for their own characteristics) for they usually derive their facts and ideas not from direct observation but from the writings of others.

Once the proper documents for investigation have been assembled, the next step is careful and critical appraisal of each of them. Such an appraisal usually takes two forms. First there is external examination, or an attempt to determine the genuineness or authenticity of the document. Is it what it purports to be? The n there is internal examination, which concerns the meaning, accuracy and general trustworthiness of the statements contained in the document.

It may be well to remind ourselves at this point of the two chief dangers to be avoided in Historical researches. These are:

- Insufficiency of data, and
- Improper selection of data. These issues are treated in details under sampling.

Descriptive Research

It attempts to systematically describe a situation or area of interest factually and accurately. It is a process for learning appropriate and precise information about an existing situation. The methods that fall under descriptive research are correlation studies, surveys, case studies, direct observations, cross-cultural studies, and developmental studies. Correlational studies investigate the extent to which variations in one factor correspond with variations in one or more other factors based on correlation coefficients.

Case studies- study intensively, the background, current status and environmental interactions of given social unit, an individual, group, institution or community. Developmental studies investigate patterns and sequences of growth and/or change as a function of time. Survey studies-are conducted to determine the status quo. The samples used in these studies should be representative. At the same time, the sample must be large enough, in terms of the whole group and of the problem being studied, to yield reliable results. The principal instruments for gathering data in this form of research are the interview and the questionnaire. Each of these must be carefully planned, for there are many pitfalls in their use. Besides, the error stemming from faulty sampling, these are seeds of possible error in the construction of the questionnaire itself. The use of ambiguous language, the failure to explain the full purpose and scope of the study and other failures in objectivity and in communication may distort the results.

Ethnography

It is the process of describing a culture or way of life from a folk peoples' point of view. Another name for it is field research. The folk point of view is the idea that each person is a reflection of his or her culture. To this effect, all their gestures, displays, symbols, songs, sayings have some implicit and tacit meaning for others in that culture. It is the job of ethnography to establish the hidden inference that distinguishes any given gesture in any given culture.

The ethnographic method involves observation and note taking. One of the assumptions of ethnography is naturalism, or leaving natural phenomenon alone. The ethnographer has to try to be invisible. He or she would have to devise a variety of ways to develop trust and rapport with the folk group in order to do this, so he/she can watch and listen carefully without being noticed. At some point, the research would have to disengage and retreat to a private place in order to take notes. Neuman and Wiegand (2000) have suggested some standard rules for taking field notes. These are:

- Take notes as soon as possible, and do not talk to anyone before note taking.
- Count the number of times key words or phrases are used by members of the folk group.
- Carefully record the order or sequence of events, and how long each sequence lasts.
- Do not worry that anything is too insignificant; record even the smallest things.
- Draw maps or diagrams of the location, including your movements and any reaction by others.
- Write quickly and do not worry about spelling; devise your own system of punctuation.
- Avoid evaluative judgments or summarizing; do not call something "dirty" for example, describe it.
- Include your own thoughts and feelings in a separate section; your later thoughts in another section.
- Always make backup copies of your notes and keep them in a separates location.

Experimental Research

The method is used to investigate possible cause and effect relationships by exposing one or more experimental groups to one or more treatment conditions and comparing the results to one or more control groups not receiving the treatment (random assignment being essential). Experiment is the best method in social research for establishing causal

links. It enables the investigator to measure the value of the dependent; introduce the independent variable he or she suspects to be the cause, and observe whether any change ensues in the dependent variable. The main problem with using experiment in behavioural research is that sufficient control is impossible in a natural setting. The behaviour of interest must be placed in an artificial environment that affords proper control. Experimental Research design shares a number of characteristics that tend to distinguish it from other research designs. These include:

1. Equivalence of subjects in different groups. The groups being compared are made equivalent so that any differences in their performance cannot be attributed to differences in the group but to the treatment or independent variable. This is achieved through random assignment of subjects or matching of subject or groups or using objects as their own controls.
2. Minimum of two groups or conditions: The intent of an experiment is to compare the effect of one condition on one group with the effect a different condition has on a second group, or to compare the compare the effect of different conditions on the same group. At least two groups or conditions are necessary to make such comparisons.
3. Manipulation of independent variables: Manipulation in this sense means that the researcher decides upon or controls the group of subjects that will receive a particular treatment or condition. If the conditions cannot be assigned as needed by the researcher, then the study is not a true experiment.
4. Measurement of dependent variable. This means that experimental research is concerned with things that can be assigned a numerical value. If the outcome of the study cannot be measured and quantified in some way, then the research cannot be experimental.
5. Use of inferential statistics. This allows us to generalize the results to similar groups or to the population of subjects.
6. Elimination of plausible rival hypotheses: Extraneous variables are controlled by making sure that they have no effect on the dependent variable, or their effect is the same for all groups. In this way, no extraneous variables that could be controlled will provide plausible rival hypotheses to explain the results.

Notation

In presenting the designs in this manual, we will use a notational system to provide information for understanding the designs. The notation system is unique, though similar to the basic notation system used by Campbell and Stanley (1963) and Cook and Campbell (1979). Our notation system is as follows:

R = randomization
O = observation a measure that records observation of a pre-or posttest
X = treatment conditions (subscripts ‘i’ through ‘n’ indicating different treatments)
A, B, C, D, E, F groups of subjects, or for single-subject designs, baseline or treatment conditions.

Classification

Experimental designs can be classified into three, namely: pre-experimental, true experimental and quasi-experimental designs.

Pre-experimental Designs

The three designs summarized in this section are termed pre-experimental designs because they are without two or more of the six characteristics of experimental research listed earlier. As a consequence, few threats to internal validity are controlled, and the results are often interpretable. This does not mean that these designs are always interpretable, nor dose it mean that the designs should not be used. There are certain cases in which the threats can be ruled out on the basis of accepted theory, common sense, or other data. Because they fail to rule out most rival hypotheses, however, it is difficult to make reasonable causal inferences from these alone. They are best used, perhaps, as a way of generating ideals that cannot be tested more systematically.

One-Group Post-test Only Designs

In the one-group postal-only design the research gives a treatment and then makes an observation, as is represented in the following diagram.

X O

Without a **pretest**, for example, it is difficult to conclude that behaviour has changed at all (such as when testing a method of teaching math to students who know the answers to the final exam before receiving any instruction). Without a comparison or control group it is also difficult to known whether other factors occurring at the same time as the treatment were causally related to the dependent variable. The above weaknesses are so severe that the results of research based on this alone are usually uninterpretable. The only situation in which this deign is reasonable is when the researcher can be fairly certain of the level of knowledge attitude, or skill of the subject before the treatment and can be fairly sure that history [i.e. other events occurring between the pretest and posttest] will not affect the validity of the results.

One-group Pretest-Post-test Designs

This common design is distinguished from the one-group posttest-only design by a single difference –the addition of an observation that occurs before the treatment condition is experienced (pretest)

O_1 x O_2

In the one-group posttest-only design a single group of subject is given a pretest (O_1), then the treatment (X), and then the posttest (O_2). The result that is examined is a change from pretest to posttest. While the research can at least obtain a measure of change with this design, there are still many plausible rival hypotheses that are applicable.

The most serious threat is history. Because there is no control or comparison group, the researcher cannot be sure that other events occurring between the pretest and posttest did not cause the change in attitude.

Posttest-Only with Nonequivalent Groups

Group
X O_1
X O_2

This design is used frequently after a treatment has been implemented. The procedure is to give the treatment to one group and then assess the dependent variable (via the

position), and give only the posttest to another group at the same time as the posttest is administered to the first group. The term 'nonequivalent groups' is used as the name for the design because selection is the most serious threat to the internal validity of the results. Notice that there is no randomization of subjects to each group. Differences in the groups of subjects may therefore account for any differences in the results of the posttest. The more different the groups are, the more plausible selection thus becomes as a reason for the results.

True Experimental Designs

These designs represent what historically has been called experimental in the biological and physical sciences.

Pretest-Posttest Control Group Design

The pretest-posttest control group design is an extension of the one-group pretest-posttest design in two ways: a second group is added, called the control or comparison group; and subjects are assigned randomly to each group. This design is represented.

R	O_1	x	O_2
R	O_3		O_4

The first step is random assignment of the subject to the experimental or treatment group and the control group. In studies with a relatively small number of subjects, it is often best to rank-order the subjects on achievement, attitudes, or other factors that may be related to the dependent variable.

The second step is to pretest each group on the dependent variable. The third step is to administer the treatment condition to the experimental group but not to the control group, keeping all other conditions the same for both groups so that the only different is the manipulation of the independent variable. Each group is then post-tested on the dependent variable.

Posttest –Only Control Group Design

The purpose of randomization, as indicated previously, is to equalize the experimental mental and control groups statistically before introducing the independent variable. If the groups are equalized through randomization, is it necessary to give a pretest? While there are certain cases in which it is best to use a pretest with randomization, if the groups have at least fifteen subjects each, the pretest is unnecessary. That is, it is not essential to have a pretest in order to conduct a true experimental study. The **posttest–only control group design** is exactly the same as the pretest-posttest control group design except that there is no pretest of the dependent variable. The posttest-only control group design is represented as follows:

R	x	O
R		O

Quasi-Experimental Designs

True experimental designs provide the strongest, most convincing arguments of the causal effect of the independent variable because they control for the most sources of internal invalidity. There are, however, many circumstances in educational research for which,

while causal inference is desired, it is unfeasible to design true experiments, or in which the need for strong external validity is greater. The most common reasons that experimental designs cannot be employed are that randomization of subject to experimental and control groups is impossible, and that a control or comparison group is unavailable, inconvenient, or too expensive. Fortunately, there are a number of good designs that can be used under either of these circumstances. These designs are termed **quasi-experimental** because, while not true experiments, they provide reasonable control over most sources of invalidity and they are usually stronger than the pre-experimental designs.

Ex-Post Facto Designs

In experimental research design, the researcher investigates a problem by observing what will happen, in other words, the research approach is to manipulate conditions, observe what happen, and then record the result. There are, however, many situations and research problems that exclude this approach because manipulation conditions are impossible. Consider the following list of research questions. In each case the implied cause-and-effect relationships rule out experimental manipulation.

- What is the effect of attendance at day care on the social skills of children?
- What is the effect of single parenting on achievement
- What is one relationship between participation in extra curricular activities and self concept?

In all these operations, we notice that it is either impossible or unethical to manipulate the variables. We obviously cannot manipulate attendance at day care, single or couple parenting etc. This is a situation, then, in which it is desirable to study cause-and-effect relationships but the circumstances are such that the variables cannot be manipulated and random assignment of groups can not be carried out. The type of design most frequently used in these situations is called **ex-post facto** or causal comparative. The purpose is to investigate whether one or more pre-existing conditions that have already occurred (***ex-post facto*** is Latin for ***after the fact***) and then collects data to investigate the relationship of these varying conditions to subsequent behaviours.

Ex post facto research can be conducted thus:

- Formulate a research problem that includes possible causes of the dependent variable.
- Identify plausible rival hypotheses that might explain the relationship.
- Find and select the groups that will be compared.
- Collect and analyze data on the subjects, including data on factors that may constitute rival hypotheses.

Activities

1. What is Research Design? What purpose does it serve in Educational Research?
2. Examine the following research topics:
   (a) What is the origin of the Olukwuni people of Ugbodu in Aniocha North Local Government Area of Delta State?

