NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF EDUCATION

COURSE CODE: EDU823

COURSE TITLE: Educational Research Methods

COURSE GUIDE

EDU823
EDUCATIONAL RESEARCH METHODS

Course Team Dr. Olufunmilayo I. Oloyede (Writer/Developer) -NOUN
Prof. Nduka Okon (Editor) - NOUN
Dr. I. O. Salawu (Programme Leader)-NOUN
Dr. C A Okonkwo (Coordinator)-NOUN

NATIONAL OPEN UNIVERSITY OF NIGERIA

National Open University of Nigeria
Headquarters
14/16 Ahmadu Bello Way
Victoria Island
Lagos

Abuja Office
No. 5 Dar es Salaam Street
Off Aminu Kano Crescent
Wuse II, Abuja
Nigeria

e-mail: centralinfo@nou.edu.ng
URL: www.nou.edu.ng

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CONTENTS PAGE

Introduction

EDU823: Educational Research Methods is a 3 credit course for all Masters Degree students in Education.

The course consists of 21 units divided into 7 modules at 3 units per module. The course material has been developed to suit graduate students in Education at the National Open University of Nigeria (NOUN) by adopting an approach that highlights the key areas of Educational Research.

After you have successfully completed this course you would have developed a positive attitude to research. You would be able to initiate research work, develop it and successfully execute it. You would be able to write and publish research reports. You would be able to write research proposals for grants and criticise all types of research reports with confidence. You are required to avail yourself the opportunities that abound in modern libraries such as the Internet, CD-ROM, E-mail and some current collections of research and statistics textbooks.

There are no compulsory prerequisites for this course. However, you are expected to have done some basic courses in research methods and written a project at the undergraduate level. The course however demands that you be computer literate enough to search for information from the Internet and other accessories such as the CD-ROM.

The Course Guide tells you briefly what the course is about, what course materials you will be using and how you can work your way through these materials. It suggests some general guidelines for the amount of time you are likely to spend on each unit of the course in order to complete it successfully. It also gives you some guidance on your Tutor-Marked Assignments.

What You Will Learn in this Course

This course will introduce you to the major aspects of research methods in education. During the course, you will learn about what research is all about: parts of research that deal with the identification and development of the problem; the search and use of review of literature; the different methodologies in research development; and the various techniques for the collection, writing research proposal and reports. The recent approach for referencing based on the American Psychological Association (APA) format will also be discussed.

The importance of research in a world faced with myriads of problems need no emphasis. Research deals with identifying problems and

searching for solutions for them. The problem is compounded by the fact that we are in a world that is finite which is accommodating a population both in land and sea that is doubling fast. The world will collapse if researchers in the various fields of endeavour do not seek for solutions arising from their fields. Education and science education in particular, is an area where the problems seem to defy solution: only well thought out and well executed research studies might provide panacea to these problems. On the other hand, if you are within the academic community, you have no choice but to master the techniques of research if you must climb the ladder of progress, success and greatness, and also to reach the peak of your career.

As you go through the course, you will discover that the different aspects of research are like the human body, if any part is left out, the research work and its product cannot be complete. To be an expert in research, you must endeavour to master very meticulously all aspects of research work.

Course Aims

This course aims to give you an understanding of the techniques of research and how they are used in conjunction with statistics and a good command of English language to initiate, develop and execute research work and produce quality research reports.

Course Objectives

To achieve the aims listed above, the course sets overall objectives. In addition, each unit also has specific objectives. The units' objectives are also included at the beginning of each unit; you should read them before you start working through the unit. You may want to refer to them during your study of the unit to check on your progress. You should always look at the unit objectives after completing a unit, in this way, you can be sure that you have done what is required of you.

Below are the overall objectives of the course. By meeting these objectives, you would have achieved the aims of the course as a whole. On successful completion of the course, you should be able to:

- explain what research is;
- select, shape and define research problems;
- relate theories and concepts to hypotheses formulation;
- write components of the problems;
- carry out feasibility report of a research problem;
- review related literature;
- explain constructs and variables;

- differentiate between quantitative and qualitative research;
- describe the different types of research;
- carry out a research;
- select appropriate methodology for a specific research;
- define population and sample;
- select sample from a target population;
- utilise the different sampling techniques;
- design an instrument;
- use the appropriate instrument for data collection;
- determine the validity and reliability of an instrument;
- produce a research proposal; and
- write a research report.

Working through this Course

To complete this course, you are required to read the study units, read set books and read other materials provided by the National Open University of Nigeria (NOUN). You will also need to undertake practical exercises for which you need access to a personal computer running Windows 95. Each unit contains Self-Assessment Exercises, and at certain points during the course, you will be expected to submit assignments. At the end of the course is a final examination. The course should take you about a total 42 weeks to complete. Below are the components of the course, what you have to do, and how you should allocate your time to each unit in order to complete the course successfully on time.

Course Materials

Major components of the course are:

- Course Guide
- Study Units
- Textbooks
- Assignment File will be available from the web CT OLE in due course
- Presentation Schedule.

In addition, you must obtain the set books and the Pspice computer software. There are copies of the Pspice computer student version available on the internet for download or you may also purchase your own copy of Pspice on a CD-ROM. You are advised to use version 8.0 because different versions may have different screen layouts. You may contact your tutor if you have problems in obtaining the Pspice.

Study Units

The study units in this course are as follows:

Module 1

Unit 1	What is Research?
Unit 2	Problem, Selection, Shaping and Refining
Unit 3	Theories, Concepts and Hypotheses Formulation

Module 2

Unit 1	Components of the Problem and Feasibility of a study
Unit 2	Review of Literature
Unit 3	Constructs and Variables

Module 3

Unit 1	Qualitative and Quantitative Approaches
Unit 2	Action Research, Case Study and Observation Research
Unit 3	Ethnography, Phenomenology, Grounded Theory and Correlation Studies

Module 4

Unit 1	Historical Research
Unit 2	Survey Research
Unit 3	Experimental and Quasi-Experimental Research I

Module 5

Unit 1	Experimental and Quasi-Experimental Research II
Unit 2	Ex-Post Facto Research and Evaluation Research
Unit 3	Population and Sample

Module 6

Unit 1	Sampling Techniques
Unit 2	Designing Questionnaire
Unit 3	Interview and Observations

Module 7

Unit 1	Level of Measurement, Validity and Reliability
Unit 2	Research Proposal
Unit 3	Writing a Research Report

Assignment File

The assignment file will be posted on the Web CT OLE in due course. In this course, you will find all the details of the work you must submit to your tutor for marking. The marks you obtain for these assignments will count towards the final mark you obtain for this course. Further information on assignments will be found in the assignment file itself and later in the section on assessment in this course guide. There are 21 Tutor-Marked Assignments in this course; the student should do at most 4. There are also two compulsory assignments of which one is to write a research proposal.

Presentation Schedule

The Presentation Schedule included in your course materials gives you the important dates for this year for the completion of Tutor-Marked Assignments (TMA) and attending tutorials. Remember, you are required to submit all your assignments by the due date. You should guard against falling behind in your work.

Assessments

There are two aspects to the assessment of the course: first are the Tutor-Marked Assignments; and second is a written examination.

In tackling the assignments, you are expected to apply information, knowledge and techniques gathered during the course. The assignments must be submitted to your tutor for formal assessment in accordance with the deadlines stated in the Presentation Schedule and the Assignment File. The work you submitted to your tutor will count for 50% of your total course mark.

At the end of the course, you are required to sit for a final written examination of '3 hours' duration. This examination will also count for 50% of your total course mark.

Tutor-Marked Assignment (TMA)

There are 21 Tutor-Marked Assignments in this course and you are advised to attempt all. Aside from the course material provided, you are advised to read and research widely using other references which will give you a broader viewpoint and may provide a deeper understanding of the subject. Ensure all completed assignments are submitted on schedule before the set deadlines. If for any reasons, you cannot complete your work on time, contact your tutor before the assignment is

due to discuss the possibility of an extension. Unless in exceptional circumstances, extensions may not be granted after the due date.

Final Examination and Grading

The final examination for this course will be of 3 hours' duration and have a value of 50% of the total course grade. All areas of the course will be assessed and the examination will consist of questions, which reflect the type of self-testing, practice exercises and Tutor-Marked Assignment you have previously encountered.
Utilise the time between the conclusion of the last study unit and sitting for the examination to revise the entire course. You may find it useful to review your self-tests, Tutor-Marked Assignments and comments on them before the examination.

Course Marking Scheme

The work you submit will count for 50% of your total course mark. At the end of the course, you will be required to sit for a final examination, which will also count for 50 percent of your total mark. The table below shows how the actual course marking is broken down.

Table 1 Course Marking Scheme

Assessment	**Marks**
Assignment 6 (TMA)	6 assignments, best 5 will be used for C.A = 10 x 5 = 50%
Final Examination	50% of overall course marks
Total	**100% of course marks**

Course Overview

This table brings together the units and the number of weeks you should take to complete them and the assignment that follow them.

Unit	**Title of Work**	**Weeks Activity**	**Assessment (end of unit)**
	Course Guide		
	Module 1		
1	What is Research?		
2	Problem Selection, Shaping and Refining		
3	Theories, Concepts and Hypotheses		
	Module 2		
1	Components of Setting and Feasibility of a Study		

2	Review of Literature		
3	Constructs and Variables		
	Module 3		
1	Quantitative and Qualitative Research		
2	Action Research, Case Study and Observation Research		
3	Ethnography, Phenomenology Ground Theory and Correlational Studies		
	Module 4		
1	Historical Research		
2	Survey Research		
3	Experimental and Quasi Experimental Research I		
	Module 5		
1	Experimental and Quasi Experimental Research II		
2	Ex-Post Facto Research and Evaluation Research		
3	Population and Sample		
	Module 6		
1	Sampling Techniques		
2	Designing Questionnaire		
3	Interviews and Observations		
	Module 7		
1	Level of Measurement, Validity and Reliability		
2	Research Proposal		
3	Writing a Research Report		
	Revision		
	Total		

How to Get the Best from this Course

In distance learning, the study units are specially developed and designed to replace the university lecturer. Hence, you can work through these materials at your own pace, and at a time and place that suits you best. Visualise it as reading the lecture instead of listening to a lecturer.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit, and how a particular unit is integrated with the other units and the course as a whole. Next is a set of learning objectives. These objectives let you know what you should

be able to do by the time you have completed the unit. You should use these objectives to guide your study. When you have finished the unit, you must go back and check whether you have achieved the objectives. If you make a habit of doing this, you will significantly improve your chances of passing the course.

The main body of the unit guides you through the required reading from other sources. This will usually be either from your set books or from a ***list of References/Further Reading.*** You will be directed when you need to use a computer and also the tasks you must do. The purpose of the computing work is two-fold. First, it will enhance your understanding of the material in the unit. Second, it will give you practical experiences of using programmes which you could well encounter in your work outside your studies. In any event, most of the techniques you will study are applicable on computers in normal working practice, so it is important you encounter them during your studies.

Activities are interspersed throughout the units, and answers are given at the end of the units. Working through these tests will help you to achieve the objectives of the units and prepare you for the assignments and the examinations. You should do each activity as you come to it in the study unit. There are also numerous examples given in the study units, work through these when you come to them, too.

The following is a practical strategy for working through the course. If you run into any problem, telephone your facilitator or post the questions on the Web CT OLE's discussion board. Remember that your facilitator's job is to help you. When you need help, do not hesitate to call your tutor to. In summary,

- Read this Course Guide.
- Organise a study schedule. Refer to the course overview for more details. Note the time you are expected to spend on each unit and how the assignments relate to the unit. Important information e.g. details of your tutorials, and the date of the first day of the semester is available from the Web CT OLE. You need to gather together all this information in one place, such as your diary or a wall calendar. Whatever method you choose, you should decide on and write in your own dates for working on each unit.
- Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their coursework. If you get into difficulties with your schedule, please let your facilitator know before it is too late for help.

- Turn to unit 1 and read the introduction and the objectives for the unit.
- Assemble the study materials. Information about what you need for a unit is given in the 'Overview' at the beginning of each unit. You will always need both the study unit you are working on and one of your set books, on your desk at the same time.

- Work through the unit. The content of the unit itself has been arranged to provide a sequence for you to follow. As you work through this unit, you will be instructed to read sections from your set books or other articles. Use the unit to guide your reading.
- Keep an eye on the Web CT OLE. Up-to-date course information will be continuously posted there.
- Well before the relevant due dates (about 4 weeks before the dates) access the Assignment file on the Web CT OLE and download your next required assignment. Keep in mind that you will learn a lot by doing the assignments carefully. They have been designed to help you meet the objectives of the course and, therefore, will help you pass the examination. Submit all assignments not later than the due dates.
- Review the objectives for each study unit and confirm that you have achieved them. If you feel unsure about any of the objectives, review the study material or consult your tutor.
- When you are confident that you have achieved a unit's objectives, you can then start on the next unit. Proceed unit by unit through the course and try to pace your study so that you keep yourself on schedule.
- When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your facilitator's comments. Consult your tutor as soon as possible if you have any questions or problems.
- After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives and the course objectives.

Facilitators/Tutors and Tutorials

There are 20 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of these tutorials, together with the names and phone number of your tutor, as soon as you are allocated a tutorial group.

Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter as

they would provide assistance to you during the course. You must mail your Tutor-Marked Assignments to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible. Do not hesitate to contact your tutor by telephone, e-mail, or discussion board if you need help. The following might be circumstances in which you would find help necessary when:

- you do not understand any part of the study units or the assigned readings.
- you have difficulty with the self-tests or exercises.
- you have a question or problem with an assignment, with your tutor's comment on an assignment, or with the grading of an assignment.

You should try your best to attend the tutorials. This is the only chance to have face-to-face contact with your tutor and to ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from course tutorials, prepare a question list before attending them. You will learn a lot from participations in discussions.

Summary

EDU823: Educational Research Methods intends to expose you to research techniques. Upon completing the course, you will be equipped with the knowledge required to produce a good research work. You will be able to answer questions such as:

- What does research mean?
- How does one identify research problems?
- What is the role of literature?
- What are the qualities of a good research proposal?
- At what level of significance will I reject this hypothesis, etc?

We wish you every success in the future.