(b) Investigating the relationship between attitudes towards science and Students' Achievement in Integrated Science
(c) The Effect of Enquiry Method and Cognitive Styles Students Achievement in Biology
(d) The Agbasa Juju Festival of Okere-Urhobo in Delta State
(e) Students' perception of introduction of tuition fees in Universities.

What types of research are these? Give reasons for your choice.

Module 5

Determining Sample for Research

Introduction

The four previous modules have covered the concepts of educational research, selecting and stating a research problem, reviewing research literature and research designs. In this module, sampling and sampling techniques in a research study are explained. The units are concepts clarification, sampling, probability sampling, non-probability sampling, and important considerations in sampling.

Unit 1: Concepts Clarification

This unit examines the meaning of some basic concepts. These are:

- Population
- Sample, and
- Sampling

Population

To the layman, a population signifies the totality of human beings residing in any given area, but in a more technical sense, a population refers to all of any specified group of objects, methods, responses, geographic area or persons. Thus, we may talk about a population of textbooks, test-items, middle-class residential areas or students. The population (often referred to as a universe) may be infinitely large (such as children, past, present and future) or finite (such as primary two pupils attending school in a given day at a given locality).

Where populations or universes are infinitely large, relatively inaccessible, or expensive to investigate, researchers select samples from the population with which to work.

Sample

A sample may be defined as a limited number of selected from a population to be representative of that population. Representative samples are ones, which have been drawn in a random unbiased manner. It should be noted here, that a representative sample refers to the extent to which samples approximate population characteristics, which are often unknown.

Unit 2: Sampling

This unit discusses

- The sampling process
- Advantages of sampling and
- Types of sampling

Process

Sampling is the procedure a researcher uses to gather data that could be people, places, things, etc, to study. Research conclusions and generalizations are only as good as the sample they are based on.

The process of sampling consists of three phases:

- Defining the population
- Drawing a sample from the population; and
- Estimating population parameters from knowledge obtained from the sample statistic.

Before gathering your sample, it is important to find out as much as possible about your population. Every effort should be made to find out some of the overall demographics of your population. This information will be needed later after you get to the data analysis part of your research, but it is also important in helping you decide sample size. The greater the diversity and differences that exist in your population, the larger your sample size should be. Capturing the variability in your population allows for more variation in your sample, and since many statistics tests operate on the principles of variation, you will be making sure the statistics used later can serve their purpose.

Advantages

Some of the advantages of sampling are as follows:

- If done with care, sampling can be highly accurate. Also, the savings in time and money should be obvious.
- Surveying an entire population would take much longer than a sample study, and time is often very important. If a total population is to be surveyed, it is difficult within a short period without using a large number of assistants which may, in fact, reduce accuracy of the data since the competence of the assistants may not be uniform.
- Sample may achieve a greater response rate and greater cooperation in general from respondents and thus may be more accurate. This is especially true when sensitive questions are asked.
- By using a sample instead of the entire population, the researcher can make him/herself receive very little attention. With this he or she does not offend as many people and these who are offended have less chance to organize in their common interest because no respondent knows the identity of other respondents who have been asked the same questions.

Types of Sampling Techniques

Samples can be drawn in a random unbiased manner referred to as **probability sampling** or in a biased manner referred to as **non-probability sampling**. Probability sampling is possible if the population characteristics or sampling frame are available. The sampling frame is the procedure for listing all the accessible members of your population. The term refers to the procedure rather than the list. It is important for researchers to discuss their sampling frame because that is what ensures that systematic error or bias has not entered into your study.

Unit 3: Probability Sampling

The probability sampling techniques that could be used by the investigator to collect his or her samples are, the simple random sampling, stratified random sampling, systematic sampling, area or cluster sampling.

Simple Random Sampling

With this method, every element in the population has an equal chance of being included in the sample. This means that no population element has been either deliberately or unintentionally omitted or excluded from the sample except by chance. The selection of sample is accomplished either by balloting or lottery method or by a table of random numbers. In the case of the ballot or lottery method, the investigator assigns a number to each member of the population, puts them into a bag or can and draws one after the other. Selection could also be without replacement in which case the probability at each new sampling would be different. In the case of the use of the table of random numbers, the investigator also assigns a number to each member of the population, enters a table of random numbers at any point and moving in any predetermined direction reach the number of individuals to be included in the sample.

The problem with this method is that logistics sometimes makes it impossible for an investigator to achieve a random sample.

Stratified Random Sampling

This method makes use of random sampling technique as part of its design. Stratification is the process of dividing a population into a number of strata or subpopulations, so that the variability of elements selected within each stratum is more homogenous than is the variability of elements between strata.

Once the population has been subdivided into strata, samples are drawn independently and randomly from each stratum and an estimate of the parameter is computed over all strata. The major advantage of stratification is that sampling error arises only within each stratum and not between different strata. In addition, stratification allows us to use different methods of drawing samples within each stratum, which may help us to reduce cost of sampling.

Area or Cluster Sampling

Where list of individuals are unavailable or the characteristics of the population are not well known, it is possible for the researcher to sample areas or clusters of elements first, and then to sample individuals or elements within the clusters. This procedure is called area or cluster sampling. The major purpose of cluster sampling is to reduce costs per element sampled, although this offset by the usual increase in error. To reduce error, clusters would have to be selected in such a way that differences between clusters are small in comparison to the variability within clusters.

Unit 4: Non- Probability Sampling

Despite the accepted superiority of probability sampling method in research, non-probability methods are sometimes used instead – usually for situation in which

probability sampling would be very expensive and/or when representativeness is not necessary. The primary methods of non-probability sampling are:

Systematic Sampling
Sometimes a population is so structured that it is possible to select a sample by counting every fifth, tenth, or hundredth person until the desired sample size is obtained. This procedure is called systematic sampling. If a school has students listed in alphabetical order, it may be possible to select every tenth or fifteenth name on the list for inclusion in a sample, instead of assigning number to each member of the population to select a simple random sample. To avoid a biased systematic sample, it is essential that the first element to be sampled be determined from a table of random numbers. For example, if we wanted to select some names in a telephone directory, we could enter a table of random numbers and select at random the first two-digit number between 01 and 10. if the number we selected is 04, we should select the fourth name in the directory, followed by the fourteenth, twenty-fourth, etc., until the desired sample size is reached.

The advantages ascribed to this method are that it:

- saves work considerably
- gives us the assurance that we are sampling broadly throughout our population.

The major disadvantage to systematic sampling is that it may be seriously in error if elements in the population are repeated at constant intervals.

Purposive or Judgmental Sampling
Occasionally, it may be appropriate for the researcher to select his sample on the basis of his knowledge of the population, its elements and the nature of his/her research aims. For instance, in the design of his questionnaire, an investigator might wish to select the widest variety of respondents to test the broad applicability of his questions. While the findings would not represent any meaningful population, the test might uncover some peculiar defects in his instruments. In some instances, the researcher may wish to study a small subset of a larger population in which many members of the subset are easily identified but the enumeration of all would be nearly impossible.

Quota Sampling
It begins with a matrix describing the characteristics of the target population. The researcher must know what proportion of the population is Ibo, Hausa or Yoruba and for each ethnic group what proportion falls into the various age categories and so forth. Once such a matrix has been created and a relative proportion assigned to each cell in the matrix, the researcher collects data from persons having all the characteristics assigned a weight appropriate to their proportion of the total population. When all the sample elements are so weighted, the overall data should provide a reasonable representation of the total population.

Reliance on Available Subjects
Stopping people at a street corner or some other location is never an adequate sampling method, although it is employed all too frequently. It would be justified only if the researcher wanted to study the characteristics of people passing the sampling point. The method is often used in medical research where the investigator settles for subjects that attend his clinic.

Snowball Sampling
Also called network, chain or reputational, this technique is conducted in stages. In the first stage a few persons having the requisite characteristics are identified and interviewed. The persons are used as informants to identify others who qualify for inclusion in the sample. The second stage involves interviewing these persons, who in turn lead to still more persons who can be interviewed in the third stage, and so no. The term "snowball" stems from the analogy of a snowball, which begins small but becomes bigger ad bigger as it rolls down hill.

Unit 5: Important Considerations in Sampling

The determination of an adequate sample size is a problem faced by every investigator. Too often we consider large samples necessary if valid conclusions are to be drawn from our research data. The sample size is rather determined by the following factors:

- **Accuracy**- this has to do with exactness or correctness. It is important to point out that this may not necessarily increase significantly by selecting large samples.
- **Cost-** the cost of securing additional samples should be considered before determining the sample size to be used in a study. Cost here, should include expenditure of funds as well as effort.
- **Homogeneity of the population** – the homogeneity or heterogeneity of the population is a factor that must be considered before a sample size is considered adequate. Intuitively, it can be demonstrated that where the population is homogenous in the attributes that are under investigation, a smaller sample is required than if the population is quite diversified.

Note that sampling error is reduced by two factors:

- A large sample produces a smaller sampling error than does a small sample.
- A homogeneous population produces samples with smaller sampling errors than does a heterogeneous population.

- Size of the population - It is important to state here that the size of the sample depends on the size of the population to be sampled. Although general rules are hard to make without knowledge of the specific population, around 30 cases seems to be the bare minimum for studies in which statistical data analysis is to be done, although some techniques can be used with fewer than 30 (Champion, 1970). However, many researchers regard 100 cases as the minimum. One reason is that there are often several

sub-populations the researcher may wish to study or several variables to be controlled. They reason that 30 cases would then be too small.

It is necessary to note that, regardless of the theoretical sample size decided upon, the actual number of cases from which data are ultimately collected may be substantially fewer because of respondents who cannot be located, refuse to be interviewed, or return illegible or otherwise unusable questionnaires. A further actually varies form question to question, depending on the percentage of the respondents who fail to answer each particular question.

- **The Sampling Error (or the Sampling Distribution)**

The sampling distribution is a hypothetical device that figuratively represents the distribution of a statistic (some number you have obtained from your sample) across an infinite number of samples. You have to remember than your sample is just one of a potentially infinite number of samples that could have been drawn. While it is very likely that any statistics you generate from your sample would be near the center of the sampling distribution, just by luck of the draw, the researcher normally wants to find out exactly where the center of this sampling distribution is. That is because the center of the sampling distribution represents the best estimate of the population average, and the population is what you want to make inference to. *The average of the sampling distribution is the population* p*arameter*, and inference is all about making generalization from statistics (sample) to parameters (population).

You can use some of the information you have collected thus far to calculate the sampling distribution, or more accurately, the sampling error. In statistics, any standard deviation of a sampling distribution is referred to as the standard error (to keep it separate in our minds from standard deviation). In Sampling, the standard error is referred to as **sampling error**.

Definitions are as follows:

- *Standard deviation:* The spread of scores around the average in a single sample.
- *Standard error*: The spread of average around the average of average in hypothetical sampling distribution.

You never actually see the sampling distribution. All you have to work with is the standard deviation of your sample. The greater your standard deviation, the greater the standard error (and your sampling error). Standard error is also related to sample size. The larger your sample, the smaller the standard error. You are not reducing bias or anything by increasing sample size, only coming closer to the total number in the population. Validity and sampling error are somewhat similar. However, you can estimate population parameters from even small samples.

Activities

1. (a) To a layman, what is Population? From a research point of view what is Population?
   (b) What is a Sample?

2. What Sampling technique can you employ in your study?

3. What factors would you put into consideration in deciding an adequate sample for your study.

Module 6

Developing Techniques and Instruments for Data Collection

Introduction

As a scientific investigation, data collection constitutes a crucial and critical phase in the educational research process. The collection of relevant data calls for the use of appropriate data collection techniques and instruments. Indeed a variety of such techniques and instruments exist in educational research. This module will examine some of these techniques and instruments that can be employed in collecting data in educational research.

Unit 1: Questionnaire

The questionnaire is a form containing specific questions to which a research subject is expected to respond by filling out the form by himself. This is the most widely used technique or instrument in educational research. It is used mainly to elicit the views or perceptions of respondents on issues that are of interest to the researcher.

Types of questionnaire

There are two major types of questionnaire namely; the *structured or fixed response questionnaire* and the *unstructured or open-end questionnaire*.

Structured or fixed response questionnaire

In the structured or fixed response questionnaire, the responses are structured by the researcher such that the respondent only needs to select the particular option that suits his/her condition. The respondent is not free to choose and organize his/her own responses the way (s)he likes. Rather his restricted to those responses as structured and pre-determined by the researcher. Some examples of structured or fixed response questionnaire are given below:

Examples of Structured or Fixed Response Questionnaire Items

1. Sex : Male ☐ Female ☐

2. Teaching Experience
   - Less than 5 Years
   - 5 – 10 Years
   - More than 10 Years

3. How many times are you supervised by external supervisors in a year?
   - None
   - 1-3 times
   - More than 3 times

4. How satisfied are you with these external supervision visits ?
   - Highly Satisfied
   - Moderately Satisfied
   - Slightly Satisfied
   - Not Satisfied

The structured or fixed response questionnaire is more amenable to statistical

analysis and more respondent-friendly. However, it is more time consuming to construct and restricts the respondent to pre-determined responses which may not be exhaustive.

Unstructured or Open-ended response questionnaire

Here, the responses are not structured or pre-determined by the researcher. The respondents choose and organize their own responses the way and manner they like. The construction of this type of questionnaire is easier and takes less time. Also this type of response will capture much more information from the respondents. However, it is not respondent–friendly just as the analysis of the data will be problematic and time-consuming. The box below shows some examples of unstructured or open-ended questionnaire items.

Example of Unstructured or Open-ended Questionnaire Items

1). Sex : …….

2. Teaching Experience: …….

3. How many times are you supervised by external supervisors in a year?: ……

4. How satisfied are you with these external supervision visits?: ……..
……

Guidelines on the Construction of a Questionnaire

The following guidelines will help the researcher to construct a good questionnaire:

1. Determine the objectives the questionnaire is to achieve in terms of the information it is supposed to capture. This should synchronize with the objectives of the study, the research questions and hypothesis.
2. Choose an appropriate format or the type of questionnaire to use.
3. Construct or write appropriate items that will elicit the required information under each objective. The language and context of the items should reflect the characteristics of the respondents. (Nworgu, 2006; Black and Champion, 1979).
4. The questionnaire should not be unnecessarily bulky. It should not, on the other hand be, too short.
5. Items which do not directly deal with any of the objectives should not be written or included in the questionnaire. They make the questionnaire unnecessarily bulky.
6. The items should not contain any response cues. In other words, leading questions should be avoided.
7. The items should be arranged in clusters or sections beginning with the cluster or section on bio-data.

8. Solicit the input of some of your knowledgeable colleagues or experts in the field on the items in terms of relevance, appropriateness of language and examples. This is referred to as "face validation".
9. Revise the items based on the suggestions of your knowledgeable colleagues or experts who vetted the questionnaire.
10. Trial test the revised questionnaire on a suitable sample of the respondents for whom the questionnaire is meant. To avoid sample contamination, the respondents who participated in the trial testing should not participate in the main study.

Modes of Questionnaire Administration

The questionnaire can be administered by the modes- on-the-spot or face-to-face and by mail. The on-the-spot administration mode is what is common in our setting. It entails the researcher or his/her aide administering the questionnaire to the respondents in person and collecting the completed instrument on-the-spot. In some cases, the researcher or his/her aide may be asked by the respondent to come back a few days later to pick up the completed instrument. The researcher or his/her aide is available to offer explanations.

The other mode of administering the questionnaire is via the mail (postal or electronic). The postal or e-mail addresses of the respondents are identified and the questionnaire mailed to them as may be appropriate. The questionnaire is usually accompanied by a letter which introduces the researcher and the purpose of the research as well as solicits the assistance of the respondent in completing the questionnaire as factually as possible.

Activity

1. Choose a researchable topic on any issue on basic education and develop a 10-item questionnaire on the topic using the structured response format.

2. Identify four (4) potential problems a researcher may encounter in administering the questionnaire

- **on-the-spot**
- **by postal mail**
- **by electronic mail**

3. Suggest remedies for each of the identified problems in (2) above.

Unit 2: Interview

This data gathering technique "involves eliciting information from the respondent (*interviewee*) through some verbal interaction between him (*interviewee*) and the researcher (*interviewer*)." (Nworgu, 2006). The interviewer poses questions to which the interviewee responds. The responses of the interviewee are recorded by the interviewer himself either mechanically or electronically. The interviewer, therefore, has to be skilled in the art of communication – asking questions, having good diction, listening and writing.

What serves as the major instrument here is the interview schedule or protocol. It consists of the questions to be asked during the interview session listed in the order in which they are to be asked.

This technique is flexible. This means that depending on the situation, the interviewer can modify the questions or even the order in which they are to be asked.

Recording of Interview Responses
One distinguishing characteristic feature of the interview technique is that the interviewer (and not the interviewee) records the responses by him or her self. Interview responses can be recorded either mechanically or electronically.

Mechanical recording involves the process of note-taking. The interviewer and/or his/her assistant record the interviewee's responses in a notebook.

Electronic recording involves the use of electronic devices such as audio or video tape recorder in recording the interviewee's responses.

Modes of Interview
With the present development in Information and Communication Technology (ICT), three modes of interview are now possible (Nworgu, 2006). These are:

1. Face to face interview: In this mode, both the interviewer and the interviewee are in the same physical setting. They are in both visual and audio contacts.
2. Telephone interview: The interviewer and interviewee are not in the same physical setting. They are in different locations that are separated by very long distances. Communication is only through the telephone system. The interviewer and interviewee maintain only an audio contact.
Video conferencing: This mode of interview has been made possible by recent advances in ICT. It is an improvement over the telephone interview mode in the sense that the interviewer and the interviewee although not in the same physical setting are able to maintain both audio and visual contacts.

Guidelines for Conducting an Interview

1. Identify the objectives of the interview in terms of all the necessary information you need to collect from your respondents (i.e. interviewee).
2. Develop an interview schedule or protocol i.e. a list of the questions that will elicit the required information from the interviewee.
3. Solicit input from your knowledgeable colleagues or experts in the field with respect the relevance and appropriateness of the language and context of the questions. Use such inputs to modify the questions and finalize the interview schedule.
4. Make firm arrangements for time, venue, and all the equipment and materials required for the interview.
5. Your appearance as the interviewer should be gentle and neat. As much as possible your dressing should reflect the culture of the area.
6. Ensure that the physical setting of the interview is as conducive as possible. Sitting arrangements, lighting, ventilation and humidity should all be optimal.
7. Establish a rapport with the interviewee before commencing the interview. This can be achieved by chatting with him/her for a few minutes and assuring him/her that her responses will be treated confidentially.
8. Ask questions whose meanings are clear and avoid the use of technical jargons which the interviewee may not understand.

9. Probe any of the interviewee's responses that do not give all the required details.
10. But make sure you stop at the point the interviewee begins to feel uncomfortable.
11. Do not ask leading questions i.e. questions that suggest particular answers.

Activity

Suppose you were to interview the traditional ruler of the host community of one of the primary schools in your state on the community's participation in the management of the primary school, develop an interview schedule or protocol that will help you undertake this interview. With one of you in the group role-playing the Traditional Ruler and another researcher (interviewer), conduct the interview with the schedule you developed recording the responses with an audio tape recorder.

Unit 3: Observation

Observation is a process of watching objects, events or situations in as much a careful and systematic manner as possible with the intent of noticing and recording certain characteristics of the objects events or situations that are of interest to the investigation. It operates in a natural setting and therefore yields authentic information than the questionnaire. It is appropriate for studying behaviours that occur only when certain situations or conditions are prevalent. These are called situation-based behaviours.

In order to make the observation systematic and objective, the researcher needs to use either a checklist or rating scale as an instrument for collecting his/her data.

Types of Observation

Observation could be of two kinds. These are **non-participant** and **participant** observation. The non-participant observation involves using an outsider to observe the behaviours of others in a particular setting. The observer does not play any part in the behaviour or activity being observed. On the other hand, participant observation involves using someone who is a member of a group (i.e. an insider) to observe the behaviours of members of that group.

In non-participant observation, those being observed may distort their behaviours due to the presence of an observer who is an outsider. This phenomenon is referred to as Hawthorne's Effect. One way of dealing with this problem in situations where participant observation is not possible is to "ignore the first two or three observations. This is because, with time, the group returns to its normal mode of behaviour having overcome the influence of the presence of the observer" (Nworgu, 2006).

Checklist and Rating Scale

Any of these instruments could be used during observation to achieve greater objectivity. A checklist or a rating scale is basically a list of all the relevant attributes to be observed. For a checklist, the response format provides for the absence or presence of each of the attributes listed. In the case of a rating scale, the response format provides for the degree or intensity to which each attribute is available. Illustrative items for each type of instrument are provided in the two boxes that follow.

Illustrative Items of a Checklist

Checklist of Teacher Classroom Behaviours

Instruction: Indicate by checking (X) against any of the following behaviours exhibited by the teacher in the class.

Dictating Note	☐
Facing the Chalk board	☐
Drawing on the board	☐
Talking to students rudely or in harsh tones	☐
Directing Questions to only male pupils	☐
Moving around in the class	☐
Reinforcing correct responses	☐
Providing immediate feedback to students	☐

Illustrative Items of a Rating Scale

1.

	Rating Scale for Observing Teacher Classroom Behaviours *Instruction: Indicate how often the teacher exhibits the following behaviours in the class by ticking (√) in the appropriate column.*	Very Often	Often	Occasionally	Rarely	Never
1.	Dictating Note					
2.	Facing the Chalk board					
3.	Drawing on the board					
4.	Talking to students rudely or in harsh tones					
5.	Directing Questions to only male pupils					
6.	Moving around in the class					
7.	Reinforcing correct responses					
8.	Providing immediate feedback to students					

Guidelines for Conducting Observation

For effective conduct of observation, the following guidelines will be useful:

1. Identify the objectives for which you are embarking on the observation in terms of the specific aspects of the situation and what type of information will be required about each.
2. Based on these specific aspects of the situation and the type of specific information required in each case, develop an observation schedule in the form of either a checklist or a rating scale.

3. Decide ahead of the actual observation how many observers would be involved. If more than one observer will be involved, training on what to observe and how to record the observation will become necessary.
4. Trial test the observation schedule (checklist or rating scale) on a relevant sample by having two or more independent observers using the checklist or rating scale to observe and rate the same individuals or situations. This process will help the researcher to determine the extent to which different individuals using the observation instruments will be in agreement. This is referred to as rater reliability.
5. Minimize any form of interferences that may distort the natural setting where the observation is taking place.
6. In non-participant observation, be mindful of the fact that the presence of the researcher would interfere with the natural setting; the consequence being distortion in behaviour (Hawthorne's Effect). This should be handled as earlier suggested.