Course Code EDU823
Course Guide Educational Research Methods

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CONTENTS PAGE

MODULE 1 BASIC ISSUES IN RESEARCH METHODS

UNIT 1 WHAT IS RESEARCH?

CONTENTS

1.0 INTRODUCTION

Research has become such a prevailing phenomenon of our civilisation that all of us are impacted by it. Scholars and practitioners of various academic disciplines and professions engage in research. Students do not progress very far in our formal education system without encountering the necessity to do some type of research. Research is conducted in many settings, laboratories, classrooms, libraries, the city streets, and foreign cultures, just to mention a few. A lot of research is now done by computer.

Graduate students may find it difficult, at least early in a graduate programme to identify with research situations and to key into a process of conducting research. It may be that the only motivation for taking a research methods course and for engaging in research at all is that they are required in the graduate programme. Expertise and experience for conducting research are limited, so the necessity for this course.
No course, no matter how well designed can be expected to confer research competence, nor can any book, present all relevant information. Research skills and understanding are achieved only through the combination of a course like this and experience.

This course aims at providing you with tools to do research, to help you to avoid some of the pitfalls and time-wasting trails, to establish good research habits and to take you from the stage of selecting a topic

through to the production of a well-planned, methodologically sound and well-written final report or dissertation. Specifically, in this unit you will find the answer to the question "what is research?"

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain what research is;
- state the characteristics of a research;
- list the goals of research;
- explain the role of theory in research; and
- name the different types of educational research.

3.0 MAIN CONTENT

3.1 Definition of Research

The term "Research" is used to cover a broad spectrum of meaning in everyday speech; this makes it a confusing word for the students – especially those who must learn to use the word in its specialised denotation.

When it comes to matter of research, the situation of the average consumer – primary or secondary school teacher, counsellor or administrator is not much different from that of the graduate student. In fact, a considerable portion of the graduate student population is often made up of school personnel pursuing graduate degrees on a part-time basis. But regardless of degree requirements, research is done for the purpose of explaining and predicting phenomena, and in the case of educational research, those that impact upon teaching and learning and the operation of the schools. There is an inherent assumption that educational research, by providing a better understanding of the education process will lead to the improvement of educational practice. Decision making in the schools is based on a combination of experience, expert opinion and research results, and the professional educator should be knowledgeable about research methodology and results.

Often the students who spend the whole day in the library making notes from textbooks and other publications or the one who visits many websites in the computer or another who manages through available sources to retrieve some information all claim to be doing research. Research has been defined by many scholars, science educators and others. Some of the definitions are stated below:

Leedy (1997) defines research as the systematic process of collecting and analysing information (data) in order to increase our understanding of the phenomenon with which we are concerned or interested. Leedy goes on to state what research is not. Research is not mere:

i. information gathering;
ii. transformation of facts from one location to the other;
iii. rummaging for information; and
iv. catchword to get information.

SELF-ASSESSMENT EXERCISE 1

1. State two operational terms in Leedy's definition of research.
2. Give two examples of what research is not.

According to Leedy, research is an activity or process through which we attempt to systematically and with the support of data, give an answer to a question, the resolution of a problem or a greater understanding of a phenomenon. This process is called research methodology.

According to Leedy, the process has the following eight characteristics:

(i) Research originates with a question or problem: The world is filled with many unanswered questions and unresolved problems. Everywhere we turn, there are things that make us wonder or ask questions. And by asking questions, we strike the first spark igniting a chain reaction that terminates in the research process. An inquisitive mind is the beginning of research. He asserts that the hope of mitigating our ignorance lies in the question we ask and the information we gather in whose collective meaning we may find insight.

(ii) Researchers require a clear articulation of a goal: a clear unambiguous statement of the problem is critical. This statement means that ambiguity must be avoided in research and goals must be stated clearly and precisely.

(iii) Research requires a specific plan of procedure: Research is not an excursion into happy expectation of fondly hoping that the data necessary to solve the problem will magically turn up. Rather it requires a carefully planned attack, a search and discovery mission, properly planned in advance. Researchers plan their overall research design and specific research methods in a purposeful way – i.e. to yield data relevant to their particular research problem. The research design and methods to be used depend on the specific research question.

(iv) Research usually divides the principal problems into more manageable sub-problems: The whole is composed of some of its parts. That is, a universal natural law, that is also a good precept to observe in thinking about one's principal goal in research. Principal problems are broken down much more frequently than is realised. Definitely, most researchers do not take time or the trouble to isolate the lesser problems within the major problem and consequently their research projects become cumbersome and unwieldy.

(v) Researchers are guided by specific research problems; question or hypothesis: A hypothesis is a logical supposition, a reasonable guess, an educated conjecture. It may direct your thinking to the possible source of information that will aid in resolving the research problem through the resolution of attendant sub-problems. Hypotheses are constant recurring features of everyday life. They present the natural working of the human mind. Each of these hypotheses provides a direction for exploration to locate the information that may resolve the problem of malfunction. It is noteworthy that hypotheses are never proved; they are either rejected or accepted. After the hypotheses come data. The data either support or fail to support the hypotheses. Many of the greatest discoveries in science have begun as hypotheses.

(vi) Research accepts certain critical assumption: In research, assumptions are equivalent to axioms in geometry i.e. self-evident truths, the sine qua non of research. The assumptions must be valid or else the research cannot proceed. For this reason, careful researchers – certainly in academic research – set forth a statement of the assumption as the bedrock upon which their study must rest. In your research, therefore, it is important that others know what you assume with respect to your study. Note, that an assumption is a condition that is taken for granted, without which the result situation would be impossible. For the beginning researcher, you need to state your assumptions, for it is better to be over explicit than to take too much for granted.

(vii) Research requires the collection and interpretation of data in attempting to resolve the problem that initiated the research: Having isolated the problem, divided it into appropriate sub-problems, posited reasonable questions or hypotheses and recognised the assumptions that are basic to the entire effort, the next step is to collect whatever data that seem appropriate and to organise them in meaningful ways so that they can be interpreted. Data, events, happenings and observations are of themselves only

data, events and observations – nothing more. The significance of the data depends on the way the human mind interprets the information from those data. In research, unprocessed data are worthless.

(viii) Research is by its nature, cyclical or more exactly helical: The research process follows a cycle and begins simply. It follows logical developmental steps.

What however, seems like a neat circle may never be conclusive. In exploring an area, one comes across additional problems that need to be resolved. Research begets research. To view research this way is to invest it with a dynamic quality i.e. its true nature which is different from the conventional view, which sees research as static, self-contained and an end in itself. Every researcher eventually learns that genuine research creates more problems than it resolves. Such is the nature of the discovery of knowledge. You will note that all this while, we have been discussing Leedy's definition of research and his eight distinct characteristics of research methodology.

SELF-ASSESSMENT EXERCISE 2

Explain why research requires a specific plan of procedure.

Best and Khan (1995) define research as the systematic and objective analysis and recording of controlled observations that may lead to the development of generalisations, principles or theories, resulting in prediction and possibly ultimate control of events. Due to the abstract nature of this definition, they stated a summary of characteristics of research which according to Best and Khan (1995) may help to clarify its meaning. The characteristics are summarised below.
Research:

- emphasises the development of generalisations, principles or theories that will be helpful in predicting future occurrences;
- is based upon observable experience or empirical evidence;
- involves gathering of new data from primary or first-hand sources or using existing data for a new purpose;
- is often characterised by carefully designed procedures that apply rigorous analysis;
- requires expertise;
- strives to be objective and logical, applying every possible test to validate the procedures employed, the data collected and the conclusions reached;
- involves the quest for answers to unresolved problems;

- is characterised by patient and unhurried activity;
- is carefully recorded and reported; and
- sometimes requires courage.

Best and Khan believe that a researcher should be a scholarly imaginative person, with a high integrity, who is willing to spend long hours painstakingly seeking truth. They noted that researchers are human beings, and ideals that have been listed are never completely realised. Like righteousness, their goals to strive for it are not at all achieved by every research.

SELF-ASSESSMENT EXERCISE 3

Mention three similarities and two differences between Leedy's and Best and Khan's characteristics of research.

3.2 Classification of Educational Research

There are many ways to classify educational research studies, and authors use classification systems of varying degrees of complexity. Essentially, classification systems are valuable to the extent that they are useful for enhancing the effectiveness and efficiency by which research is conducted. Three systems are described here, the first based on the goal or purpose of the research; second is the qualitative – quantitative dichotomy that represents two distinct orientations to phenomenon being studied. The third system is a classification of general methods used in educational research. All of the three systems will be discussed in greater details in this course. However, below are listed the different types of research based on the three systems discussed above:

i. Basic and applied research;
ii. Qualitative and quantitative research;
iii. Experimental research;
iv. Quasi-experimental research;
v. Non-experimental quantitative research;
vi. Historical research; and
vii. Ethnographic research.

SELF-ASSESSMENT EXERCISE 4

State the three systems of classifying research.

4.0 CONCLUSION

In this unit, you have learnt the:

- different definitions and characteristics of research;
- goals of research; and
- different types of research.

5.0 SUMMARY

You have been introduced into research methods by discussing its definitions, characteristics and types. In the next unit, we shall discuss the steps to be taken in conducting a research.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss why there is no single definition of research.
2. In your own opinion, why do we have different classifications for educational research?

7.0 REFERENCES/FURTHER READING

Best, J. W. & Khan, J.V. (1995). *Research in Education* (7th Edition). New Delhi: Prentice Hall. PP 20-23.

Leedy, P. D. (1997). *Practical Research: Planning and Design* (6th Edition). New Jersey: Morill, PP103 – 110.

William, W. & Stephen, G.S. (2005). *Research Methods in Education.* (8th Edition). Boston: Allyn & Bacon, PP 1 – 18.

UNIT 2 PROBLEM SELECTION, SHAPING AND REFINING

CONTENTS

1.0 INTRODUCTION

In this unit, we shall discuss how to select a research topic. In most cases, you are expected to select your research topic by yourself, though occasionally, your supervisor may suggest a topic for you. Note that the supervisor can only suggest as the final choice of a research topic is that of the researcher. However, both the supervisor and the student must necessarily agree on the topic to be researched into. Selection of an appropriate research topic for investigation is the first hurdle to be crossed by a researcher. In this unit, you will learn how to go about selecting a topic for investigation.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- select a research topic for investigation;
- identify the various sources of materials for choosing a topic;
- shape and refine a research problem;
- recognise that personal interest plays a role in selecting a research topic;
- narrow a wide research topic to workable size.

3.0 MAIN CONTENT

3.1 Selecting a Research Topic

This is the first activity in the research process and it is often the most difficult especially for beginners. The problem must be identified with adequate specificity. It is at this point in many studies that hypotheses – tentative "guesses" or conjectures about whatever is being studied are generated. Variables must be identified and defined adequately for their use in the context of the study so that necessary data can be identified in preparation for data collection. This is done on the basis of existing knowledge. The literature is reviewed for information related to the research problem and to the possible methods for conducting the research, basically to determine what others have done and have discovered that might be useful.

One fact a beginner should bear in mind, is that research is often tasking, slow and rarely spectacular. It should be realised that the search for truth and the solution to important problems take a great deal of time and energy and intensive application of logical thinking. In the search for a topic for study of investigation, the definition and characteristics of research must be borne in mind.

3.2 Likely Sources for Suitable Research Topic

Many of the problems confronted in the classroom, the school or the community lend themselves to investigation. Also, technological changes and curricula developments are constantly bringing forth new problems and opportunities for research. For example, the impact of Universal Basic Education programme (UBE) on such things as primary school enrolment, production and sale of primary science instructional materials, the state's concern for primary science etc. The whole area of computer education provides avenue for a good number of research topics through CD-ROM and Websites. Also, through international abstracts typed for computer process. , classroom lectures, class discussions, seminar reports and out of class exchange of ideas with fellow students and lecturers could suggest many stimulating problems for solution. Reading assignments, particularly journals and current textbooks, research reports, term papers often suggest additional areas of needed research.

The selection of an appropriate problem is a matter of asking good questions – that is, questions that are relevant and important in the educational context. There are different ways by which research problems are selected, not all of them are due to the internal motivation of the researcher, desirable as that may seem. Graduate students seeking

research problems in order to complete the requirements for a graduate degree typically zero in on a research problem in one or two ways. They associate themselves closely with the research efforts of one or more professors serving as their mentors, and identify a related problem or one that comprises a subset of that research effort. The assumption is that the reason students are studying with specific professors is because of mutual interest. The second way is through discussions with other graduate students, some of whom are farther along in the graduate programme and can provide insight into the selection process.

Although the selection of a research problem may seem to be somewhat of a "broad" process as described above, there are certain factors that facilitate the process. The research problem should be of interest to the researcher, and to at least some recognised segment of the education profession. Its place in the context of education should be assured, especially if the research topic is being selected for a thesis, but a completely original research idea is rare. It is more likely that the research will be an extension of some already completed project. The extent of duplication or replication that is desirable in such studies depends on the specific area and the conditions of the research.

SELF-ASSESSMENT EXERCISE 1

What is the most reliable factor to be considered in choosing a research topic?

Another factor is the significance of the research problem for education from either a practical or theoretical viewpoint. Trivial problems – for example the proportions of elementary students who wear canvas or leather shoes and the relationship of this choice of footwear to achievement – can be researched procedurally. Many research problems can be identified relative to the effects of school reform. A research problem should add to the existing knowledge or contribute to the educational process in a meaningful way.

Also, previous research can lead to new research if there is reason to doubt or question the findings of the original study. If you have a reason to suspect research findings, then you have a ready-made topic on which to conduct a research yourself.

Evaluation in the form of programme evaluation and practice effectiveness evaluation has become an increasingly important activity in science educators' agencies or organisations that fund science education programme these days demand that evaluation study be conducted if funding is to be granted or continued. Such research

developed for various practical reasons can take many forms often such studies are commissioned by the funding agency.

SELF-ASSESSMENT EXERCISE 2

Why do funding agencies demand evaluation of project?

3.3 The Political Context of Problem Selection

The impression one might have from the preceding discussions is that the problem selection process is largely a matter of personal preferences. But problem selection, like most other types of human activity, cannot be explained solely in such individual terms. In fact, many students chose their research topics based on some theoretical orientation or practical interest; some selection were guided by such factors as: my supervisor had much information on the topic, so I hope studying might help me get a better grade, or I got financial assistance to work on the topic, etc.

This means issues in political efficacy can influence problem selection. In the world of professional research, the situation is like that of the student. Although the number of problems to be studied may be infinite, the resources society can allocate to them are not. Research is a major societal enterprise in which universities, non-governmental organisations, private research corporations and independent researchers compete with each other for limited resources. At the same time, there are forces working in the society, to make sure that the concerns of the vested interest groups receive attention from the research community. If you select a good topic for your study, you could attract some external sponsorship. The above discussion shows that problem selection for grant aided research is very much a political issue.

3.4 Consultation with Supervisor

The major focus of this unit is how to select a research topic. A lot of students waste much time searching for a topic, some even abandon the course midway because of inability to select a topic acceptable to the supervisor. It becomes highly frustrating when almost all the topics presented to the supervisor are not feasible. However, the student must be determined, patient and persistent on his/her search.

However, consultation with your supervisor is helpful. Although, the student should not expect research problems to be assigned, consultation with supervisors or departmental lecturers in the department is very desirable. Most students feel insecure as they approach the choice of a research problem. They wonder if the problem they may have in mind

is significant enough, feasible and reasonably free of unknown constraints. To expect a student to arrive at the supervisor's office with a complete acceptable problem is quite unrealistic. One of the most important functions of the supervisor is to help student clarify their thinking, achieve a sense of focus, and develop a manageable problem from one that may be top, vague and complex.

SELF-ASSESSMENT EXERCISE 3

Explain reasons why some students abandon their graduate work?

3.5 Shaping and Refining a Research Problem

Not all problems in education are researchable. Some are philosophical in nature and can be discussed but not researched. An example is a question such as, "should the history requirement in the senior high school be one or two courses?" Chances are that if the requirement is two courses, the students will learn more history, but the question remains whether it is important that they have two courses. Answers to such questions are mostly based on value judgements. If additional conditions are not stipulated, the questions are not researchable. Even if problems are researchable, doing the research may not be feasible. The necessary data for the study may be excessive or may be too difficult to obtain. Ethical considerations may be an invasion of the individual's privacy. Necessary resources such as laboratory facilities and funds may not be available. Many of these kinds of conditions can make it impractical to research a specific problem. Sometimes, the research topic is so broad and encompassing that by itself, it offers little guidance in terms of how to proceed. An example is, "Policy development in higher education in Nigeria". This is a broad topic that lacks focus. The next step is the research process which is translating a general topical interest into a precise researchable problem. The scope of the problem needs to be narrowed to manageable proportions. Refining, narrowing and focusing a research problem do not occur at once but rather from a continuous process involving a number of procedures, such as conceptual development, review of literature, unit of analysis and reactivity.

3.5.1 Conceptual Development and Literature Review

A key step in refining a research problem is conceptual development, which entails identifying and defining the concepts that will be the focus of the study. In exploratory studies of a course, we are entering areas where there is little conceptual development and a major purpose of the research itself may be to identify and define concepts. In cases where there is an existing theory and research to rely on however, some

conceptual development occurs as a part of formulating a research programme. One important part of the process is to narrow the focus of the concept so that it encompasses something that is feasible to research in a single study. For example, study on "policy development in higher education in Nigeria" could be reduced to Gender in Science Education in a specified zone of the state or country. Once the key concepts have been clearly defined, the next consideration is their measurability. As a rule, only concepts that are in some way measurable can be used in the research process. Eventually, concepts will have to be measured (defining how effective are the concepts) so that any concept that is not readily measurable will be dropped.

With concepts measurable and deemed to be measurable, the next step is the review of related literatures on the topic. This is done to familiarize the researcher with the current state of knowledge in this area and to learn how others described similar problems. It is unlikely that a researcher will formulate his/her problem like any of the previous researchers, except in a replication study. Through review of literature, the focus of the research project could be narrowed to ensure that what others have done are not unnecessarily duplicated. The researcher is also likely to avoid pitfalls by learning from the experience of others. It might be, for example, that one or more specific approaches to a topic have proved unproductive i.e. several studies have failed to find significance results or strong relationships. Unless there is good reason to believe that there were methodological weaknesses in these earlier studies, using the same approach is likely to lead once again to failure. Research is likely to be more productive, if it focuses on studies that have achieved some positive results.

SELF-ASSESSMENT EXERCISE 4

Discuss the importance of literature review in reshaping a research problem.

3.5.2 Units of Analysis and Reactivity

Units of analysis are the specific objects or elements whose characteristics are to be described and explained and about which data will be collected. Although there are many units of analysis, five commonly used in humanities are: individuals, groups, organisations, programmes and artifacts.

Much of survey research focuses on the individual as the unit of analysis. The typical survey, for example, obtains information from individuals about their opinions, attitudes or behaviours. Anytime you define a population of inquiry with reference to some personal status,

then you are operating at the individual level of analysis. If you identify your unit of analysis as an individual, it is important to recognise that the entire analysis will remain at that level. At times, the study may focus on groups such as teachers as the unit of analysis and data are collected on group characteristics or behaviour. Also, studies in humanities could deal with organisations such as teachers, schools, unions, governments, and corporations. Research in humanities can focus on programmes as the basic unit of analysis. The programme may provide services for and it may exist as part of an organisation, but it is still a separate unit of analysis about which data can be collected.

Another unit of analysis is the social artifacts which are simply any material products produced by people. Examples are many, such as books, magazines, automobiles etc. Clearly specifying the unit of analysis in research is very important in order to avoid an illegitimate shift in the analysis from one unit to another. Shifting from one level to another can result in drawing erroneous conclusions. An example of this kind of error is called ecological fallacy which is inferring something about individuals based on data collected about groups. A clear awareness of the unit of analysis which a researcher is dealing with can help ensure that no illegitimate shifts are made.

Another point to consider in refining and shaping a problem is the issue of reactivity. This term refers to the fact that people can react to being studied and may behave differently from when they do not know they are being studied i.e. the data collected from people who know they are objects of study might be different from that collected from the same people if they did not know. Therefore, a reactive research technique changes the very thing that is being studied. Suppose you are a teacher, and a researcher comes to observe the teaching and classroom interaction, definitely the reaction of the teacher and the pupils would be such that would provide the best possible classroom environment and interaction.

SELF-ASSESSMENT EXERCISE 5

Summarise the two units of analysis commonly used in humanities studies.

4.0 CONCLUSION

In this unit, you have learnt that several factors should be considered when choosing a research topic. Information on suitable topics on research could be obtained from a variety of sources including libraries, journals, CD-ROM, websites etc. An identified general research topic must be narrowed and focused into a precise researchable problem. The

shaping and refining of a research problem involves: conceptual development, review of literature, units of analysis and reactivity.

5.0 SUMMARY

You have studied how to select, refine and reshape a research problem.
In the next unit, you will learn concepts theories and formation of hypotheses.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the various ways through which you can select a research problem.
2. Explain the influence of the following on a research topic:

   Literature review

7.0 REFERENCES/FURTHER READING

Best, J.W. & Khan, J.V. (1995). *Research in Education* (7th Edition). New Delhi: Prentice Hall. PP 20 – 23.

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UNIT 3 THEORIES, CONCEPTS AND HYPOTHESES FORMULATION

CONTENTS

1.0 INTRODUCTION

In the last unit, we discovered that a well articulated research topic provides a focus for the entire study. This unit will explain how to formulate hypotheses, concepts and theories which are all components of scientific knowledge. A good research follows the scientific approach in its execution. According to Kerlinger (1973), a scientific approach is a special organised form of all reflective thinking and inquiry and he views the formulation of a problem thus – "the scientist will usually experience an obstacle to understanding a vague unrest about observed and unobserved phenomena, a curiosity as to why same is as it is. His first and most important step is to get the idea out in the open, to express the problem in some reasonably manageable form. Rarely will the problem spring full blown at this state. The formulation of a good research problem requires time, reflection and examination of all possible components.

In this unit, you are going to study about theory and concept and the role they play in hypotheses formulation.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define a theory
- define a concept
- explain the relationship between concept and theory

- discover the role played by concept and theory in the formulation of a research problem
- write statement of the problem for a chosen research topic.

3.0 MAIN CONTENT

3.1 What is a Theory?

The term "theory" is used often in educational research: for example, we talk about curriculum theory or learning theory. Kerlinger and Lee (1999) define a theory as "a set of interrelated constructs (concepts), definitions and propositions that present a systematic view of phenomena by specifying relations among variables with the purpose of explaining and predicting the phenomena" (p. 11).

Brodbeck (1963) includes many of the same ideas in her discussion of theory, adding that a theory is a set of laws and that all statements in a theory, both explained and explaining are generalisations. The laws doing the explaining are the axioms; the generalisations explained are the theorems. Theories can range from a single, simple generalisation to a complex formulation of laws. She thus summarises that "a theory is a generalisation or series of generations by which we attempt to explain some phenomena in a systematic manner".

In comprehending theories and the role they play, it is helpful to realise that "theories are used in our everyday lives, although they may not be called theories or people may not be aware of using them. Nonetheless, our decisions and behaviour are based on our past experience and what we have learned from others. From these experiences, you can generalise that certain physical, psychological and social processes are operative and will continue to be important in the future with predictable consequences. This is our "common sense" theory about how the world operates and forms the basis for our decisions.

Unlike common sense theories, theories in research are precise, detailed and explicit. It is however important to recognise that a theory is always tentative in nature. By conducting research, scientists gather evidence that either supports or fails to support a theoretical explanation or practice intervention. No theory stands or falls on the basis of one trial. Theories are tested over a long period of time by many investigations. Only with the accumulation of research outcomes can you begin to have confidence concerning the validity of a theory.

SELF-ASSESSMENT EXERCISE 1

Define a theory.

3.2 The Functions of Theories

Basically, theory helps provide a framework by serving as the point of departure for the pursuit of a research problem. Theory identifies the crucial factors. It provides a guide for organising and connecting the various facets of the research. However, besides providing the systematic view of the factors under study, the theory may also very well identify gaps, weak points, and inconsistencies that indicate the need for additional research. Also, the development of the theory may light the way for continued research on the phenomena under study. In educational research, theory serves as synthesising function, combining ideas and individual bits of empirical information into a set of constructs that provides for deeper understanding, broader meaning and wider application. In a sense, a theory attaches meaning to facts and places them in proper perspective. Through this process, the theory aids in defining the research problem; that is, it helps to identify the proper questions to be asked in the context of the specific project.

As indicated in Kerlinger and Leeds (1999) definition, a theory also serves the purposes of explaining and predicting. It suggests an explanation of observed phenomena and it can also predict as yet unobserved or undiscovered factors by indicating their presence. Operating under the assumption that the theory is consistent, the researcher is then tipped off: in terms of what to look for. Another function of theory is to provide one or more generalisations that can be tested and then used in practical applications and further research. This development of generalisations is based on the assumption that generalisations do exist in education (or in any area under study) and that individual observations are special cases of such generalisations.

3.2.1 Characteristics of a Good Theory

Conditions under which research is conducted and data are obtained within and across studies tend to be more valuable when incorporated into a meaningful unit: standing alone, they may not mean much. As the facts of the research study, the data derive significance from the theory or theories which they fit. Conversely, the theories become acceptable to the extent that they enhance the meaning of the data. Through this process, more adequate theories and unobstructed facts are secured; theory stimulates research and conversely, research stimulates theory development and theory testing.

The criterion by which we judge a theory is not its truth or falsity, but rather its usefulness. Theories sometimes decrease in usefulness in the light of new knowledge, and they are combined, replaced and refined as more knowledge is made available.

A good theory is developed in such a way that the generalisations can be tested. The theory must be compatible with the observations made relative to it and with already existing knowledge. It must adequately explain the events or phenomena under study. The greater the generalisability of the theory the more useful it will be because of its wider applicability.

Another characteristic of a good theory is reflected in the law of parsimony, which holds that a theory should be stated in the simplest form that adequately explains the phenomena. This does not mean that all theories should be simple statements; rather, they should be stated succinctly and precisely, avoiding ambiguities and unnecessary complexity. Important factors must not be overlooked, and the comprehensives of the theory must be adequate for its purpose.

3.3 Concepts and Hypotheses

3.3.1 Defining Concepts

An important part of theories are concepts. These are mental constructs or images developed to symbolise ideas, persons, things or events. Concepts are the "elements of theories discussed earlier, they are the building blocks that are interrelated in propositions that form the explanatory statements of a theory. Scientific concepts, like worlds in everyday language, are also symbols that can refer to an extremely broad range or referents. They may refer to something concrete like mass or something highly abstract like cohesion and adhesion.

Monnete et al (1994) state that scientific analysis involves two types of definitions of concepts – each functioning at a different level of analysis and serving different purposes. At the theoretical or abstract level, concepts are given nominal definitions, verbal definitions in which scientists agree that one set of words or symbols will be used to stand for another set of words or symbols. Nominal definitions are directly analogous to the dictionary definitions of ordinary words in which a phrase is designed to give meaning to the word or concept being defined (Cohen and Nagel, 1934).

An important step in moving from the abstract level of theory to the concrete level of research is to give concepts operational definition: definitions that indicate the precise procedures or operations, to be followed in measuring a concept. The process of moving from nominal to operational definitions can be complex because concepts are more general than abstract, and controversy often arises over exactly what they refer to. So it should be evident that operationalising concepts can be difficult, complex and sometimes, controversial. The process of

moving from the nominal to the operational level is called measurement and will be treated in this course.

SELF-ASSESSMENT EXERCISE 2

Explain why we should be cautious of operationalising concepts.

3.3.2 Developing Hypotheses

Any attempt to include all specific information in the statement of the problem would make the statement cumbersome and unmanageable, so hypotheses may be developed to provide more specificity and direction. Hypotheses may be derived directly from the statement of the problem. They may be based on the research literature, or in some cases, they may be generated from data collection and analysis. A hypothesis is a conjecture or a guess at the solution to a problem or the status of the situation. In a general sense, hypothesis take on some of the characteristics of a theory, which is usually considered a larger set of generalisations about a certain phenomenon. Thus, a theory might include several hypotheses. Logically, the approach is to proceed so that a decision can be made about whether or not the hypotheses are tenable. This is called testing the hypothesis; the results of such a test either support or refute the hypothesis.