Activity

1. Explain the two types of observation.
2. What steps would you take to ensure the effective conduct of an observational study?
3. Differentiate between a checklist and a rating scale?
4. Develop a 5-item checklist for observing students' deviant behaviours in the classroom.
5. Develop a 5-item rating scale which you can use to observe and assess the teaching effectiveness of your teachers.

Unit 4: Sociometric Techniques and Documentary Analysis

This is a technique for gathering data on the patterns of social relationships among individuals within a group. Information about certain characteristics of individuals is supplied by their peers. According to Mehrens and Lehmann (1984), this technique is "concerned with how an individual is seen and accepted by his peers". Hence it is a peer appraisal technique appropriate for studying the socio-personal adjustments of individuals in a group or the social structure prevalent in a given group.

There are two main procedures for eliciting data in sociometric technique. These are the *nomination technique* and *guess who technique*. In the nominating technique, individuals are asked to write the names of those they would like to perform a given activity with. The particular event or activity chosen would depend on the information being sought and what the information would be used for. For instance, if a school is planning to assign the students in a class to sitting positions, each student in the class may be asked to write the names of his/her classmates he/she would like to sit next to. On the other hand, if the purpose of seeking the sociometric data is to form groups or committees, the students could be asked to write the names of their classmates they would like to serve with on the same committee with.

In the 'guess who' technique, descriptions of traits or characteristics are listed and the student is asked to indicate the name of his/her classmate that best matches each of the traits or characteristics. For instance, the students could be asked:

Who in your class best fits the each of the following traits or characteristics?

This person is always friendly and caring for others……

This person is always neat in the class……..

This person is always quiet in class …….

To analyze responses to the sociometric questions, we can simply use the total count of the number of times each person is chosen by his peers. This gives an index of the individual's social acceptance or rejection in that group.

A diagram showing these choices (i.e. sociometric data) is called a ***sociogram***.
From the sociogram, we can gain information about the group structure, identify the following types of individuals:

- **Stars** - Most popular individuals in the group. They receive the highest choices from their peers. In the sociogram below, Ada and Seidu are examples of stars.
- **Isolates** – Those that received no choices and made no choices. In other words, they were neither chosen by any one nor did they choose any one. Examples are Grace and Idowu.

An example of a **sociogram** for hypothetical sociometric data is shown in figure 1.

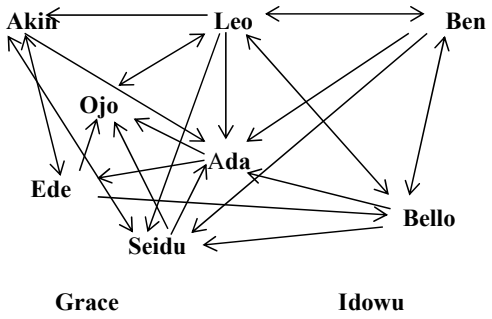

Figure 1: A Sociogram

Guidelines
(1). Sociometric questions should be clear and unambiguous.
Questions should be directly related to the purpose which the sociometric data is intended to serve.
The language used should be consistent with the age and experience of the students.
The administration of the sociometric test should be as informal as possible.
The number of nominations or choices to be made by each candidate should be fewer for younger children than for older children. For instance, Mehrens and Lehmann (1984) suggest two or three nominations for children in primary schools and four or five nominations for secondary school children.

Documentary Analysis

Documentary analysis is a technique of gathering data from already existing documents. It is a unique data gathering technique in the sense that the data are not collected directly from any human subject as is the case with the other types of techniques. A document may be defined as any data or materials already in existence at the time of the investigation which are considered relevant to the research objectives. They may be in the form of figures (e.g. records of pupils' achievement found in schools); written materials (e.g. diaries or newspapers) or physical materials (e.g. photographs, pupils' chairs etc).

Documentary analysis can therefore be seen as the process of sourcing, examining and extracting useful data from documents. This technique can be used alone or in combination with other techniques.

Types of Documents

According to Merriam (1998), there are three major types of documents. These are:

1. Public Records: These are records of what goes on in the society. They include those records kept and maintained by both governmental and non-governmental agencies. Specific examples include census data, birth and death registrations, statistics of students' enrolment and performance in internal and public examinations, policy documents, notice of meetings, minutes of PTA meetings, newspaper reports, etc.
2. Personal documents: These are records kept by individuals about their life's experiences. Specific examples include personal diaries, letters, autobiographies, photo albums, etc.
3. Physical Materials: These are physical objects from which some useful data pertinent to the research objectives can be sourced. Some specific examples include sporting equipment, pupils' furniture, school uniforms, school badges etc.

Guidelines for Documentary Analysis

1. Identify clearly the specific documentary sources from where the data for your investigation will be collected and how to locate each source.
2. Ensure that such documentary sources are
   accessible to you. Do not plan to use classified documents because such documents although available, will not be accessible to you until they are declassified.
   3. Endeavour to establish the authenticity and accuracy of the documents. For authenticity, you must consider the qualification of the author, his motives for preparing the document, possibilities of bias or evidence that may suggest that the document has been tampered with or 'doctored'. For accuracy, you should look out for inconsistencies in the document.
   4. Design a system for extracting the desired data from the documents. This may entail a system for coding qualitative data (e.g. themes or categories) or a form designed to extract the desired data from statistical records.
   5. Approach the exercise with an open but critical mind so as to discover any useful trends that may be 'hidden' in the document.

Activity

1. Identify and explain the two (2) techniques for obtaining sociometric data.
2. Explain the terms – sociogram, isolate and star.
3. Identify the various types of documentary sources that could be used in educational research and for each type give two (2) examples.
4. Explain any four (4) principles that will enhance the process of documentary analysis.

Unit 5: Cognitive Tests

These are instruments used to measure any of the intellectual abilities such as general intelligence, special aptitude and achievement. In general, therefore, cognitive tests (Nworgu, 2003) would include:

- General Intelligence Tests
- Aptitude Tests
- Achievement Tests

The type of cognitive test to use in a particular study would depend on the purpose of the research investigation and therefore what type of data the researcher wishes to collect. For instance, a researcher would choose a general intelligence test or an aptitude test if the investigation is concerned with predicting how well an individual may learn. On the other hand, an achievement test will be used if the investigation is concerned with an individual's present level of learning in a school subject (knowledge and skills). In this unit, our focus will be on achievement test'

Achievement Test

An achievement test is used to measure what amount or level of knowledge and skills an individual has acquired after going through a programme of instruction. Achievement testing is therefore a major technique for gathering data on what pupils have learned from instruction in the various school subjects.

In terms of format we can distinguish between two major types of achievement tests. These are: *Essay* and *Objective* type tests. The essay type test permits the individual to choose and organize his/her response. It is a free-response format. Examples of essay-type questions include:

1. Explain how plants manufacture their food.
2. Write a composition on your visit to a market.
3. Solve the equation: 3a +17 = 5a - 11

In the objective-type test, responses are structured and the individual either select or supplies a specific response. It can take any of the following specific formats:

(a). **Completion type**: The individual is supposed to complete a blank or space by supplying a missing word or phrase. For instance:

The capital of Lagos State is _____?

(b). **Yes or No Type**: The individual is provided with only two options out of which (s)he is expected to choose **one**. Some examples are given below.
The capital of Ghana is Legon. Yes ☐ No ☐
The ruling party in Nigeria is the PDP Yes ☐ No ☐

(c). **Matching Type**: The individual is expected to match words or phrases in one list with those are linked with in a second list. For example:
List A comprises food sources and List B comprises the food nutrients. Match each food source with the particular food nutrient it supplies.

Food Source	**Nutrient**
Margarine or butter	Carbohydrate
Banana	Protein
Salt	Vitamin
Yam	Fats and Oil
Groundnut oil	Mineral Salts

Multiple Choice Types: This type of test item provides more than two (usually four or five options or alternative answers to a question. From these alternative answers, the individual is expected to select one as his answer to the question. The question is called the item. Out of the alternative answers provided, only one is the correct answer. This called the **key** whereas the incorrect options are called **distracters**.

Guidelines for the Construction of Achievement Tests

1. The objectives or specific knowledge and skills which the test is to measure should be clearly identified.
2. The content domain to be covered by the test should be well defined.
3. Choose an appropriate format bearing in mind the nature of your research and the need for adequate sampling of the content universe or domain.
4. Breakdown the content into topics and ensure that items are distributed across all the topics in a manner that reflects their relative importance.
5. Avoid the use of technical jargons or terms with unclear meaning.
6. Keep the instructions as simple and clear as possible.
7. Ensure that in the case of multiple choice items that only one option is the correct option.

Activity

1. Mention three (3) types of cognitive tests.
2. Distinguish between the essay-type and objective-type achievement tests.
3. Identify the various types of objective-type achievement test.
4. Explain the steps a researcher would take in order to construct a valid achievement test.

Unit 6: Qualities of Research Instruments

For a research instrument to function as intended, there are two important statistical (or psychometric) qualities it should possess. Such an instrument must be valid and reliable. In other words every research instrument is supposed to possess these two statistical qualities – validity and reliability. This unit discusses the meaning, types and procedures for establishing each of these qualities.

Validity

Validity refers to the property of a measuring instrument that is concerned with how well the instrument measures what it was designed to measure. It relates therefore to the extent an instrument satisfies or accomplishes its purpose. For example, if an instrument designed to measure widowhood practices in a certain culture, turns out to be measuring child caring practices of widowed mothers in that culture, such an instrument no matter how well developed, is not valid. This suggests that an instrument may be valid in one situation but not valid in another situation.

Types of validity

The types of validity commonly in use in educational research include:

- Face Validity
- Content validity;
- Criterion – related validity and
- Construct validity.

Face validity: This refers to the "looks" or appearance of a test in terms of such features as the relevance to research objectives and appropriateness of language and examples. It is usually established by presenting a draft copy of the instrument to a panel of experts (or knowledgeable colleagues) for vetting.

Technically, face validity is not regarded as a form of validity because it is only concerned with the appearance of the instrument to "the expert" and not about any statistical quality of the instrument. However, it is a useful process in instrument development that is used to improve the non-technical features of the instrument. Improving such non-technical features of an instrument makes the instrument more respondent-friendly and ensures to some extent that the required information is captured.

Content Validity

This type of validity is concerned with the extent of coverage of a particular content domain by an instrument. In other words content validity deals with whether the particular content domain which is the focus of an instrument was adequately covered or sampled by the instrument. This type of validity is applicable only to situations where the

behaviours to be measured belong to a well-defined content domain such as in achievement tests. The procedure for establishing this type of validity involves the use of what is referred to as test blueprint of table of specifications. This will enable the researcher to assign appropriate relative weights to the various sections of the content and thereby determine how many items that will be developed in each section in order to give a fair representation to all the sections.

Criterion – Related Validity
Criterion-related validity according to (Nworgu, 2003 and 2006) "is concerned with the degree to which the performance on an instrument can estimate or predict performance in other situation(s)". This is expressed as a statistical index called 'criterion-related validity index or coefficient'. This type of validity is appropriate for instruments that are designed to serve predictive functions. This is the case with common entrance examinations, selection examinations etc.

From the definition of criterion-related validity, it becomes apparent that two sets of scores, measures or variables are involved in its determination. One is the set of scores or measures from the instrument. This is referred to as the predictor or predictor variable. The other is the set of scores or measures representing the performance in another situation that is to be estimated or predicted by the instrument. This is referred to as the criterion or criterion variable. Therefore the procedure for establishing this type of validity will entail obtaining these two measures and correlating them with an appropriate correlation coefficient. The resultant correlation coefficient gives the criterion-related validity index or coefficient.

Criterion-related validity can be further classified into two. These are concurrent and predictive validity. It is **concurrent validity**, if the predictor and criterion measures are ready at the same. Otherwise, if the criterion measure matures much later than the predictor measure (i.e. scores on the instrument), it is referred to as **predictive validity**.

Construct Validity
Construct validity deals with the degree to which the items of a single instrument are measuring a single construct. It therefore provides a measure of homogeneity or heterogeneity of the items in an instrument. The procedure for establishing this type of validity involves the use of a statistical procedure called factor analysis. This procedure is well beyond the scope of this manual.

Reliability
Reliability refers to how consistent or dependable an instrument is in measuring whatever it measures. For instance, to what extent will an individual's score on an instrument remain the same from one occasion to the other? If an individual's score on an instrument fluctuates from one occasion to another, not on account of any real changes in the trait being measured, then the instrument is not reliable. Therefore reliability provides an estimate of changes in scores of individuals on an instrument that arise from error sources.

A reliable test is not necessarily a valid test. On the other hand, for a valid test, the likelihood is high that it will also be reliable.

Types
The following are the common the types of reliability:

- Estimate of temporal stability
- Estimate of internal consistency
- Estimate of rater or scorer variability.

Estimate of Temporal Stability
This is an estimate of how stable or consistent the scores of an instrument are across two different occasions marked by a time interval. In other words, it deals with errors introduced in the scores of an instrument due to the passage of time only. It is a recommended form of reliability for "an instrument will be used to measure a trait on two or more occasions in the same study. Examples include studies focusing on retention or experimental studies involving pre-testing and post-testing using the same instrument" (Nworgu, 2006).

To establish this reliability estimate, the instrument is administered on the same sample of individuals twice. The time gap between the two administrations of the instrument should neither be too short nor too long –between 7 to 14 days. The two sets of scores obtained from the two different administrations of the instrument are then correlated using an appropriate correlation coefficient. This gives the estimate or coefficient of temporal stability of the instrument. This whole procedure for obtaining this reliability estimate is called the 'test-retest method'.

Estimate of Internal Consistency
This is concerned with the degree of homogeneity exhibited by the items of an instrument. It deals with how consistent the items are in measuring one single trait. Therefore, inadequate sampling of the content by the items of the instrument constitutes the error source that this type of reliability deals with.

One of the procedures for establishing this type of reliability is known as the 'Split-half method'. In this method, the instrument is administered once on an appropriate sample. During scoring, the instrument is split into two equal halves such that each individual obtains two sets of scores. That is, one on each half of the instrument. The instrument could be split either on the basis of odd-even numbered items, first half and second half of the items or on any other basis at all. These two sets of scores are then correlated using an appropriate correlation technique to obtain an estimate of internal consistency for one half of the instrument. The coefficient of internal consistency for the entire instrument is obtained by using a step–up formula known as the Spearman-Brown Prophecy formula. This formula is given as:

$$r_t = \frac{2r}{1+r}$$

Where
r = correlation coefficient for half of the test
r_t = Coefficient of internal consistency for the whole instrument

Other methods for establishing this type of reliability which are not discussed here include:

- Rulon's method
- Kuder-Richardson method

- Cronbach's alpha method

Information on these can be found elsewhere such as Nworgu (2006) and Ezeh (2005).

Scorer Reliability
Scorer (or rater) reliability deals with how consistent the scores given to same individuals are across different scorers or raters. It tries to estimate the extent of agreement among different scorers or raters using the instrument. This type of reliability is therefore appropriate for essay-type instrument or rating scales where different individuals are expected to score of rate the instruments. Variations in scores introduced as a result of using different scorers or rater constitute the error source.

To establish this type of reliability, two or more persons are made to independently score or rate a number of subjects using the instrument. The scores of these independent scorers or raters are then correlated using an appropriate correlation coefficient. The resultant coefficient gives the coefficient of scorer or rater reliability.

Activity

1. Differentiate between validity and reliability of a research instrument.
2. Give research situations where each of the following types of validity is appropriate:
   (a). Content validity
   (b). Predictive validity
   (c). Concurrent validity
   (d). Construct validity
3. Differentiate among the following types of reliability estimate:
   - temporal stability
   - internal consistency
   - rater or scorer variability.

Module 7

Analyzing Research Data

Introduction

In educational research, we try to find solutions to problems through the application of the scientific method. One of the basic characteristics of this approach is empiricism. Empiricism demands that the conclusion of any research investigation be based on facts and figures. This makes the collection of data in such investigations imperative. The quantum of data resulting from a single investigation is usually large. The researcher and/or his/her assistants return from the field with bags of completed research instrument containing data whose size is intimidating and its depth and meaning unclear or unfathomable. At this stage, the question that confronts the researcher is how do I make sense or draw meaning out of this intimidating and confusing set of data? The answer to this question definitely lies in the application of an appropriate statistical procedure. In this module, the basic statistical procedures for analyzing data are discussed.

Unit 1: Meaning and Uses of Statistics

In this unit, the following topics will be treated:

- Meaning of statistics
- Branches of statistics and
- Uses of Statistics

Meaning of Statistics

Nworgu (2003) has distinguished three different conceptions of the term statistics. The first is the layman's conception which relates statistics to any set of figures or numerical values (e.g. the statistics of school enrolment, statistics of books supplied by UBEC). The second conception sees statistics not as a set of scores or figures but as the mathematical properties or qualities of a set of data. In this case, statistics connotes any measure or value derived or computed from a set of scores or figures that signifies a definite mathematical property or characteristic of the set of scores. (e.g. mean, mode, median each of which signifies the property of central location or variance and standard deviation that signify the property of spread etc,)

The third is the conception of statistics as a branch of knowledge or discipline. Statistics can be seen as that branch of human knowledge that is concerned with those theories and techniques for organizing, analyzing and interpreting data as well as for drawing inferences from such data.

Branches of Statistics

From this definition, it is evident that statistics can be classified into two. These are *descriptive* and *inferential* statistics. Whereas descriptive statistics deals with the theories and techniques of organizing, summarizing and describing data, inferential statistics deals with the theories and techniques of drawing inferences about population characteristics based on data collected from a sample of that population. In a way therefore, statistics can also be seen as a study of population characteristics otherwise referred to as parameters.

We can also distinguish between *pure statistics* and *applied statistics*. Pure statistics deals with the derivation and the study of the mathematical properties of distributions. Applied statistics on the other hand concerns itself with the application of the knowledge of the mathematical properties of distributions gained from pure statistics in solving practical problems in other fields of human endeavour. Statistics enjoys wide applicability as it is extensively used in almost all the science and social science disciplines. Its application is so extensive in certain disciplines that it has given rise to sub-disciplines e.g. biometrics in biology, econometrics in economics and psychometrics in psychology and education.

Uses of Statistics
In modern times, the use of statistics has become pervasive in almost all the facets of human operations. In the context of educational research, statistics serves many important uses in that it is considered an indispensable tool in the hands of any researcher. Specifically, statistics provides the researcher with the techniques and principles for:

- Quantification of data;
- Organizing and summarizing data;
- Presenting data in a way that captivates the interest of the audience;
- Describing data in as accurate and precise manner as possible;
- Making the best interpretations out of any given data;
- Drawing inferences about population parameters from sample of that population;
- Reporting research findings using appropriate statistical terms;
- Understanding research articles which are normally written in statistical terms.

Activity

1. Explore the different conceptions of the term- statistics.
2. Distinguish between descriptive statistics and inferential statistics on one hand and pure and applied statistics on the other hand.
3. In what ways statistics be useful to the school administrator?

Unit 2: Types of Educational Data

This unit discusses two ways of classifying data. These are a two-level classification and a four-level classification respectively.

Two-level Classification
Here educational data are classified into two. These are discrete and continuous.

Discrete Data
These are data that occur as whole numbers or integers. Middle vales (i.e. decimals or fractions) are not possible. Nominal and ordinal data fall under this category.

Continuous Data
Continuous data are data that can assume any value and between any two points, there is infinite number of values. In other words, there is no discontinuity or break in values

between any two points. These are data for which any value is possible within any defined range of values. The interval and ratio data fall under this category.

Four-Level Classification
Data can also be classified into four types on the basis of the type and quality of the measuring scale from which it was obtained. These are nominal, ordinal, interval and ratio data respectively.

Nominal Data
These are data in the form of categories that have no magnitude and therefore can not be ordered. Some examples include:

Sex: Male, female
Zone: North-Central, North-East, North-West, South-East, South-South and South-West.
.

Ordinal Data
This type of data is associated with magnitude and therefore can be ordered. Therefore with this data we can make such comparisons as one object is less than or greater than the other. However, the same data intervals do not necessarily represent the same amount of trait in question. Some examples of this type of data include:
Pupils' Relative Positions: 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, etc.
SSCE or NECO Grades: A1, B2, B3, C4, C5, C6, P7, P8, and F9

Interval Data
This type of data has equal data intervals. However, it has no real or absolute zero. The zero associated with this type of data is arbitrary. Some examples include test scores, attitude score, Celsius temperature scale etc.

Ratio Data
All the relevant properties (order, equal data interval and absolute zero) are present in this type of data. It is therefore the most refined type of data (Nworgu, 2003, 2006). Some examples are: age, height, weight, Kelvin temperature scale, etc.

Activity

1. Differentiate between discrete and continuous data giving two examples of each.
2. List the different types of data under the four-level classification.
3. Give four examples of interval data.
4. Compare the ratio data and the ordinal data in terms of the measurement properties possessed by each category of data.

Unit 3: Data Organization
The first step after collecting the data is for the researcher to seek ways of making sense out of the large quantum of data staring at him/her. This calls for organizing the data using appropriate modes. We can organize our research data in two modes: the tabular and graphical. This unit discusses these two modes of data presentation.

Tabular Mode
The tabular mode involves organizing data (frequency) tables whereas the graphical mode involves presenting the data in pictorial or graphical forms.

Let us illustrate the tabular mode of data organization using the following set of data obtained from 60 pupils who took a 10-item test.

Table 1: Scores of 60 pupils on a hypothetical 10-Item Test

1	4	3	9	4	7	1	1	8	6
1	3	7	8	2	9	4	0	3	6
2	5	5	9	8	2	7	7	0	2
4	5	2	0	2	1	2	1	4	2
0	4	1	8	10	5	9	6	6	3
5	3	4	10	4	5	9	8	4	2

The data in table 1 basically show the scores and the number of times each occurred in the data. Such a table is called frequency distribution table or simply frequency table. The frequency table for the data in table 1 is shown in Table 2.

Table 2: Frequency distribution table

Score (X)	Tally	Frequency (f)	Cumulative Frequency
10	/ /	2	60
9	~~/ / / /~~	5	58
8	~~/ / / /~~	5	53
7	/ / / /	4	48
6	/ / / /	4	44
5	~~/ / /~~ / / /	6	40
4	~~/ / /~~ / / / /	9	34
3	~~/ / / /~~	5	25
2	~~/ / /~~ / / / /	9	20
1	~~/ / /~~ / / /	7	11
0	/ / / /	4	4
		60	

To construct a frequency table, the score are listed in the first column from the highest to the lowest. In the second column, the scores are tallied. After tallying, the number of tallies at each score is counted to obtain the frequency of that score. (For ease of counting, the tallies are arranged in groups of five strokes).