What are the characteristics of hypothesis?

There should be a definite reason for the hypothesis either from a theory or from some evidence that it is a useful and valuable hypothesis. Typically, a hypothesis states a relationship or effect between variables and this should be done in a straightforward and clear manner. Finally, a hypothesis should be testable; indeed much of research is directed towards testing hypothesis. A weakness of many hypotheses is that they are too broad to pinpoint the specific problem under study – as for example, in the following hypothesis, "Bright students have good attitudes towards school."

The term bright, good and attitudes represent types of broad, undefined generalities. Some type of vague relationship between brightness and good attitude is implied, but little direction for research is provided. To convert the statement into an acceptable hypothesis, it might be changed to read:

"A positive relationship exists between the scores on the (specific) IQ test and the (specific) attitude inventory for students aged nine through eleven".

This new statement of the hypothesis includes expected relationship and it is testable. It contains the operational definitions of the statements involved: academic aptitude (brightness) and attitude towards school. These variables are defined by scores on a specific test and a specific inventory.

Developing hypotheses from theories is a creative process that depends in part on the insight of the investigator. Because hypotheses link theories to particular concrete settings, the researcher's insight is often the trigger to making such connections. Also, researches combine two or more theories to develop hypotheses that neither theory alone is capable of generating.

3.3.3 The Research Problem

The heart of the research project is the problem. The first important state in a research is to articulate an acceptable problem. Whatever you do should have one purpose: to formulate a problem that is carefully phrased and represents the single goal of the research efforts. The selection of an appropriate research problem is a matter of asking good questions …. that is questions that are important and relevant in the educational context. Successful researchers at every step in the investigation ask themselves; "what am I doing, and for what purpose am I doing it?"

Selection of a research problem does not necessarily mean it is adequately stated. Usually, a problem requires some modification to get it into a suitable form for the study to proceed effectively. A problem may be stated broadly and then systematically restricted through a review of the literature in the initial stages of the research effort. It is better to work in this direction than to begin with a problem that is too narrow and then attach pieces to expand it.

Research problems may be stated in a declarative or descriptive manner or in question form. Many researchers, possibly the majority, prefer the question form, but either form is acceptable. The question form may aid in focusing the problem, and it is especially effective when sub-problems, are included within the larger research problem. The most important characteristic of the problem statement is that it must provide adequate focus and direction for the research.

At this point, it might be useful to give an example of satisfactory and unsatisfactory problem statements. A term such as "the elementary school curriculum" is far too broad to serve as a problem statement: in fact, it really contains no problem. A satisfactory statement might be: "A study of the effects of elementary school curriculum practices on the

reading achievement of primary six pupils in Lagos State". Or in question form, we might have "What are the effects of elementary school curriculum practices on primary six pupils in Lagos state?"

A good statement of the problem should provide the researcher with direction in pursuing the research. The basic directive for the statement of the problem is: Always state the problem in a complete grammatical sentence in as few words as possible.

A problem could be: "A survey of the level of understanding of chemistry textbooks by Nigerian Secondary School students".

This is a problem. The next stage will be to state the purpose of the problem. This may include to:

i. determine the difficulty level of the textbooks;
ii. find if all the books treat all topics in the syllabus sequentially;
iii. compare the understanding of the books between students in public schools with those in private schools; and
iv. find out if students in rural areas understand the books as much as those in urban areas.

Having stated the purpose, the next will be the research questions. Once the research objectives are stated, both the research questions and hypotheses will be easier to state. Research questions based on the topic could be:

i. Do Nigerian students understand the chemistry textbooks available in the country?
ii. Do all the chemistry books treat all the topics in the syllabus sequentially?
iii. Do urban students understand the chemistry textbooks better than the rural students?
iv. Do public schools students understand the chemistry text books better than private school students?

More questions and objectives could be raised.

SELF-ASSESSMENT EXERCISE 3

What will be the meaning of the variable "understanding" in the study above?

3.3.4 Developing Hypotheses

The wide and controversial nature of this topic is deliberate as it will be used in discussing other aspects of this course. Hypotheses can be stated in two different forms either in a directional manner or in a 'null' form. Examples of directional hypotheses are:

i. Urban students understand the chemistry textbooks better than rural students.
ii. Public school students do not understand the chemistry textbooks better than the private school students.

Null Form:

a. There is no significant difference in the understanding of the chemistry textbooks between urban and rural school students.
b. There is no significant difference in the understanding of the chemistry textbooks between public and private school students.

Hypotheses could also be stated in a correlational manner, such as:

"There is no relationship between the understanding of the physics textbooks by urban and rural students"

The concise title of the problem, the research objectives, the research questions and the hypotheses constitute the very important part of the research known as the research problem. If there is no problem, there will be no research because research is all about solving the identified problem.

Stating the Hypotheses and/or Research Questions

Hypotheses as discussed earlier in this unit are tentative, intelligent guesses posited to direct one's thinking toward the solution of the problem. Research questions provide another means for guiding and directing researchers thinking and are more common in non-quantitative studies. Hypotheses and questions are helpful because the researchers need some points around which to orient the research in searching for relevant data and in establishing a tentative goal against which to project the data.

You should note that hypotheses are neither proved nor disproved. They are tentative propositions set forth as possible explanations for an occurrence or a provisional conjecture to assist in guiding the investigation of a problem.

The Null Hypothesis (H_0)

The null hypothesis relates to a statistical method of interpreting conclusions about population's characteristics that are inferred from the variable relationships observed in samples. The null hypotheses assert that observed differences or relationships merely results from chance errors inherent in the sampling process. This will be discussed further in this course.

SELF-ASSESSMENT EXERCISE 4

Name the various ways by which hypotheses can be stated.

4.0 CONCLUSION

In this unit, you have learnt that:

- a theory is a set of interrelated constructs; and,
- guide for research and integration of multiple observations;
- concepts are building blocks and operationalising concepts are difficult;
- hypotheses link theories to particular concrete settings;
- the heart of the research project is the problem;
- hypotheses can be stated in the directional and null forms;
- the concise topic, objectives, questions and hypotheses constitute the statement of the problem; and
- null hypothesis asserts that observed differences or relationships merely result from chance errors inherent in the sampling process.

5.0 SUMMARY

In this unit, the role of theory and concept in the formulation of hypotheses were discussed. Also, how to state the statement of the problem involving the topic, objectives, questions and hypotheses were also discussed. In the next unit, components of a problem feasibility of a study will be discussed.

6.0 TUTOR-MARKED ASSIGNMENT

1. Explain what is meant by a theory?
2. Discuss the role of concepts in formulating hypotheses.
3. Write one each of research questions, objectives and hypotheses on the topic: "The effect of Remedial Mathematics on students' performance in chemistry".

7.0 REFERENCES/FURTHER READING

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MODULE 2 STATING PROBLEMS, LITERATURE REVIEW AND VARIABLES

UNIT 1 COMPONENTS OF SETTING A PROBLEM AND FEASIBILITY OF A STUDY

CONTENTS

1.0 INTRODUCTION

In unit three, you learnt about the major components of the research problem – objectives, research questions and hypotheses. The statement of the problem establishes the main objectives of the research project. The sub-problem provides ways of managing the study for focus and scope. Other components of the research that will be discussed in this unit are delimiting the research, stating the assumption, discussing the significance and definition of terms. By the time you have selected, shaped and refined a research problem, the discussion of the feasibility of the study becomes important. Often, practical considerations of what can be reasonably accomplished given the time and resources available can force the researchers sometimes painfully to reduce the scale of a project. A careful and honest appraisal of the time and money required to accomplish a project will be useful in determining the feasibility of the project as planned and show if a modification is necessary. Time

and money are two important issues when considering a research, particularly those for fulfilling a requirement for the award of a degree like you are doing now. This unit will address the components of setting the problem as well as the feasibility of the study.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- delimit a research
- state the assumptions of a study
- describe significance of a study
- define terms that may assume specific meanings in a study
- carry out a feasibility on the researchability of a study.

3.0 MAIN CONTENT

3.1 Components of Setting a Problem

As mentioned in the introduction, there are components of the setting of the problem, which help in shaping and refining the problem and provide a focus and manageable scope for it. They also help the researcher to quicken the pace of the study and the reader in understanding it. Each component is discussed below.

3.1.1 Delimitation

These are the boundaries of the study. For example, a study on "Attitude of students towards integrated science" may be concerned with Junior Secondary School (JSS) II students with a defined location such as state, local government or a school or schools in a community. Often, conclusions are not to be extended beyond this population sampled unless the researcher can justify beyond reasonable doubt that the additional groups have the same characteristics. Also, this aspect of the study should provide full information of what the researcher intends to do and not to do. For example, in choosing the subjects for the study, the researcher may decide not to include all students who transferred from other schools and those who attend science classes irregularly.

The problem of delimitation often arises because of large area that might be covered by the statement of the problem. For example, the researcher might discover that students from upper or middle class have all the recommended textbooks and other instructional materials. She may decide later to classify the students into high and low income groups in order to find out the attitude of groups towards science. This raises a problem to the researcher thus: Should the new issue be included into

the problem? Is there any issue that could be deleted to make room for the new one? Does the inclusion still leave the study with a critical mass of the problem? All these are questions that are associated with the delimitation of the problem.

The discussion shows that only a researcher who thinks carefully about the problem will distinguish between what is relevant and what is not relevant to the problem. All variables and issues considered irrelevant by the researcher must be firmly ruled out in the statement of delimitation. For a beginner, this is one of the areas where consultation with the supervisor or advisor is necessary. Most beginners tend to write statement of the problem that they could hardly manage. Best and Khan (1995) provided some distinction between limitations and delimitations. Limitations are those conditions beyond the control of a researcher that may place restrictions on the conclusions of the study and their applications to other situations, such as administrative policies that do not allow the use of more than one class in an experiment, an instrument that has not been validated or due to some reasons, inability to randomly select and assign subjects to experimental and control groups.
Delimitations on the other hand are the boundaries of the study.

SELF-ASSESSMENT EXERCISE 1

Explain the terms “limitations” and “delimitations”.

3.1.2 Assumptions

Assumptions are statements of what the researcher believes to be facts but cannot verify. A basic assumption in studies that involve the completion of questionnaires is that the respondents will complete the questionnaires providing to the best of their abilities, honest and reliable information without any biases. Suppose the researcher wants to determine by means of experimental method (to be discussed later) whether the treatment produced the result hypothesised, the researcher must assume that the test is valid, and if the treatment is a class test or examination, that it is within the capability of the examinees.

Assumptions are what the researcher takes for granted. If the assumptions of a researcher are known, that makes it easier to evaluate the conclusions of that result from such assumptions. You should note that in research, you do not leave anything to chance; therefore, all assumptions that have bearing on a problem must be clearly and unreservedly spelt out. According to Leedy (1997), to discover assumptions, you have to ask yourself “what am I taking for granted

with respect to the problem?" The answer to this question will bring your assumptions into view.

SELF-ASSESSMENT EXERCISE 2

With the aid of an example, explain the meaning of the term "assumption" in a research.

3.1.3 Significance

Part of setting the problem is for the researcher to state clearly the reasons for undertaking the study. To address this aspect of the study, you must ask yourself such questions as, of what use is the study? For educational studies, the beneficiaries of the findings are mostly the pupils/students, teachers, educators, ministry of education and its various organs, parents, the public, examination bodies etc. It is therefore necessary to state how the study will be useful to some, if not all the groups. For example, a study on "causes of poor performance of pupils in secondary school physics examinations" will be useful to:

i. teachers to assist them perhaps in their approaches to physics teaching;
ii. examination bodies – to improve their techniques of setting questions and ascertain the pupils' views as to the difficulty level of the questions and such other related issues as the time allocated to the questions;
iii. parents, in terms of the type of support they should provide for their children/wards to ensure better performance and
iv. curriculum developers, to assist in curriculum review of programme etc.

In writing the significance of the problem, attention should be concentrated on each of the hypothesis/research questions.

SELF-ASSESSMENT EXERCISE 3

In not more than five sentences, write the significance of the topic: "The effects of teacher competence on students' performance in integrated science".

3.1.4 Definition of Terms

It is important to define all unusual terms that could be misinterpreted. This definition helps to establish the frame of reference with which the researcher approaches the problem. The variables to be defined as mentioned earlier in unit three of this course should be defined in

operational terms. Such expressions/terms as academic performance, difficulty, level, 'understanding' when used in special contexts within a study, must be operationally defined. Academic grades assigned by teachers or scores on standardised achievements are operational definitions.

You should know that without knowing explicitly what a term means, you cannot evaluate the research or determine whether the researcher has carried out what, in the problem, was mentioned as the major objectives of the study. The definitions must interpret the term as it is employed in relation to the study, e.g. a study on students' understanding of "matter" – the terms "understanding" and "matter" must be operationally defined. You should bear in mind that in defining a term in your study, you determine whatever you wish the term to mean within the context of the problem or its sub-problems.

SELF-ASSESSMENT EXERCISE 4

In the study "effects of teachers' competence in a chemistry course", define the term competence operationally.

3.2 Feasibility of a Research Problem

By the time researchers have selected, shaped and refined a research problem, the problem should be sufficiently clear that a consideration of practical issues involving its feasibility is in order. Practical considerations of what can reasonably be accomplished given the time and resources available can force researchers sometimes painfully to reduce the scale of a project. A careful and honest appraisal of the time and money required to accomplish a study will be useful in determining the feasibility and reveal if a change in aims and objectives is necessary. The appraisal aspects of a project's feasibility centre primarily on two related issues – time and money. Also, other issues of importance include special aptitude of the researcher to the problem, availability of data and special equipment, etc. A checklist will be provided as part of this discussion.