Another useful statistic that could be provided in a frequency table is the *cumulative frequency*. This is the number of scores whose values are equal to or less than a given value. This is obtained by adding the frequencies of all preceding scores to the frequency of the score whose cumulative frequency is being determined as shown in the fourth column. The cumulative frequency can be expressed as a percentage of the total number of scores in the distribution to obtain what is called the *percentage cumulative frequency.* The percentage cumulative frequency can be found using the formula:

$$Percentage\ Cumulative\ \ Frequency = \frac{Cumulative\ Frequency}{N} X \frac{100}{1}$$

Let us illustrate how to apply this formula by using it to calculate the percentage cumulative frequencies of scores 0 and 1 in tables 1 and 2.

Score 0

$$\%\ Cum.\ Freq. = \frac{4}{60} \mathrm{X} \frac{100}{1} = 3$$

Score 1

$$\%\ Cum.\ Freq. = \frac{11}{60} \mathrm{X} \frac{100}{1} = 5$$

Graphical Mode

This mode involves representing research data graphically or pictorially. This enhances the visual appeal of the data as well as highlights the major features of the data. Some of the specific approaches under this mode are bar chart, histogram, frequency polygon, pie chart etc. Two of these – bar chart and pie chart are presented in this unit.

Bar chart

The bar chart can be used to pictorially show how the scores vary according to their frequencies. It is a sort of graph that uses rectangular bars of equal width to show how the scores vary according to their frequencies. Such a pictorial presentation will show at a glance, the most frequent as well as the least frequent score in the distribution. The bar chart for the data in the table is shown in figure 2.

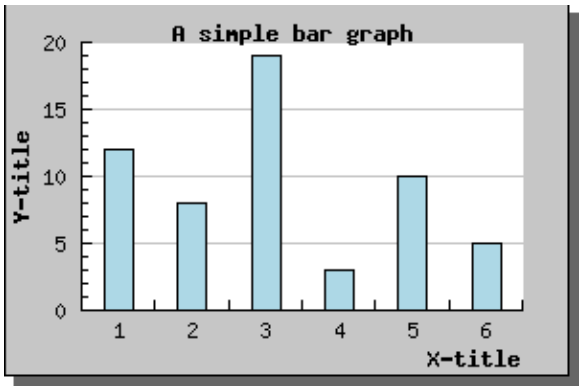

Figure 2: A Bar Chart Representing Data in Tables 1 and 2

Pie Chart

The pie chart is useful in showing the sectoral distribution or allocation of scores or values in a circle. The circle is sub-divided into as many sectors as there are components of the data being represented such that the sizes of the sectors (in degrees) correspond to the relative proportions of the data components they represent.

Consider the following data representing the supply of UBE/Word Bank books in the four core primary subjects in a given state:

English	25,000
Mathematics	30,000
Primary Science	15,000
Social Studies	20,000

We can proceed to find out the contribution or proportion of the books supplied in each core subject relative to the total number of books supplied as follows:

English : $\frac{25000}{90000} \times \frac{100}{1} = 27.78 \approx 28\ \%$

Mathematics: $\frac{30000}{90000} \times \frac{100}{1} = 33.33 \approx 33\ \%$

Primary Science: $\frac{15000}{90000} \times \frac{100}{1} = 16.67 \approx 17\%$

Social Studies: $\frac{20000}{90000} \times \frac{100}{1} = 22.22 \approx 22\ \%$

The circle is then sub-divided into four portions or sectors whose sizes will vary according to the percentage contributions of the core subjects. Given that there are 360 degrees in a circle, the size of the portion of the circle or sector that will represent each core subject will be:

English: 27.78 % of $360^o = 100.01^o \approx 100^o$
Mathematics: 33.33 % of $360^o = 119.99^o \approx 120^o$
Primary Science: 16.67 % of $360^o = 60.01^o \approx 60^o$
Social Studies: 22.22 % of $360^o = 79.99^o \approx 80^o$

	Core Primary Subject				Total
	English	Mathematics	Primary Science	Social Studies	
Number of Books	25,000	30,000	15,000	20,000	90,000
%	27.78	33.33	16.67	22.22	100.00
Size of Sector (in degrees)	100.01	119.99	60.01	79.99	360

The pie chart is shown in figure 3.

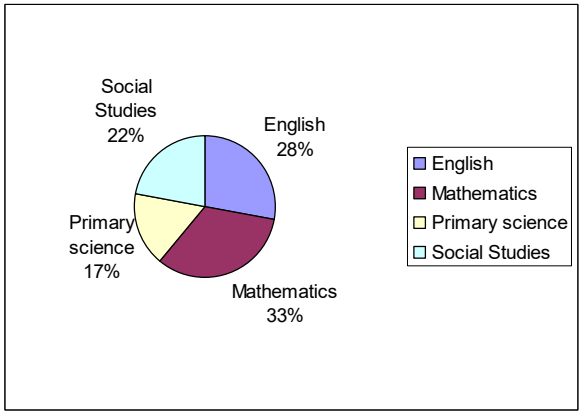

Figure 3: Pie chart of the core textbooks

Activity

1. The scores obtained by 60 pupils in a class test are as follows:

   8 5 7 3 9 0 4 6 8 3 3 5 1 1 4 5 3 1 2 4
   9 5 0 6 7 2 5 6 6 4 1 3 9 5 0 0 4 4 4 8
   1 0 6 2 7 0 9 6 4 2 6 9 4 8 7 9 2 8 4 9

   (a). Construct a frequency table for the above data
   (b). Using the cumulative frequency, determine how many students scored 5 or below.
2. Represent the above data in a bar chart.
3. The number of teachers in a school with the various qualifications are as follows:

Degree	7
NCE	20
Below NCE	13

   Represent the above data using a pie chart.

Unit 4: Measures of Central Tendency and Spread

In educational research, we need to describe the group as whole and not individual cases in our sample. For this, we need a measure which can typify the group (i.e taken to represent the group) as well as one which will give an idea of how far apart the individual score are from one another or from this representative value. In this unit therefore, effort is made to discuss two of these measures, namely:

- Measures of Central tendency and
- Measures of spread

Measures of Central Tendency

They provide information about the entire group hence they may be termed 'group-based measures' or 'averages'. A measure of central tendency is a value somewhere in the centre of the distribution around which other values tend to cluster or cling (Nworgu, 2003). They are therefore taken as representative or typical values for any set or group of data (Nworgu, 2006). Three of such measures most commonly used in education are the mean, median and mode.

Mean

The mean is the arithmetic average of any set of scores. It is the sum of all the scores (values) divided by the number of score (values). Thus the formula is as follows:

$$\text{Mean} = \overline{X} = \frac{\sum fX}{\sum f}, \quad \text{where}$$

$\sum$ = "Sum of"
X = Score

f = Frequency

Let us illustrate the computation of the mean using the data in table 3.

Table 3: Computation of the Mean

Score (X)	Frequency (f)	fX
10	2	20
9	5	45
8	5	40
7	4	28
6	4	24
5	6	30
4	9	36
3	5	15
2	9	18
1	7	7
0	4	0
Sum	**60**	**263**

We proceed by multiplying each score by the corresponding frequency to obtain (fX) as shown in the last column. Then the sums of the frequencies on one hand and the products of the scores and their corresponding frequencies on the other hand are obtained as in the last row, i.e.

$\sum f = 60$ and $\sum fX = 263$

These values are substituted in the formula for the mean as follows:

$$\text{Mean, } \overline{X} = \frac{\sum fX}{\sum f} = \frac{263}{60} = 4.38$$

Median

The median is the score or value that is at the middle of the distribution. One half of the scores lie above it and the other half lie below it. The median is based on the relative order of the scores or values in the distribution hence it is said to be an 'ordinal statistic' (Nworgu, 2003). Therefore to determine the median, the scores or values should be arranged in order of relative magnitude. Having arranged the scores in order of relative magnitude, the score at the centre is taken as the median. If the number of scores involved is even, the average of the middle scores is taken as the median. Consider the following set of 15 scores:

6	10	4	6	0	5	6	10	8	3	1	8	9	3	4

To obtain the median, the scores are re-arranged in ascending order as follows:

0	1	3	3	4	4	5	6	6	6	8	8	9	10	10

⇑

Score in the Middle

Score in the middle = Median = 6

Mode

The mode is the commonest score in the distribution. In other words, it is the score with the highest frequency. For example, in the set of 15 scores above, the score that occurred the highest number of times is 6. Therefore the mode of the distribution is 6. When a distribution has only one mode as in this case, it is said to be *unimodal.* But in some cases a distribution may have two or more modes. When a distribution has two modes, it is said to be *bimodal* whereas when it has more than two modes it said to be *multimodal.*

Choosing an appropriate Measure of Central Tendency

The mean, median and mode provide the same information. Under what condition should a research prefer to use one of these and not the other?

The mean is the most accurate and dependable and should therefore be preferred at all times except when the data contain extreme values or are discrete (i.e. ordinal or nominal). The median should be preferred to there are extreme values in the data or when the data are ordinal. The mode can only be preferred if the data are nominal or if one is under pressure to provide a quick but rough idea of the central tendency (an average) for a set of data. Otherwise it is the most inaccurate measure of central tendency.

Measures of Spread

This group of statistics provides information about the extent of spread or scatter inherent in a set of scores. These are also referred to as measures of scatter, dispersion or variability. Some of these measures include: range, deviation, mean deviation, variance and standard deviation.

Range

This is a measure of the distance between the highest score and the lowest score in a distribution. It is calculated using the formula:

Range = H-L; Where H = Highest Score and L = Lowest score.

Although simple, it is an unreliable measure of spread because different sets of scores may have the same range but show different patterns of spread or variability

Deviation

A deviation is a measure of the distances of a score from the mean. It tells us how far a score is from the mean. We can find the deviation using this formula:

Deviation, $d = X - \overline{X}$

The deviation can be positive, negative or zero. If positive, it means that the score is higher than the mean but if negative, it means that the score is lower than the mean. A deviation of zero suggests that the score is equal to the mean.

Mean Deviation

This is the average of the deviations of the scores from the mean. It is given by the formula:

Mean deviation, $\overline{d} = \dfrac{\Sigma\left|X - \overline{X}\right|}{N}$

$\left|X - \overline{X}\right|$ = the deviation from the mean ignoring the sign (i.e. absolute value of the deviation).

Standard Deviation
This is the most accurate and dependable measure of spread. It is calculated as:

$$SD = \sqrt{\frac{\Sigma f(X - \overline{X})^2}{N}} \quad \Rightarrow \text{ Population Standard Deviation } (\sigma)$$

or

$$SD = \sqrt{\frac{\Sigma f(X - \overline{X})^2}{N - 1}} \quad \Rightarrow \text{ Sample Standard Deviation (S)}$$

Let us illustrate the computation of the standard deviation with the data in table 4. Recall that we had earlier determined the mean of this set of data to be 4.38.