3.2.1 Time Constraints

In determining a research, one of the major considerations is whether there will be sufficient time to complete adequately what you hope to do. This is very important particularly when you are working within a specified time such as completing a study or dissertation for a degree. Some of the major factors related to time in a study are:

i. **Population:** If the population has characteristics that are fairly widespread, then a sufficient number of people will be readily available from which to collect data. If however a study focuses on people with special characteristics (e.g. first class degree holders in physics and mathematics) that are somewhat rare, then data collection might be problematic and time consuming.

ii. **Proper Development of Measuring Instrument:** All techniques for gathering data should be tested before the actual study is conducted. This surely is time consuming. If a study involves a host of pre-tests, then it means that a lot of time will be consumed in modification and administration of the test as well as analysis of data collected.

iii. **Time Required for Data Collection:** The time required may range from a short period of less than one hour to years depending on the type of study. Due to the variability of the time required for data collection, time should be properly looked into when considering the feasibility of a study.

iv. **Time for Analysis of Data:** Generally, the less structured a questionnaire is, the more time the analysis consumes. Just like the time for data collection, the time for data analysis should also be the concern of the researcher.

3.2.2 Financial Constraints

The financial expenditures associated with a study is another constraint on feasibility. The major areas that involve finance are:

i. Production of questionnaire;
ii. Allowance(s) to research Assistant(s);
iii. Transportation cost;
iv. Cost of Analysis of Data
v. Office supplies and equipment.
vi. Use of computer.

In recent times, respondents to questionnaires demand some repository. Some costs are at times difficult to quantify hence you put all together under “miscellaneous”. Most funding bodies demand a proposed budget for a study. In that case, all possible sources of expenditure must be clearly spelt out. It is also advisable to estimate how much your thesis would cost you. This will help you scout for the money in time. Lack of money and efforts to get some could delay a well thought out research for some time.

3.3 Anticipating and Avoiding Problems

Problems related to time and financial considerations arise virtually in all research studies, but their impact on the outcome of the research can be minimised if they can be anticipated as much as possible, especially during the planning stage, when the details of the study are easier to change. A knowledgeable researcher may be able to identify trouble spots in his/her proposal and suggest modifications to avoid them. It is also necessary to obtain whatever permissions or consents that may be needed early in the planning stage of the study.

Also, it is necessary to conduct a pilot study, which is a preliminary run-through of all the procedures that surface during the main study. Any problems that surface during the pilot study can then be dealt with before the main study. If inadequate time or money is the problem, perhaps the project can be scaled down. It is possible to reduce the sample size, or the number of hypotheses, mail questionnaires instead of personal distribution of questionnaires. It is advisable not to abandon a project until all efforts to make it feasible have been investigated.

SELF-ASSESSMENT EXERCISE 5

Elaborate on two major constraints to address when considering the feasibility of a study.

4.0 CONCLUSION

This unit discussed that in setting up a research, the following terms need to be addressed: limitation, delimitation and significance of the study. Also, assumptions and operational definitions of some terms and expressions need attention. Time and money are also two major constraints to a study. How to conduct a feasibility study was also discussed. This unit ends with identification of problems and how to remediate them.

5.0 SUMMARY

In this unit, you have studied the important aspects of setting up a problem. You found that time and money are two major constraints in a study. You also discovered that identification of possible problems helps to strengthen the study by reviewing it. The next unit will discuss how to read, study and understand literature review for a given problem.

6.0 TUTOR-MARKED ASSIGNMENT

Choose a research topic, identify the major problems you envisage and suggest ways to solve them.

7.0 REFERENCES/FURTHER READING

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UNIT 2 REVIEW OF LITERATURE

CONTENTS

1.0 INTRODUCTION

One of the early activities in the research process is the review of the research literature – the body of research. Information will be needed about the problem; so, it can be put in the proper context and the research can proceed effectively. Most researchers probably begin their literature search on the internet. This can be a frustrating and overwhelming experience because of the sheer volume of information. A search using Yahoo, Google or another search engine will produce more sources than can be used in a lifetime.

With the amount of information available from a variety of sources, the review of the literature is by no means a trivial task. It is a systematic process that requires careful and perceptive reading and attention to detail. In the review of literature, researcher attempts to gather information relevant to the research problem at hand. The process centres on three questions:

1. Where is the information found?
2. What should be done with information after it has been found?
3. What is made of the information?

The first question deals with the specific sources, both electronic and hard copy. For most students, these sources can be found in or obtained through the library and the internet. Finding the information often involves using reference works such as indexes of periodical, literature. Computer searches of databases are very helpful in focusing the search and speeding up the process of sorting through the literature and

identifying the potentially most useful sources. The sheer volume of available information on most topics makes searching through a computer almost imperative for any extensive review.

The second question deals with how information is assembled and summarised. Assuming the content of a report is relevant to the research problem under study, the information must be retained in a useable manner.

Answering the third question requires a critical analysis of the reports reviewed about analytical and theoretical frameworks, purpose of reviews, how to search for related literatures, defining the scope and indicating the source of the related literature etc.

2.0 OBJECTIVES

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

- state the purpose of the review of literature;
- explain how to begin a search for related literature;
- discover how to organise the related literature; and
- write analytical and theoretical frameworks.

3.0 MAIN CONTENT

3.1 Purpose of Literature Review

According to Leedy (1997), review of literature has several purposes. Primarily, it is to assist you in confronting your research problem. In any study, your own problem is central. Everything you embark upon is because it helps you to resolve your own problem or answer your research questions. When you know what others have done, you will be in a position to investigate your chosen problem with deeper insight and complete knowledge. Other benefits of literature review are:

i. Informing the researcher of what has already been done in the area.
ii. More specifically, limiting and identifying the research problem and possible hypotheses.
iii. Providing possible research design and methodological procedures that may be used in the research study.
iv. Providing suggestions for possible modifications in the research to avoid unanticipated difficulties.
v. Identifying possible gaps in the research.
vi. Providing a backdrop for interpreting the results of the research study.

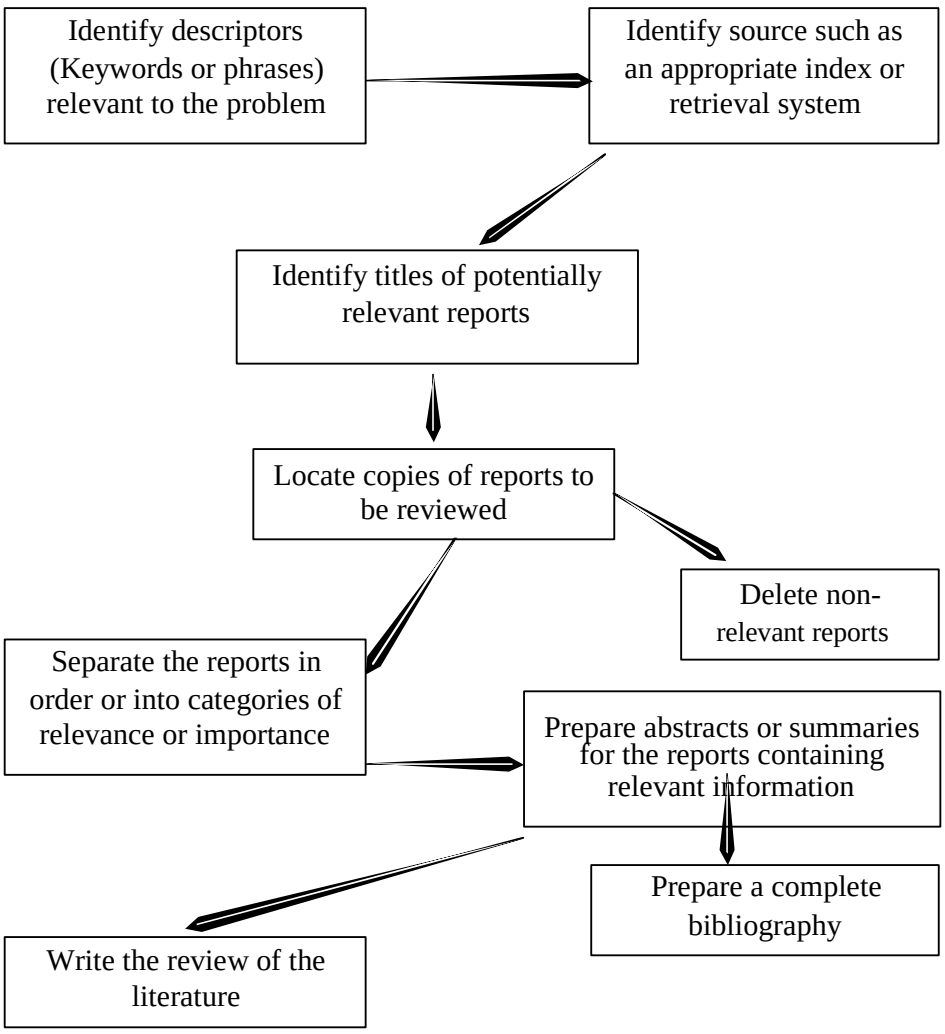
SELF-ASSESSMENT EXERCISE 1

State two benefits of' literature review in a study.

3.1.1 The Activities of the Review of the Literature

As indicated in figure 1 below, the existing body of knowledge relative to the research problem provides information for identifying the problem. As shown below, the general activities of conducting a research study were ordered in their most likely sequence of occurrence. The review of the literature itself consists of several specific activities that, to a large extent, also take place in a sequence. These activities shown in the flowchart in Figure 1 are initiated after the research problem has been identified, at least tentatively. The order of activities follows the flow of the arrows in the figure.

***Figure 1*: Flowchart of Activities in the Review of Literature**



Like most activities or steps in a process, there are efficient and inefficient ways to review the literature. Rather than going to the library or the internet and haphazardly beginning to take notes, the researcher should follow a systematic process, as represented by the activities in the flowchart. Although even this process may involve some inefficiency in locating sources and reports, efficiency will be enhanced by following the process. Another important procedural point in conducting activities is, for each activity, to do as complete and accurate an initial job as possible. For example, when a relevant report is located and an abstract is prepared, a complete bibliographic entry for the report should be included and page numbers of potential quotations should be noted. If a report is relevant enough to include in the review, sufficient information should be obtained from it so that there is no confusion later about what was done (conditions, procedures, individuals involved etc.) or about the results. Doing the review of literature in this suggested manner, will not only reduces frustration but also saves time.

3.1.2 Sources of Information

There is no scarcity of reports of research studies related to education. Studies are published in books, periodicals, technical reports, conference proceedings and academic theses. Most of the recent reports are available in electronic form and can be accessed at your institution's library.

The Library

Over the years, the library has had some basic functions as a repository of writings, books and manuscripts; a kind of literary museum where manuscripts and books are kept and added as the slow advance in knowledge become available.

In the 20th Century and especially in the latter half of the century – the role of the library changed. An explosion of information, and knowledge occurred. Research altered old ideas in almost every domain of human interest. The availability of new knowledge caught many libraries unprepared. Most are struggling to revamp their original purpose of providing a repository of written thought and factual information. Libraries have come to grip with two important facts.

First, they can no longer hold all the information written within their walls. With the vast amount of information being produced daily, it is unfeasible to hold a majority of it in any one location. The space cannot be afforded, nor can the ever increasing purchasing cost.

Secondly, and perhaps more importantly, library patrons are becoming more sophisticated in their wants and desires. Ease and speed of access are two important priorities. New ways of storing vast amount of information (e.g. CD-ROM) are replacing and augmenting the shelves of books and periodicals that line up the walls of the library. Surely, in the future, the library must continue to evolve. With advances in telecommunications, libraries may exist literally without limits. Now if you want to browse the shelves for related works, you can, if you want to access quickly a specific bit of information, you can search the entire collection in a matter of seconds. All these capabilities are currently available. As a powerful tool for the researcher, the library continues to evolve.

In well organised libraries, in place of card catalog, you have computer terminals and keyboards. These are standard equipment for most college libraries. With this, the researcher can access vast amount of information, search countless online databases and manipulate factual information with a facility that saves time, increase accuracy and boggles the mind at its efficiency (this is more in the developed world).

Research has become less disciplinary and more global in both problems and it's methodology. This change has created demands that libraries had never faced before. In recent times, most college libraries have replaced the card-catalog with an electronic database containing the total resources in the library. Now, you can sit before a keyboard and type in the area of knowledge or the title of the book. With a flick of a finger, the information about the book will be instantaneously displayed on the monitor screen. There is no more need to paw through long trays of individual cards in a catalogue file and no more searching through heavy index volumes for a periodical article that may turn out to be irrelevant to your needs. These days, the principal publishers of indexes are encoding their information electronically. The use of the computer facilities for information gathering is just at its gestation stage in most libraries in Nigeria. It is hoped that within the next few years, the situation will improve.

SELF-ASSESSMENT EXERCISE 2

State two modifications that have taken place in the role of the library as a source of literature for research.

3.2 Online Computer Searches: Database Access to Literature

You have been told about CD-ROM journal indexes as a valuable tool in identifying and locating different references for the researcher. In most cases, the CD-ROM searches are carried out by the end-user and they pertain to one specific database. Just like CD-ROM database searches, online searches involve a computer looking for a specific keyword by reading the text of a journal article title, abstract, as well as all other words in the record.

"Reviewing all the abstracts over many years would be utterly impossible for a human being but it is easy for a computer" (Krathwol, 1993). A major difference between the two types of searches relates to the scale of the search. Whereas the CD-ROM search usually focuses on a single database, the online search can have access to approximately 4,000 databases. The database provides access to literally billions of records.

Advantages of online computer search are:

- access to large number of record of the world's published literature;
- reduced time required in comparison with a manual search;
- frequent update that narrows the gap between publication of documents and user access.
- search requests tailored to use needs immense breadth of search topic that could not be performed manually; and
- fast turnaround from request to results.

Limitations of online computer search are:

- Possibility of unavailability of cited documents, some charges for access to various databases; and
- No guarantee that human input of indexed materials and keywords will provide complete retrieval relevant records;

- Databases documentation that varies in quality and coverage;
- Some training required by user.
- Turn around time dependent on system availability and competency of the searcher.

As mentioned earlier, most libraries in Nigeria are yet to embark on computerised service to the public. The write up is to sensitise you on what to expect in the near future particularly as the Federal Ministry of

Education through the National Universities Commission is to hasten the use of CD-ROM, ON-LINE service, etc. soonest (Leedy, 1997).

SELF-ASSESSMENT EXERCISE 3

State two advantages and two disadvantages of the online search for literature.

3.3 Analytical and Theoretical Frameworks

Reading as much as time permits about your topic may give you ideas about approach and methods which had not occurred to you, and may also give you ideas about how you might classify and present your own data. It may help you to devise a theoretical framework as a basis for the analysis and interpretation of data. It is not enough to collect facts and to describe what it is. All researchers collect facts but must organise and classify them into a coherent pattern. Verma and Beard (1998) suggest that researchers need to:

Identify and explain relevant relationship between the facts. In other words, the researcher must produce a concept or build a theoretical structure that can explain facts and the relation between them……The importance of theory is to help the investigator summarise previous information and guide his future course of action. Sometime the formulation of theory may indicate missing ideas or links and the kind of additional data required. Thus, a theory is an essential tool of research in stimulating the advancement of knowledge still further.

As you read previous studies, get into the habit of examining how authors classify their findings, how they explore relationship between facts and how facts and relationship are explained. Methods used by others may be unsuitable for your purposes, but they may give you ideas about how you might categorise your own data, and ways in which you may be able to draw on the work of other researchers to support or refute your own argument and conclusions. You will recall that the role of theories in research work particularly in the formulation of hypotheses had been discussed earlier in Unit 3. You may like to review that section of the unit to enable you understand this section properly.

SELF-ASSESSMENT EXERCISE 4

Discuss two issues you should take special note of while reading previous studies.

3.4 How to Write on the Related Literature

As you begin to collect information, articles, etc. about your study, you will need some type of structure to organise your information. Nothing is more aggravating than returning to the library to locate an article you know you already possess but currently cannot find. One easy way to organise is to set up a database that includes records of each article and book you possess. These records can include fields containing the title, author, date, journal reference, special keyboard, an identification number, as well as notes you have taken while studying the item. These items can be filled or neatly packed together. When any is needed, a quick search of the database should reveal where they are located.

- **Computerise as much as possible.** If you have a personal computer, open a file and computerise your data as much as possible. You can always work out the format of presentation e.g in an alphabetical order.

- **Be systematic and thorough:** In research, you should "make haste slowly" be careful not to make careless, half complete notes that, when consulted later – are either entirely unintelligible or so lacking in essential information that they are practically useless. The original time spent seeking out the item can be wasted, it would be much better to take care and do the job right in the first place. Little is gained by rushing so that you fail to get adequate or correct information the first time around and cannot read it when referring to it later. After you have amassed an impressive literature, you will need to arrange your information in some order.

- **Get the proper psychological orientation:** Be clear in your mind what you are trying to do. The review of literature is a
discussion of previous publications that bear directly on the topic you are investigating. Consider the review of related literature to be a review with someone about what others have written in relation to what you plan to do. Viewing the literature section in this way, will help you develop the proper psychological perspectives and will help you see your own effort in relation to other researchers.

- **Have a Plan:** Writing a review of literature takes planning and organisation. This effort requires structure, unity and coherence; perhaps a careful consideration of the problem should suggest relevant areas for discussion and indicate the direction that the discussion of the related literature should take.

- **Emphasis relatedness:** Keep your reader constantly aware of how the literature you are discussing is related to your problems. Point out precisely what that relationship is. Remember that you are writing a review of the related literature. Literature review should not create a chain of pointless, isolated summaries of the writing of others. Jegede says ……. Okebukola says …….. Oloyede says ……. Olarinoye says …….. This is not a discussion of related literature as no attempt is made to demonstrate the relatedness of the literature to the present problem. Whenever you cite a study, account for it in terms of the problem you are investigating. Specifically explain precisely what the relationship is. Unless you can establish such a relationship, you may consider whether there is need to include the study at all.

- **Review the literature, do not reproduce it:** A sound discussion shows the relationship of the problem to the broad environment of similar studies done by others. This is the sole purpose of the literature discussion. To show the connection between the discussion of the literatures that others have produced and the investigation you are carrying out, Leedy (1997) has made the following recommendations:

a. Write out your problems at the top of the page where you cannot lose sight of it. By this, it will continue to remind you of the central axis on which the entire study revolves.
b. Divide the problem by numbering its various parts.
c. Cite each specific study separately.
d. Gather together all citations that refer to a particular subdivision of the problem and the rationale for inclusion in the review of literature.
e. Gather together all the citations that refer to a particular subdivision of the problem that you have as many group as you have subdivisions of your main problem.
f. Study these groups in relation to each other.
g. Write the review, label each section with a heading whose wording contains the identical words found in the statement of the problem.
h. Summarise what you have said. A summary is necessary, in which you gather up all that has been said and set forth in importance in terms of the research problem. Summary should epitomise the discussion and show its direct relationship to the problem under study.

SELF-ASSESSMENT EXERCISE 5

Explain the purpose of literature review in a research work.

4.0 CONCLUSION

In this unit, the meaning of literature review and its purpose, such as relation of source of extra data, how to begin a search for a related literature – the library, CD-ROM, Online, etc. how to provide analytical and theoretical framework to the study by identifying and explaining the relevant relationship between the facts, have been established. The systematic procedure for writing the review of literature vis: getting the proper psychological orientation, have a plan, emphasise relatedness, review do not reproduce and summarise, were discussed.

5.0 SUMMARY

In this unit, you have studied how the literature could be gathered, organised and reported. It has also been emphasised that the success of the literature review is the ability to show the relatedness of the various aspects of quested prior studies to the present. In the next unit, you are going to study the two major types of research approaches in the longitudinal researches.

6.0 TUTOR-MARKED ASSIGNMENT

1. Choose any topic of interest to you and write the sub-topics of the areas you will review.
2. Write a literature review of not more than three pages of foolscap sheets on your chosen topic.

7.0 REFERENCES/FURTHER READING

Leedy, P.D. (1997). *Practical Research: Planning and Design* (6th Edition). New Jersey: Morill, PP 103 – 110.

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UNIT 3 CONSTRUCTS AND VARIABLES

CONTENTS

1.0 INTRODUCTION

In Unit 3, you studied hypotheses and how to formulate and state them. You also learnt about theories and concepts. You were taught that theories serve to guide and direct research. Also, theories serve to integrate and explain the many observations made in diverse settings by researchers, while concepts are seen as important part of theories.

Concepts were defined ideas, persons, things, or events. Concepts are often given both nominal definitions which explain their meaning and operational definitions that indicate how they are measured. Constructs and variables are to be discussed in this unit.

The behavioural sciences have been limited by a lack of adequate definition. Accurate operational definitions are essential to the development of a sophisticated science. Such traits as intelligence, anxiety or motivation are not directly observable and are generally referred to as constructs; implying that they are mere constructions of the scientist imagination. Constructs cannot be seen, heard or felt. They can only be inferred by phenomena such as test scores or by observed hostile or aggressive acts, rules, rates or persistence at a task. Scientific methods must be applied with great vigour and imagination to the behaviour aspects of our culture. The development of the behavioural science and their application to education and other human affairs present some of our greatest challenges.

On the other hand, variables are conditions or characteristics that the researcher manipulates, controls or observes. Scientist, somewhat loosely call the constructs they study “variables”. Examples of some

important variables in sociology, psychology and education are sex, income, education, social class, organisational productivity, occupational mobility, verbal aptitude, anxiety, strength, intelligence, achievement and authoritarianism to mention but a few. It can be said that a variable is a property which takes on different values or as Kerlinger (1977) puts it, a variable is something that varies. In this unit, you are going to read about constructs and variables and their importance, in research.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define what constructs are
- explain how constructs are used in explaining research work
- give example of construct
- define variables
- state the different types of variables
- explain the different types of variables and how they are used in research work.

3.0 MAIN CONTENT

3.1 Constructs

As mentioned in the introduction, construct cannot be seen, heard or felt. They can only be inferred by phenomena such as test scores or by observed hostile or aggressive acts, skin responses, pulse rates, or persistence at a task. A construct is a concept. But it has the added meaning of having been deliberately and consciously invented or adopted for a specific purpose. For example, “Intelligence” is a concept, an abstraction from the observation of presumably intelligent and unintelligent behaviours. But as a scientific construct, intelligence means both more or less than it may mean as a concept. This means that scientists use it in different ways i.e. school achievement is in part a function of intelligence and motivation. Also, intelligence is so defined that it can be observed and measured. The intelligence of children can be observed by administering an intelligence test to them while teachers can estimate the relative degrees of intelligence of their pupils.

3.2 Variables

Scientists somewhat loosely, call the constructs of properties they study variables. Kerlinger (1977) defines a variable as a symbol to which we assign numerical values. For example, if a researcher is interested in the

effects of two teaching methods on the science achievement of JSS three students. After the different teaching methods have been implemented, the JSS three students involved would be measured with a science achievement test. It is very unlikely that all of the JSS three students would receive the same score on this test, so the score on the science achievement test becomes a variable, because different individuals will have different scores. Therefore, the score on the science achievement test is a variable.

There is another variable in the example above – the teaching method.
In contrast to the science achievement test score, which undoubtedly would be a scale with many possible values, teaching method is a categorical variable consisting of only two categories, the two methods.
So we have different kinds of variables and different names or classifications for them. There are many classification systems given in the literature; so many that there is a considerable overlap and opportunity for confusion. The names we use are descriptive, they play a role in research study. The variables described below by no means exhaust the different systems and names that exist, but they are the most useful for communicating about educational research.

SELF-ASSESSMENT EXERCISE 1

3.2.1 Independent and Dependent Variables

Variables can be categorised as independent and dependent variables. This categorisation is very important in research. An independent variable is the presumed cause of the dependent variable i.e. the presumed effect. According to Kerlinger (1977), the independent variable is the antecedent and the dependent is the consequent. The independent variable is the variable manipulated by the research. If a researcher decides to study the effects of teaching methods on students' performance in chemistry, you will then manipulate the method, the independent variable, by using different methods.

The dependent variables (Y) are the presumed effect which varies concomitantly with changes or variations in the independent variable (X). It is the variable that is not manipulated. Rather, it is observed for variation as a presumed result of variation in the independent variable. You could notice from the discussion that there are two types of independent variables, viz: Treatment and Organismic or Attribute variables.

Treatment variables are those factors that the researcher manipulates and to which he or she assigns subjects. Attribute variables are those characteristics that cannot be altered by the researcher. Examples are:

sex, age, race or tribe and already determined intelligence level. However, the researcher can decide to include or remove them as variables to be studied.

SELF-ASSESSMENT EXERCISE 2

1. Underline the dependent variables in these two topics:

a. The effect of understanding scientific terms on students scores in comprehension exercise.
b. The study of the relationship between sex and attitude towards science.

2. Give three examples of attribute variables.

3.2.2 Discrete and Continuous Variables

Discrete variables are variables with a finite number of distinct and separate values e.g. sex, race, family size, number of days present. All these are discrete variables because they can be measured only in a discrete set of units such as 2, 3, etc. No meaningful measurement values lies between these distinct and separate values.

Continuous variables are those that at least theoretically can take an infinite array of values. Age is normally measured in years, but it can also be measured in months, days, hours, minutes and seconds. There is no theoretical limit to how precise the measurement of age might be. For most educated research purposes, the measurement of age in terms of years is quite satisfactory, but age is nonetheless a continuous variable.

Nominal variables are by definition, discrete in that they consist of mutually exclusive or discrete categories. Ordinal variables are also discrete. The mutually exclusive categories of an ordinal variable may be ranked from low to high, but there cannot be a partial rank. For example, in a study of the military, rank might be ordered 1 = private, 2 = corporal, etc, but you cannot talk of 1.5 or 2.4 etc.

Family size, number of counts, etc. can only be whole numbers or discrete intervals. A continuous variable can take an ordered set of values within a certain range. It is important to recognise that a variable is continuous or discrete by its very nature and the researcher cannot change that. It is however possible to measure a continuous variable by specifying a number of discreet categories as it was explained for age, but this does not change the nature of the variable itself.

You should note that the nature of variable, discrete or continuous, determines how it is used in data analysis (to be discussed in details later in this course). Sometimes discrete data are treated as continuous in order to use statistical models, but care must be taken to assure that the results will be meaningful (Hanushek and Jackson, 1977).

SELF-ASSESSMENT EXERCISE 3

Give three examples each of discrete and continuous variables.

3.2.3 Constructs, Observables and Intervening Variables

The explanations provided earlier in this unit shows that there is a clear difference between constructs and observable variables. Constructs are non-observable and variables, when operationally defined are observable. This is important because if you are not aware of the level of discussion you are when talking about variable, you can hardly be clear about what you are doing.

Constructs are called intervening variables. Intervening variable is a term invented to account for internal and directly unobservable psychological processes that in turn account for behaviour. Intervening variable is an "in the head" variable. It cannot be seen, heard or felt. It is inferred from behaviour e.g. learning is inferred from among other things – improved performance. Anxiety is inferred from test scores, skin responses and from heartbeat, etc.

The researcher using such terms should be aware that he or she is using invented 'constructs' the reality of which has been inferred from behaviour. For example, motivation can only be judged by observing behaviour. But it cannot be measured directly because it is on "in-the-head" variable, an intervening variable, an unobservable entity. This means that, to judge 'motivation', you have to measure the presumed indicants of motivation and not motivation itself. You must in other words always measure some kind of behaviour, be it marks on paper, spoken words etc. and then make inferences about presumed characteristics.

This explains why it is always important to have operational definition of these constructs to be sure that the investigation you are embarking upon is quite clear to you and the consumers will be able to follow and understand your report.

SELF-ASSESSMENT EXERCISE 4

Provide operational definitions for any three constructs you have identified.

4.0 CONCLUSION

In this unit, we discussed the definition of construct, as a concept adopted for a specific purpose. A variable is a symbol to which we can assign numerical values. Independent variables are variables the researcher could manipulate and dependent variables vary concomitantly with changes in the independent variable. Discrete variables are variables that can take finite numbers while continuous variables can take an infinite number of values. While the knowledge of data is important for meaningful analysis and interpretation of data, constructs, observable and intervening variables are important in that they explain why you should define your terms clearly and operationally for meaningful evaluation and understanding of your research.

5.0 SUMMARY

So far, you have been studying some of the basic tools for research. From the next unit, you are going to start the study of types and approaches to research methods. You will look at quantitative and qualitative studies as well as longitudinal studies. This unit has given you an overview of the different types of research, while subsequent units will take on specific research approaches.