Table 4: Computation of the standard deviation

Score (X)	Frequency (f)	$X - \overline{X}$	$(X - \overline{X})^2$	$f(X - \overline{X})^2$
10	2	+ 5.62	31.58	63.16
9	5	+ 4.62	21.34	106.70
8	5	+ 3.62	13.10	65.50
7	4	+ 2.62	6.86	27.44
6	4	+ 1.62	2.62	10.48
5	6	+ 0.62	0.38	2.28
4	9	- 0.38	0.14	1.26
3	5	- 1.38	1.90	9.50
2	9	- 2.38	5.66	50.94
1	7	- 3.38	11.42	79.94
0	4	- 4.38	19.18	76.72
Sum	**60**			**493.92**

So we proceed by first obtaining the deviation of each score from the mean as in column 3. Next, the deviations are squared as in column 4. In the last column (i.e. column 5), we find the product of the squared deviations (column 3) and the corresponding frequencies (column 2). As usual, we obtain the sums of the relevant columns (columns 2 and 5) and substitute in the formula as follows:

$$SD[poulation], \sigma = \sqrt{\frac{\Sigma f(X - \overline{X})^2}{N}} = \sqrt{\frac{493.92}{60}} = \sqrt{8.23} = 2.87$$

Or

$$\text{S.D. [sample], } S = \sqrt{\frac{\Sigma f(X - \overline{X})^2}{N - 1}} = \sqrt{\frac{493.92}{59}} = \sqrt{8.37} = 2.89$$

Uses of Measures of Spread

1. It is mandatory in statistics for a measure of reliability to be reported wherever a measure of central tendency is used.
2. It tells us how much the subjects in our sample vary or differ on the trait or issue in question.

3. It also provides an idea of the error involved in the study known as the *standard error of estimate.*
4. In the case of classroom practice, the standard deviation if used together with the mean could help us make an instructional decision on whether or not the students have attained mastery. For instance, a high mean and low standard deviation will suggest mastery has been attained but a low mean and low standard deviation will suggest that mastery has not been achieved.
5. Likewise, in opinion studies, using the standard deviation together with the mean could help us determine the extent of consensus among the respondents. For instance, a high standard deviation will suggest divergent opinions whereas low standard deviation will suggest a consensus of opinion.

Activity

1. Distinguish among the following measures of central tendency – mean, median and mode.
2. Under what condition or conditions would you prefer each of the three measures of central tendency?
3. State the uses of measures of spread.
4. For the set of 60 scores in the Activity of the last unit, what is the
   (a). mean
   (b). median
   (c). Mode and
   (d). Standard deviation

Unit 5: Measures of Association (Relationship)

A researcher who is perhaps interested in investigating the extent of relationship between two quantities or variables will neither find the measures of central tendency, percentages and ratios nor the measures of spread useful. A special group of statistical measures known as correlation techniques is required to handle the analysis of studies seeking to establish relationships.

Two variables are said to be related or correlated if they change or vary together. If the two variables change together in the same direction, the relationship is described as direct relationship. On the other hand, if they change together in opposite directions, the relationship is described as inverse relationship. The extent of relationship between two variables is expressed statistically as a *correlation coefficient.* A correlation coefficient may be positive or negative. A positive correlation depicts a direct relationship whereas a negative relationship depicts inverse relationship. A zero correlation coefficient depicts no relationship.

Several techniques are available for calculating correlations between variables. Only one of these, Spearman Rank Order correlation technique, is discussed in this manual.

Spearman Rank-Order Correlation Coefficient

This is a technique for correlating two variables in the form of ranks. It is represented by the symbol ρ (rho). The formula for computing this coefficient is:

$$\rho = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$$

We shall illustrate the computation of this coefficient using the following set of data on study habit and achievement scores of ten students.

Table 5: Computation of the Spearman Rank Order Correlation Coefficient

Study Habit (X)	Achievement (Y)	R_X	R_Y	D= (R_X-R_Y)	D^2
21	75	4	3	+1	1
15	56	7.5	7	+0.5	0.25
25	72	3	4	-1	1
12	52	9	8	+1	1
30	85	1	2	-1	1
17	65	6	5	+1	1
26	90	2	1	+1	1
15	48	7.5	10	-2.5	6.25
20	60	5	6	-1	1
10	50	10	9	+1	1
					13.50

To apply the formula for the Spearman Rank Order Correlation, we proceed by ranking each of the two sets of scores independently (columns 3 and 4 respectively). The difference between each paired ranks is determined (column 5) and squared as in column 6. The sum of the squared differences is found and substituted in the formula as follows:

$$\rho = 1 - \frac{6\Sigma D^2}{N(N^2-1)} = 1 - \frac{6X13.50}{10(10^2-1)}$$

$$= 1 - \frac{81}{990} = 1\text{- } 0.08 = 0.92$$

Interpretation of Correlation Coefficient

One way of interpreting a correlation coefficient is to follow a rule of the thumb in the form of an interpretation guide provided by some individuals. One such interpretation guide is that recommended by Nwana (1979 and 2007) as shown below:

Value of r	*Interpretation*
0.80 and Above	Very High
0.60 to 0.80	High
0.40 to 0.60	Medium
0.20 to 0.40	Low
0.00 to 0.20	very Low

Using this guide, a correlation coefficient of +0.35 may be interpreted as a low direct relationship whereas a correlation coefficient of -0.82 may be interpreted as very high inverse relationship.

More information on choice of appropriate correlation techniques can be obtained from Nworgu (2003 and 2005b).

Activity

The data below represent the scores of 10 School heads on an Anxiety Test and their scores on a written interview for supervisors.

Anxiety Score	20	15	60	30	18	42	24	54	21	40
Interview Score	70	80	50	60	78	69	65	40	85	38

To what extent is anxiety related to interview performance?

Module 8

Writing an Educational Research Proposal

Introduction

Any proposal offers a plan to fill a need, and your reader will evaluate your plan according to how well your written presentation answers questions about ***what*** you are proposing, ***how*** you plan to do it, ***when*** you plan to do it, and ***how much*** it is going to cost. The units in this module are concepts clarification, major sections, and checklist for proposal budget items for a general purpose proposal.

Unit 1: Concepts Clarification

This unit examined the

- meaning of a research proposal and
- purposes/functions

Meaning of a research Proposal

A proposal is essentially a declared intention to conduct a research and the plan for conducting such a research. It includes objectives, rationale or justification, methods, materials, time frame and a defensible budget.

Purposes/Functions

Research proposals are developed for several reasons, each of which may be very important to the success of the research to be carried out:

- to develop a consensus on what is to be done and who is to be involved - this is especially important when the research involves several agencies or people and they are expected to commit time and/or resources;
- as an aid to implementation - the research implementation should be guided by the proposal. It follows that a poorly developed proposal will be difficult to implement as no-one really knows what is expected to be done;
- to solicit funds - this is commonly misunderstood as the only reason; and
- to get approval - not only from immediate superiors but also at the national level if external funds are being solicited.
- it helps you to think out the research project you are about to undertake and predict any difficulties that might arise.
- For those who aren't quite sure what their focus will be, the research proposal can be a space to explore options – perhaps with one proposal for each potential topic (which can then be more easily compared and evaluated than when they are still just ideas in one's head).
- Research proposals can be effective starting places to discuss projects with your Departmental/Unit/Section Heads, too. An officer who is initially skeptical about a project may be able to imagine it more easily after reading a well written research proposal (this does not mean he or she will approve the topic, especially if there are significant potential difficulties that you have not considered).
- A research proposal serves as a constant reminder of the important ingredients of the study.

Unit 2: Major Sections

The most basic composition of a proposal, as with any other written document, is simple; it needs a beginning (the Introduction), a middle (the body of material to be presented) and an end (the Conclusion/Recommendation).

Background:

- What is the context of the proposed research? Why is it important? What has already been done and what is the present state of knowledge (a literature review is generally an essential step in the study). What is the problem to be addressed? How was the topic identified?

Objectives/Outputs:

- What is the research trying to prove? What is the question it will answer? Who are the beneficiaries? Every proposal should have a clear general objective and, where appropriate, a hypothesis that matches the objective. After a general objective the proposal should be summarized in one or more specific objectives, depending on the complexity of the proposed research, that present what you hope to accomplish, in clearly defined parts or phases. These objectives should be specific, measurable, action-oriented, realistic and time bound (i.e. SMART). Apply these guidelines to your objectives. Poorly formulated objectives lead to unnecessary data collection and a project difficult to manage.
- Expected Outputs should be itemized and linked to the objectives. Many agencies these days have adopted logical framework analysis which is an excellent tool for structuring a project by logically linking the problem(s) to be addressed with objectives, outputs and activities;

Beneficiaries and Impact:

- What is the potential impact of the research on the sector? How will it improve investments or the efficiency of operation and maintenance? Many agencies have a sector 'policy'. What are the 'policy' issues addressed and the expected policy conclusions? What are the intended applications? Who will the research mostly affect? What will they do differently when they know the answer to the question? How will the results be disseminated (e.g. workshops, seminars, journal articles)?

Organization and Methodology:

- How and where will the research be carried out? Methodologically flawed research can negate otherwise meaningful results. Many epidemiological studies for example are confounded by uncontrolled variables. Describe the nature of the data needed and how it will be collected and analyzed. The methodology must be linked to the objective. A planning matrix can be presented linking the objectives, key activities, work plan and outputs. It must be evident how necessary information will be collected to answer each of the specific objectives but no more than that. This is a good way of reviewing the methodology and at the same time ensuring that resources will not be wasted by collecting unnecessary information. The character of the research should be described. For example, does it involve a single discipline or a number of disciplines? Is it gender neutral (see gender specification below)? Does it require a participatory approach involving members of the community studied or is it non-participatory in nature?

Linkages:

- Is the proposal for an independent research, or does it relate to an on-going programme of investigation? Does it relate to any other sector (e.g. health or agriculture)? Is it likely to lead to a follow-up proposal? Is further work essential to apply the results of the research? If the research institution is weak, try to link up with a stronger institution.

Gender Specifications

In a number of research topics, special attention will have to be paid to gender, to make sure that the differences that exist between men and women in work, practices, views, authority, benefits, etc. are recognized and accounted for in the research design and findings. Usually this implies that the research topic and questions are defined in gender-specific terms, that the personnel includes women when gender issues are significant, that data are collected and analyzed in a gender sensitive manner and that in the reporting of results and impacts, a distinction is made between men and women.

Personnel:

- Who will carry out the research? What are their respective roles? What are their experience and qualifications? How much time will each commit? List any proposed collaborating agencies and state whether their collaboration is secured (attach a letter). Collaboration between research institutions acts as a filter and provides a measure of quality control. It is also an excellent means of transferring skills and knowledge between research agencies.

Statement of Qualifications:

- An important piece of information that should be included is a statement of the researchers' credentials. List any achievements or awards received and provide a brief summary of other research work carried out - highlighting directly relevant research - so that the funding agency can obtain a true perspective of the principal investigator's capabilities and 'track record';

Risks:

- State any significant risks that may delay or jeopardize successful completion of the research project and if possible quantify their implications in terms of time and funding. The methodology may also need to be adaptive so that it can be revised in the light of findings as the work proceeds;

Schedule:

- Establish a work plan (chronogramme). When is it proposed to start and how long will the research take? Is it dependent on external factors? Milestones should be established so that progress can be monitored and reported;

Reporting:

- Reports are a major and often the only products of the research. They are extremely important. List the type, scope and schedule of reports that are planned to be produced. They should meet the funding agency's format for reporting.

Monitoring:

- Include how the project will be monitored. In addition to progress against the milestones in the original schedule, monitoring should include expenditure and any likely savings or potential cost over-run. Then there is the question of who will review the research to ensure its quality. External review and/or evaluation by a panel of 'outside reviewers' might be appropriate in many circumstances;

Budget:

- Proposals should have a breakdown of estimated costs to be incurred in carrying out the research. Be careful to identify the source of funding proposed, e.g. from the funding agency, from any other donor, from the research agency's own resources, and from in-kind contributions. Be specific about the areas you want the agency to fund. Indicate how you will apply the funds or linking funds to activities. This is particularly important if funding is to be shared by different agencies and can encourage joint-financing. For long term projects, show the budgets by year so that annual funding requirements are clear. Check that the figures add up! Arithmetic errors do not instill confidence on the part of the funding department or agency. Ensure the budget includes provision for essential equipment, supplies, communications cost, training, computers or computing services and necessary travel as these are often under-budgeted. In particular, consider the cost of disseminating the results of the research.