6.0 TUTOR-MARKED ASSIGNMENT

Write short notes on each of the following:

i. Constructs
ii. Variables
iii. Dependent and Independent variables
iv. Discrete and Continuous variables

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MODULE 3 TYPES OF RESEARCH APPROACHES

UNIT 1 QUALITATIVE AND QUANTITATIVE APPROACHES

CONTENTS

1.0 INTRODUCTION

The terms qualitative and quantitative are often used to identify different approaches to answering research question. In any study, different questions provide different types of information. Also, depending on the types of questions you wish to answer, different designs and methods may be used.

Methodology is merely an operational framework within which the data are placed so that their meaning may be seen more clearly. The entire research methodologies can be classified into two major approaches, namely: qualitative and quantitative approach. Whereas the quantitative approach is typically used to answer questions about the relationships among measured variables with the purpose of explaining, predicting and controlling phenomena; the qualitative is used to answer questions about the nature of phenomena with the purpose of describing and understanding the phenomena from the participants' points of view. In different research methods textbooks, the quantitative approach is sometimes referred to as the traditional, the positivist, the experimental or the empiricist approach. The qualitative on the other hand is referred to as the interpretative, the naturalistic, the constructivist or the

postpositive approach. However, most authors chose to refer to them simply as the qualitative and quantitative approaches. It should be noted that within these two main approaches, a number of research methodologies are used to gather data for answering different research questions (Leedy, 1997).

Longitudinal research involves gathering data over an extended period which might span months, years or in some few cases, decades. The decision to use a longitudinal approach is often determined by both the nature of the research problem and by practical considerations. In this unit therefore, you will study qualitative and quantitative methodologies, also you will learn about cross-sectional and longitudinal research.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of qualitative approach
- identify some studies that could be classified as qualitative studies
- state the general characteristics of qualitative studies
- explain the meaning of quantitative methodology
- identify studies that could be classified as quantitative studies
- state the general characteristics of quantitative studies
- distinguish between qualitative and quantitative studies
- explain the meanings of cross-sectional and longitudinal studies describe the characteristics of cross-sectional and longitudinal studies.

3.0 MAIN CONTENT

3.1 Qualitative Approaches

Qualitative approach is research that describes phenomena in numbers and measures (Krathwol, 1993). Qualitative approach has its origin in descriptive analysis, and is essentially an inductive process, reasoning from the specific situation to a general conclusion. As Lancy (1993) points out, qualitative research is typically thought of as a method with a set of procedures for conducting research. Qualitative research in its purest sense follows the naturalist paradigm, i.e. that research should be conducted in the natural setting and that the meanings derived from research are specific to that setting and its conditions. The qualitative approach is sometimes referred to as interpretative, the naturalistic, the constructivist or the post-positivist approach. The common qualitative research designs are case study research design. These will be discussed

in more details later in this course. Cresswell (1994) defines qualitative study as "inquiry process of understanding a social or human problem based on building a complex holistic picture formed with words, reporting detailed views of informants and conducted in a natural setting.

Most of the time, qualitative researchers often start a study with general questions, collect an extensive amount of verbal data from a smaller number of participants and present their findings with words or descriptions that are intended to accurately reflect the situation under study. A qualitative study may conclude with tentative answers on hypotheses about what was observed. These tentative hypotheses may then form the basis of the future quantitative studies designed to test the proposed hypotheses.

Qualitative research involves data in the form of words, pictures, descriptions or narratives. Qualitative researchers tend to adopt an attitude of discovery or exploration that lead to discovering, building or enhancing theory as opposed to testing it. For example, an investigation of the teaching and learning of integrated science in Junior Secondary School One (JSS.1) at Government College, Ikorodu, where the researcher spends six months asking questions transpires within the period. Qualitative researchers remain detached from their subjects in order to make unbiased, universal and context-free generalisations. Qualitative research is very holistic and emergent with specific focus, design, interview instruments and interpretations developing and changing along the way. Researchers interact with their participants, categories emerge from the data leading to "context bound" information patterns and/or theories that help in explaining a phenomena.

Qualitative researchers operate under the assumption that reality is "socially constructed" complex and ever-changing" (Glesue and Peshkin, 1992) so the "qualities" these researchers study are not easily divided into discrete, measurable variables. Rather qualitative researchers sample a large number of people with the hope of making generalisations; they tend to select participants "purposefully" to learn about the range of behaviour related to the research focus in order to gain understanding of the complex phenomena in question. For example, a study on "parents" views about what the quality of science education is all about, can effectively provide the required information and not mere selection of just any parent. Both verbal (Interview comments, documents, field-notes) and non-verbal (drawings, photographs, videotapes) data that represent the social environment are collected.

Qualitative studies tend to use an inductive form of analysis whereby observations of particular cases may be generalised to a class of cases. Inductive reasoning emphasises after-the-fact explanation; theory emerges from a careful consideration of the evidence (data). By observing the specifics of a situation, qualitative researchers believe they can increase their understanding of the phenomena of which the situation is an instance. For example, the study of the teaching and learning of Integrated Science at JSS.1 at Government College, Ikorodu could be used as a basis for generalising about the quality of integrated science teaching in secondary schools within Ikorodu Local Government Area. Qualitative researchers construct interpretative narratives from the data and employ a literary style. The language used is often descriptive and personal emphasising the participants' language and including their unique assigned 'meanings'. It is noteworthy that qualitative studies are not usually regarded as having high predictive value; rather, the knowledge gained is closely tied to the specific situation that was studied.

SELF-ASSESSMENT EXERCISE 1

Name two examples of qualitative research**.**

3.2 Quantitative Approaches

As earlier indicated, the quantitative approach is typically used to answer questions about the relationship among measured variables with the purpose of explaining, predicting and controlling phenomena. The quantitative approach is sometimes referred to as the traditional, the positivist, the experimental or the empiricist approach. Cresswell (1994) defines a quantitative research as "an inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers and analysed with statistical procedure, in order to determine whether the predictive generalisations of the theory hold true".

The quantitative researchers usually start with a preformed hypothesis to be tested. The relevant variables are isolated, extraneous variables are controlled, standardised data are collected from a sizeable number of participants and the data are analysed in such a manner that the original hypotheses can be rejected or not rejected and conditions that can be generalised are stated. Often quantitative researchers seek explanations and predictions that can be generalised.

The objective is to establish, confirm or validate relationships and to develop generalisations that contribute to theory. Careful guidelines exist for conducting quantitative studies. Concepts, variables and

hypotheses are often defined before the study begins and remain fixed throughout. For quantitative studies, methods are chosen by the researchers so that they can objectively measure the variables of interest. It is important that researchers remain detached from their 'subjects' in order to make unbiased, universal, context-free generalisations.

Quantitative researchers often use experimental or correlational designs to reduce error, bias and extraneous variables. They believe there is a relatively stable reality 'out there' that can be measured by well designed questionnaires or instruments. In all cases, generalisations receive greater acceptance if the instruments are valid and reliable. Data are normally collected from whole population or sample that is representative of the population. Quantitative researchers are always interested in describing the norm of the population sampled.

Quantitative studies tend to rely on deductive form of analysis. This type of analysis moves from general to specific i.e. from an existing premise (theory, hypothesis) to a logical conclusion. Quantitative researchers reduce their data to numbers, which they then present as the result of statistical tests. You are advised not to worry about individual scores, since the power of interpretation rests in the large number of scores that depict the norm of group performance. The statistical results are presented in a report that employs a formal scientific style, using passive voice and impersonal language. Concepts and variables are always operationally defined. In quantitative research, the observed results are more easily attributable to the conditions imposed by the researcher and can be described more precisely in terms of the strength of observed relationships. The control enables the quantitative researcher to predict the possible status of similar populations and situations. You should be aware of the fact that all studies could be classified as either qualitative or quantitative. It is therefore advisable that you master the characteristics of each type so that you could easily relate them to the appropriate research methodologies that will be discussed starting from the next unit.

SELF-ASSESSMENT EXERCISE 2

Mention three characteristics of a quantitative research.

3.3 Longitudinal Research

According to Gall et. al. (1996), a longitudinal study is one that involves "collecting data from a sample at different points in time in order to study changes or continuity in the sample characteristics. Thus, "secondary school students' attitude to science" might be started in their first year i.e. JSS.1 and end in their final year, i.e. SSS.3, which means

the study will last for a period of six years. In such a study, data are collected at different times of the period of study.

According to Leedy (1997), though longitudinal studies are difficult to implement, they are however essential for exploring developmental issues. It is only longitudinal studies that can determine the different experiences of individuals over time. One disadvantage of longitudinal studies is that they can be reactive. People responses or behaviour at one time may be influenced by the fact that they have been observed earlier. Another disadvantage is that people who participated earlier may not want to or be able to participate later. People die, move away, become uninterested or in other ways, become unavailable. This loss of participants can adversely affect the validity of the research findings. The major disadvantage of all longitudinal studies is that they are difficult and expensive to conduct, especially if they span a long period of time. Longitudinal studies may or may not use survey methods to gather data. Its most distinguishing characteristics, unlike most research designs, is not related to how data are collected and analysed, but to the time period in which data are collected.

SELF-ASSESSMENT EXERCISE

What is the major aim in a longitudinal study?

4.0 CONCLUSION

In this unit, you have learnt that all research methodologies could also be called interpretative, naturalistic etc. Quantitative could be called traditional, positivist, etc. Quantitative is used to confirm, validate and test a theory, it is focused, has established guidelines, static design, context-free and detached view, adopts a deductive approach to analysis, and report is communicated through numbers, statistics aggregate data and in scientific style.

Qualitative is to describe, explain, explore, interpret and build theory. It is process-oriented and holistic, context-bound and personal view. Data are collected using observations, interviews and inductive analysis of data is adopted. Findings are narrated using words, narrative and individual quotes and literary style. Longitudinal studies are based on data collected over a period of time and are particularly useful for studying trends or behavioural changes.

5.0 SUMMARY

In this unit, you have learnt that qualitative and quantitative methodologies are the two broad classifications of research methodology. Each classification has a number of other methods under it. Most of these methods share major common characteristics. In the next three to four units, you will study other research methodologies that are subsets to these two broad ones. To understand these other methods, you have to understand the characteristics of these two major characteristics very appropriately.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define qualitative and quantitative methodologies of research.
2. What is a longitudinal research?

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UNIT 2 ACTION RESEARCH, CASE STUDY AND OBSERVATION METHODOLOGY

CONTENTS

1.0 INTRODUCTION

In the preceding unit, you learnt about two main categories of research. You were informed that each category has its characteristics which run through all the methodologies within the group.

Classifying an approach as quantitative or qualitative, ethnographic survey, action research and so on does not mean that once an approach has been selected the researcher may not move from the methods normally associated with that style.

Each approach has its strength and weakness and each is particularly suitable for a particular context. The approach adopted and the methods of data collection selected will depend on the nature of the inquiry and the type of information required.

In this unit, we shall discuss about action research, case studies and observations.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of action research
- use action research methodology to carry out some investigations
- describe a case study
- apply case study approach in educational research
- explain what observation entails in research
- describe the different forms of observation methodology.

3.0 MAIN CONTENT

3.1 Action Research

Cohen and Manion (1989) describe action research as essentially an on-the-spot procedure designed to deal with a concrete problem located in an immediate situation. This means that the step-by-step process is constantly monitored over varying periods of time and by a variety of mechanism (questionnaires, diaries, interviews, for example) so that the feedback may be translated into modifications, adjustments, directional changes, redefinitions as necessary, in order to bring about lasting benefit to the on-going process itself.

While Leedy (1997) describes action research as a type of applied research that focuses on finding a solution to a local problem in a local setting. For example a teacher investigates whether a new spelling programme he/she has adopted leads to improvement in the students' achievement scores. As can be deduced from the definitions, an important feature of action research is that the task is not finished when the project ends. The participants continue to review, evaluate and improve practice. Brown and Melntyre (1981) emphasise on the going nature of action research thus:

The research questions arise from an analysis of the problems of the practitioners in the situation and the immediate aim then becomes that of understanding those problems. The researcher/actor, at an early stage, formulates speculative, tentative general principles in relation to the problem that have been identified from these principles, hypotheses may then be generated about what action is likely to lead to the desired improvements in practice. Such action will then be tried out and data on its effect collected; these data are used to revise earlier hypotheses and identify more appropriate action that reflects a modification of the general principles. Collection of data on the effects of this new action may then generate further hypotheses and modified principles, and so on, as we move towards a greater understanding and improvement of practice. This implies a continuous process of research and the worth of the work is judged by the understanding of a desirable change in the practice that is achieved.

One unique feature of action research is that the practitioners operate as the researcher for instance, in the educational area, the teacher as the researcher. This research approach encourages the teacher to identify problems in his/her classroom and try to solve them. This includes problems of pupil's inability to report their findings in a science class or poor mastery of science concepts etc. From the discussion, so far, you

as the researcher are expected to continue a series of studies to improve the identified problem.

Generally, action research is not limited to projects carried out by teachers as in the educational teaching. It is appropriate in any context where specific knowledge is required for a specific problem in a specific situation or when new approach is to be grafted to an existing one; such as using a new teaching method to teach primary science, integrated science or basic science. The teacher uses a series of studies to ensure success. Action research should be planned in a systematic way. Like any other research and method(s), action research is not a method or technique; it is an approach which has proved to be particularly attractive to education because of its practical problem solving emphasis, because practitioners carry out the research and the research is directed towards greater understanding and improvement of practice over a period of time.

SELF-ASSESSMENT EXERCISE 1

Identify a problem in your science class and write down five sentences on how you would use action research to solve it.

3.2 Case Study

The case study is a way of organising social data for the purpose of viewing social reality. It examines a social unit as a whole. The unit may be a person, a family, a social group, a social institution or a community. The purpose is to understand the life cycle as an important part of the life of that unit. The case study probes deeply and analyses interactions between the factors that explains present status or that influence change or growth. It is a longitudinal approach, showing development over a period of time. According to Leedy (1997), a case study is conducted to shed light on a phenomenon, be it a process, event, person or an object of interest to the researcher. A case study constitutes a single instance of the phenomena. Data may be gathered by a wide variety of methods including:

- observation by the researcher or his/her assistants on physical characteristics, social qualities or behaviour;
- interviews with the subject(s) relatives, friends, teachers, counsellors and others;
- questionnaire, opinionnaires, psychological tests and inventories; and
- recorded data from newspapers, school, courts, clinics, government agencies, classroom, laboratory and other sources (Best and Khan, 1995).