- Budgets must be realistic and only include those resources necessary for the successful completion of the research. It is usually necessary to include a budget justification for most items in the budget that explains how the figure was derived and why the item should be included. A detailed budget assists in project management and helps to ensure that the project is not under-funded.

- Attach any relevant information. For example, an endorsement from another agency (such as a government department) adds weight to the potential of the research and substantiates the link to the application of the results. Remember, you are doing applied research so the application of the results is very important and a weakness in many proposals. Government approval may be required or clearance from a national research council. If the research involves communities, an ethics statement may be in order, or an agreement by the participants.

Unit 3: Checklist for Proposal Budget Items for a General Purpose Proposal

This is a general guide into budget spaces of proposals. Of course quite a few research proposals may not need all the categories; nevertheless they are included to provide you with an idea of the categories in case you need to conduct varieties of research with different resource requirements.

A. Salaries and Wages

- Academic personnel
- Research assistants
- Consultants
- Interviews
- Computer programmer

- Data analysts
- Secretaries
- Clerk-typists
- Editorial assistants
- Technicians
- Subjects
- Casual personnel

B. Equipment

- Fixed equipment
- Movable equipment
- Office equipment
- Equipment installation

C. Materials and Supplies

- Office supplies
- Communications
- Test materials
- Questionnaire forms
- Duplication materials
- Laboratory supplies
- Electronic supplies
- Report materials and supplies

D. Travel

- Administrative – gate-keepers, Negotiators,
- Field work
- Professional meetings
- Travel for consultation
- Consultants' travel
- Subsistence
- Car hire

E. Services

- Computer use
- Duplication services (reports, etc.)
- Publication costs
- Photographic services
- Video services

F. Others

- Space rental
- Alterations and renovations
- Purchase of periodicals and books
- Patient reimbursement

- Subcontracts

G. Indirect Costs

Activities

- Try to obtain a copy of a funded research grant proposal and a funded research contract proposal in education from the Internet. http://www.learnerassociates.net/proposal/propone.htm
- Describe the ways in which each funded proposal conforms to or deviates from the guidelines for writing research proposals, and the components of research proposals, discussed in this module.

Module 9

Research Report Writing

Introduction
As an administrator you have more flexibility in the style and structure of your report. However, remember that one of the purposes of your report is to convince people that you have produced a good, sound piece of research and the more professional your report looks the better your chances of success.

Therefore an important point to remember when writing a report is to think about your audience. What style would they prefer? Do they understand complex statistics or do you need to keep it simple? Have they the time to read through reams of quotations or are they interested only in conclusions and recommendations? Are they interested in your methodology? Do you need to write using complex terminology or do you need to keep your language as simple as possible?

Unit 1: Research Report Format
Traditional research reports tend to follow the following format:
Preliminary
This comprises:

- Title Page
- Contents Page
- List of Illustrations
- Acknowledgements
- Abstract

Main Body
This is structured into five Chapters as follows or sections

- Introduction
- Review of Related Literature
- Methodology
- Findings
- Discussion Conclusion and Recommendations

References
Here you list all the *actual* reference materials you have *directly* used in the research. Materials you have do not have access to during the write-up, but which are considered relevant to your research can be listed as *Bibliography*. But the general practice is to either have references only, or bibliography only – in which case, you can include both materials you have used and those considered relevant under the more general title of Bibliography, rather than References.

The APA style presented in the Module on Literature Review is the most popular style. The increasing availability of Internet sources means new forms of citing references have to be contended with in reports. These have also been duly covered in the Module on Literature Review.

Appendices
This term was borrowed from the medical profession. It refers to a portion of the human intestine that is redundant, and in fact can lead to complications when it gets infected – leading to appendicitis. Thus removing it will not alter anything in the quality of life of the person. Similarly, in research an appendix is an additional information to the main research, but not central to it. Removing it, or not including it, will not lower the quality of the research, but will enhance it with additional information which had no specific space (or even place) in the main body of the report.

Unit 2: Hints on Writing the Different Sections
Preliminary Pages
Title Page
This contains the title of the report, the name of the researcher and the date of publication. If the research has been funded by a particular organization, details of this may be included on the title page.

Contents Page
In this section is listed the contents of the report, either in chapter or section headings with sub-headings, if relevant and their page numbers.

List of Illustrations
This section includes title and page number of all graphs, tables, illustrations, charts, etc.

Acknowledgements
Some researchers may wish to acknowledge the help of their research participants, tutors, employers and/or funding body.

Abstract
This tends to be a one page summary of the research, its purpose, methods, main endings and conclusion.

Main Body

Introduction
This section introduces the research, setting out the aims and objectives, terms and definitions. It includes a rationale for the research and a summary of the report structure. It should reflect the following:

- Background to the problem
- Statement of the problem
- Purpose/objectives
- Significance/Rationale
- Research Questions/hypotheses

Review of literature
In this section is included all your background research, which may be obtained from the literature, from personal experience or both. You must indicate from where all the information to which you refer has come, so remember to keep a complete record of everything you read. If you do not do this, you could be accused of plagiarism which is a

form of intellectual theft. When you are referring to a particular book or journal article, find out the accepted standard for referencing from your institution (see below).

Methodology
In this section is set out a description of, and justification for, the chosen methodology and research methods. The length and depth of this section will depend upon whether you are a student or employee. If you are an undergraduate student you will need to raise some of the methodological and theoretical issues pertinent to your work, but if you are a postgraduate student you will need also to be aware of the epistemological and ontological issues involved. If you are an employee you may only need to provide a description of the methods you used for your research, in which case this section can be titled 'Research Methods'. Remember to include all the practical information people will need to evaluate your work, for example, how many people took part, how they were chosen, your time scale and data recording and analysis methods.

Findings
In this section are included your main findings. The content of this section will depend on your chosen methodology and methods. If you have conducted a large quantitative survey, this section may contain tables, graphs, pie charts and associated statistics. If you have conducted a qualitative piece of research this section may be descriptive prose containing lengthy quotations.

Discussion, Conclusion and Recommendations
Discussion
In this section you sum up and discuss your findings. The discussion should relate your findings to the literature by highlighting those studies which either agree or disagree with your findings.

Conclusion:
This should reflect your major findings and their implications

Recommendations
If you are an employee who has conducted a piece of research for your organization, this section could be the most important part of the report. It is for this reason that some written reports contain the recommendation section at the beginning of the report. In this section is set out a list of clear recommendations that may influence decision making and policies. These should arise from your research findings.

Suggestions for Further Research
It is useful to include a section which shows how the research can be continued. Perhaps some results are inconclusive, or perhaps the research has thrown up many more research questions which need to be addressed. It is useful to include this section because it shows that you are aware of the wider picture and that you are not trying to cover up something which you feel may be lacking from your own work.

References
Here you list all the *actual* reference materials you have *directly* used in the research. Materials you have do not have access to during the write-up, but which are considered relevant to your research can be listed as *Bibliography*. But the general practice is to either have references only, or bibliography only – in which case, you can include both

materials you have used and those considered relevant under the more general title of Bibliography, rather than References.

The APA style presented in the Module on Literature Review is the most popular style. The increasing availability of Internet sources means new forms of citing references have to be contended with in reports. These have also been duly covered in the Module on Literature Review.

Appendices
If you have constructed a questionnaire for your research, or produced an interview schedule or a code of ethics, it may be useful to include them in your report as an appendix. In general, appendices do not count towards your total amount of words so it is a useful way of including material without taking up space that can be used for other information. However, do not try filling up your report with irrelevant appendices as this will not impress those reading it. When including material you must make sure that it is relevant. Ask yourself whether a person will gain a deeper understanding of your work by reading the appendix. If not, leave it out. Other information which could be included as an appendix are recruitment leaflets or letters; practical details about each research participant; sample transcripts (if permission has been sought); list of interview dates; relevant tables and graphs or charts which are too bulky for the main report.

Unit 3: Oral Presentations
Another method of presenting your research findings is through an oral presentation. This may be at a conference to other researchers or work colleagues, or in a work place to colleagues, employers or funding agencies such as UNESCO, UNICEF, World Bank, British Council, or Management. Many researchers find that it is better to provide both a written report and an oral presentation as this is the most effective way of enabling a wider audience to find out about the research, especially if there is a need to either circulate the report to a wider audience (e.g. due to its significance or implications).

PowerPoint, part of Microsoft Office 2003 or 2007 suite, is a useful presentation graphics programme which enables you to create slides that can be shared live or on-line. You can enhance your presentation with animation, artwork and diagrams which make it more interesting for your audience. You can start off by first of all having a printed copy of your presentation – just in case there is power outage while you are presenting, at least you can continue from your printed copies of the slides.

If you want people to take notice of your results, you need to produce a good presentation. The table below provides a list of dos and don’ts when making a presentation.

Good Practices that Work in PowerPoint Presentations

Dos	Don'ts
Arrive early and make sure the room is set out in the way that you want. Make sure that all the equipment is available and that you know how to work it.	Rush in late, because if you do so, you may find that the overhead projector doesn't work, or there is no electricity!
Produce aide memoirs, either on cards, paper, OHP transparencies or presentation software such as PowerPoint.	Read straight from a paper you have written.
Make it clear from the outset whether you are happy to be interrupted or whether questions should be left for the end. If you have invited questions, make sure you make every effort to answer them.	Get annoyed if you are interrupted and have not mentioned that you don't want this to happen. Invite questions and then do not answer them or patronize the inquirer.
Look around the room while you are speaking – if it's a small group, make eye-contact with as many people as possible.	Look at your notes, never raising your head.
Make it lively and interactive – providing additional and often anecdotal information.	Read the printed presentations as if you are in a lecture.
Present interesting visual information such as graphs, charts and tables in a format which can be viewed by everyone.	Produce visual information which people can't see, either due to its size or print quality.
Alter the tone and pitch of your voice, length of sentence and facial/ hand gestures to maintain audience interest. Show that you are interested in your subject.	Present in a monotone voice with no facial/hand gestures. Make it clear that the subject of your presentation is boring even to you.
Produce a paper or handout which people can take away with them.	Let the audience go home without any record of what you have said.
Talk to people after your presentation and ask them how it went, whether there are any improvements they might suggest for future presentations.	Run away never to be seen again.

Note that the PowerPoint slides are not meant as spaces for cramming all the prose report – only highlights are expected. Consequently try to avoid overloading each slide with too much verbiage – you will only end up confusing everyone, including yourself. Each slide should be few lines, containing and conveying a direct statement which you can then explain. The presentation is a ***summary*** of your key ideas, not a reproduction of the entire report.

Note that your report will fail, in many ways, for the following reasons:

- There is no logical structure.
- Ideas are not well thought out.
- Work is disorganized.
- Assumptions are made which cannot be justified by evidence.
- There are too many grammatical and spelling mistakes.
- Sentences and/or paragraphs are too long or too obscure.

- It is obvious that ideas and sentences have been taken from other sources.
- There is too much repetition.
- There is too much irrelevant information.
- Summary and conclusions are weak.

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