A single case study emphasises analysis in depth. But if the objective analysis leads researchers to consistent observations of significant variable relationships, hypotheses may be confirmed, leading to valid generalisations. Often a substantial amount of data is gathered from a wide variety of sources to present a description of the phenomena or expensive from the perspective of the participants. Gall et. al. (1996) describes the process as "watching people in their own territory and interacting with them in their own language, on their own terms".

SELF-ASSESSMENT EXERCISE 2

State one method of data gathering process in a case study.

According to Gall et. al. (1996), there are three approaches to analysing case study data: interpretational, structural and reflective analyses. Interpretational analysis refers to examining the data for constructs, themes and patterns that can be used to describe and explain the phenomenon studied. Structural analysis refers to searching the data for patterns, inherent in discourse, text, events or other phenomena with little or no inference made as to the meaning of the patterns. Reflective analysis refers to using primarily intuition and judgment to portray or evaluate the phenomena.

Although the case study is useful method or organised research observation, certain precautions should be considered:

- The method may look deceptively simple. To use it effectively, the researcher must be familiar with existing theoretical knowledge of the field or inquiry, and skillful in isolating the significant variables from many that are irrelevant.
- Subjective bias is a constant threat to objective data-gathering and analysis.
- Effects may be wrongly attributed to factors that are merely associated and rather than cause and effect related.

A case study final report takes the form of a rich descriptive narrative that attempts to reconstruct the participants' reality. Adler and Adler (1994) recommend that case study researchers use a "style of writing that draws the reader so closely into subject's worlds that these can be really felt". Case study researchers who have used interpretational or structural analysis methods tend to use an objective writing style and make effective use of tables, figures and matrices to display their findings.

An important criterion for judging the merit of a case study is the extent to which details are sufficient and appropriate for a teacher working in a

similar situation to relate his/her decision making to that described in the case study. The reliability of a case study is more important than its general ability.

SELF-ASSESSMENT EXERCISE 3

What is Adler and Adler's recommendation for reporting case studies?

3.3 Observation Research

Observation methods vary in terms of the extent to which the investigator participates in the activities of the people being observed. The two general possibilities are that of participant observer and that of non-participant observer. Each technique has its unique difficulties, advantages and disadvantages. The principal ways of getting information are by either experiencing something directly or by having someone tell us what happened.

Participant observation is a method in which the researcher is a part of, and participates in the activities of the class, group, people or situation that is being studied. In some cases, the researcher may have belonged to the group prior to the start of the research and can use this position as a group member to collect data. For example, a teacher in a science vacation course wishes to observe the reactions of his colleagues to the different lectures, demonstrations and other activities during the course.
In many types of research, the relationship between the researcher and those participating in the research is fairly clear-cut. In surveys, for example, participants know who the researchers are and that they as respondents are providing data to the researchers.

In this participant observation – the researcher – participant relationship becomes more problematic in that it can take a number of different forms: two major issues arise. The extent to which the observer will change the setting that is being observed and the extent to which people should be informed that they are being used for research purposes. The way in which a researcher resolves these issues determines the nature of the observer – participant relationship for a given project.

On the other hand, those who emphasise observation over participation argue that the more fully one becomes a group member, the less objectives he becomes. Because of this and other problems, the observer as participant role has been less popular for conducting research.

SELF-ASSESSMENT EXERCISE 4

Explain one major problem of a participant as observer in a research.

3.3.1 Steps in Participant Observer Research

The first step is to establish the specific goals of the research and decide that the participant observation is the most appropriate strategy. The second step is to decide which specific group to study. The third step is very challenging, gaining entry into the group to be studied. The fourth step is to develop rapport and trust with the people being studied so that they will serve as useful and accurate sources of information. The fifth step is to observe and record.

3.3.2 Non-Participant Forms of Observation

Some research questions call for or require the investigator to refrain from participation in the group being investigated. The concern is that the intrusive impact of an outsider might change the behaviour of group members in a way detrimental to the research question. The researcher under such conditions adopts a complete observer's role; the observer has no direct contact with or no substantial influence in those being observed. One way of doing such non-participant observation is to use an observation technique that has been called unobtrusive or non-reactive observation and physical traces.

Hidden Observation: In some research projects, it is possible to observe behaviour from a vantage point that is obscured from the views of those under observation. This might be done by observing people through a one-way mirror or by filming them with a hidden camera. When weighing the use of such a device, investigators should consider whether people are likely to see through the guise, if they do, unobtrusive nature of the observation has been compounded.

Disguised Observation: With some types of behaviour, it is possible to observe people in a natural setting, but without participating and without revealing that one is observing them. Any setting in which one can be present and not participate without calling attention to oneself is a potential scene for disguised observation. Physical traces are not discussed because it is of little relevance to educational research.

Recording Observation: The manner in which observations are carried out may be primarily quantitative or qualitative in nature. Quantitative observation typically calls for more structured recording of data on coding sheets whereas qualitative observation may use less structured

field notes. Further discussion on this will be done under methods of collecting data.

4.0 CONCLUSION

In this unit, action research, case study and observation methods of carrying out research have been discussed. Action research is directed towards greater understanding and improvement of practice over a period of time. The reliability of a case study is more important than its generalisability. There are two types of observation techniques: the participant observer and the non-participant observer. Five steps are advanced for the execution of the participant observer while two methods of unobtrusive observation were also discussed.

5.0 SUMMARY

In the effort to ensure greater understanding and comprehension, different types of research methods were discussed in this unit. These are action research, case study and observation research.

6.0 TUTOR-MARKED ASSIGNMENT

1. Identify a problem that could be studied by the action research method.
2. Justify your identification and describe fully how you would carry out the study.

7.0 REFERENCES/FURTHER READING

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UNIT 3 ETHNOGRAPHY, PHENOMENOLOGY, GROUNDED THEORY AND CORRELATIONAL STUDIES

CONTENTS

1.0 INTRODUCTION

In this unit, you are going to study three exclusively qualitative studies, namely: ethnography, phenomenology and grounded theory. Also, correlational studies will be briefly discussed.

The qualitative studies will be discussed in terms of the purpose, process, procedures, data collection and analysis, and methods of communicating findings. Examples are also provided to illustrate various approaches.

Correlational studies which are also discussed in this unit are concerned with the degree to which variations or differences in one variable are related to the variations or differences in another variable. When two variables are perfectly correlated, the coefficient equals 1 or –1.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- describe ethnography study
- give examples of ethnography studies
- use ethnography technique to investigate science education problems
- explain phenomenology
- apply phenomenology technique in studying science education problems

- explain grounded theory
- use grounded theory to investigate research problems in school science
- describe Correlational studies
- explain the significance of perfect correlation coefficient.

3.0 MAIN CONTENT

3.1 Ethnography

Ethnography sometimes known as cultural anthropology or more recently a naturalistic inquiry is a method of field study observation that became popular in the latter part of the 19th Century. It has continued to show significant development, suggesting promising techniques for the study of behaviour in an educational situation. In its earliest form, it consisted of participant observation, conversation and the use of informants to study the cultural characteristics of unique and less sophisticated groups of people (so-called 'primitive' people) in Africa, South Sea Island, and Native American Indian tribes. The groups were small in number, geographically and culturally isolated with little specialisation in social function and with simple economics and technology. Such cultural features as language, marriage, family life etc. were analysed.

The data gathered consisted of observation of patterns of action, verbal and non-verbal interaction between members of the tribe as well as between the subjects and the researcher, and his/her informants and the examination of whatever records or artifacts were available. Most of the studies were adversely criticised because the researchers spent too little time among the people of the tribe to get more than a superficial view and did not learn the native language and had to depend on the reports of poorly trained informants. Later, investigative reports on this type of studies would be invalid unless the observer:

- lived for a much extensive period of time among the tribe and became an integrated member of the social group;
- learned the native language; or
- trained his or her informants to systematically record field data in their own language and cultural perspective.

The refinement of participant observation resulted in more objective and valid observation and analysis.

In recent times, many of the time-honored techniques of the ethnography study involving integration into the group and observation are being applied to psychology and education among others. Using the method

of observation, the researcher observes, listens to and sometimes, converses with the subjects in a free and natural atmosphere. The assumption is that the most important behaviour of individuals or groups is a dynamic process of complex interactions and this consists of more than a set of facts, statistics or even discrete incidents. The strength of this kind of study lies in the observation of natural behaviour in a real life setting from the constraints of more conventional research procedure.

Another assumption is that human behaviour is influenced by the setting in which it occurs. The researcher must understand the setting in which it occurs and also the nature of the social structure, its traditions, values and norms of behaviour. It is important to observe and interpret in terms of the subjects – how they view the situation, how they interpret their own thoughts, words and activities as well as those of others in the group. The researcher gets inside the minds of the subjects, while at the same time, interpreting the behaviour from his or her own perspective. The relationship of researchers to their subjects is based upon trust and confidence. A position of neutrality is essential to objective participant observation. Unlike conventional deductive quantitative research, participant observers begin without preconceptions and hypotheses. Using inductive logic, they build their hypotheses as they are suggested by observations. They periodically re-evaluate their hypotheses on the basis of new observations, modifying them when they appear to be inconsistent with evidence. They look for negative evidence to challenge their temporary hypotheses.

This type of research has a characteristic of a series of consecutive studies. The interpretation is not deferred to the conclusion but it is a constant ongoing process of testing tentative hypotheses against additional observations in a real situation.

Ethnography methods have been used to investigate such problem as:

- students leadership role in an urban racially integrated High School
- pupil-teacher relationship in a sub-urban Junior High School.

SELF-ASSESSMENT EXERCISE 1

Discuss how ethnographers build their theses? Write down two topics that can be studied in your area of specialisation using the ethnographic method.

Ethnographers construct their final reports to present a holistic description of the people they have observed and to portray the everyday

experiences of the individuals. Their findings are often stated as assertions – that is, broad statements of the observed or inferred relations between culture and behaviour. These assertions are supported by analytical vignettes, short segments of quotation data intertwined with interpretative commentary that help the reader "see" what these quotes mean in the given context with the given participants.

3.1.1 Phenomenology

Phenomenology refers to a person's construction of the meaning of a phenomenon as opposed to the phenomenon as it exists external to the person. Phenomenologists do not assume that they know what things mean to the people they are observing. If behaviour is being observed, the phenomenologist does not simply note that certain behaviour has occurred, but attempts to understand what the behaviour means to the person being studied and this emphasises the subjective aspects of this behaviour. "Attention to experience and intention to describe experience are the central qualities of phenomenological research" (Volkmann, 1992). Essentially, the phenomenological approach is based on the concept that reality consists of the meaning of experiences by those being studied.

Mulderij, et al. (1984) introduced their students to phenomenological analysis. They started with topics that everyone had experience with such as "falling asleep" and "being afraid in the dark" all the time. Phenomenologists hope to get a better understanding of the meaning an experience has for others as well as for themselves.

SELF-ASSESSMENT EXERCISE 2

What is the main aim of a phenomenological research?

A phenomenological researcher is expected to select a topic that is personally meaningful as well as emotionally and intellectually engaging. Van Manen (1990) stated that the starting of phenomenological research is largely a matter of identifying what it is that deeply interests you or me and of identifying this interest as a true phenomenon, that is, as some experience some human beings live with. For example, Volkmann (1992) states that it is the study of two science teachers-leaders by a former science teacher. This researcher has a deep personal interest in his topic – a characteristic more common to phenomenological research than to other approaches.

Although phenomenology can be conducted with a single participant (or even as an examination of the researcher's own experience), Phenomenologists typically involve five to ten people in their studies.

Phenomenologists depend mainly on exclusive in depth interviews; as such they also choose their respondents purposively. Paton (1990) explained that purposeful sampling is done to increase the utility of information obtained from small samples. The sample is purposively selected to ensure that they are likely to be knowledgeable and informative about the phenomenon being studied. The actual implementation of a phenomenological study is as much in the participants hands as it is in the researchers. The phenomenological interview is not structured as a series of questions and answers as in ethnographic study, instead the researcher and the respondents work together to "arrive at the heart of the matter". The researchers are expected to take their cues from the participants' expressions, questions and occasional sidetracks. Such an interview is not expected to look like a dialogue or conversation, with the participant doing much of the talking and researcher doing most of the listening.

SELF-ASSESSMENT EXERCISE 3

What is main difference between ethnographic and phenomenological questionnaire?

According to Barit (1986), the data analysis aims at "trying to go to the heart of the matter by looking for themes that lie concealed in the unexamined events of everyday life…. to find meaningful, shared themes in different peoples descriptions of common experiences". Phenomenological analysis of transcribed data, though similar to other qualitative analyses is characterised as being initially more open, tentative and intuitive (Tesch, 1994). Whereas ethnographers focus on "events" as the unit of analysis, Phenomenologists focus on "meaning units" – that is, the smallest segment of text that are meaningful by themselves. Rather than identify categories, phenomenologists describe themes and patterns in the data.

Phenomenologists always report their findings in the form of a narrative that describes a pattern or a theme. However, a phenomenologist assumes a commonality among these experiences and is expected to explore and describe "what is invariable across all manifestations of the phenomenon".

SELF-ASSESSMENT EXERCISE 4

What form does a Phenomenologist's report take?

3.1.2 Grounded Theory

Grounded theory originated from the work of two sociologists (Glasser and Strauss, 1967) who were concerned with closing the embarrassing

gap between theory and empirical research. Grounded theory is not considered to be discipline bound; rather, it is a set of procedures for analysing data that will lead to the development of theory useful to that discipline. Grounded theory starts with broad research questions that provide the freedom and flexibility to explore a phenomenon in depth. The research questions identify the general focus for the study and tend to be action and process oriented. Depending on how the question is focused the researcher gathers different data and attends to different aspects during analysis.

In grounded theory research, the researcher "attempts to derive a theory by using multiple of data collection and the refinement and interrelationships of categories of information. The theory is grounded in that it is developed from the data, as opposed to being suggested by the literature i.e. theory is expected from, rather than a starting point, for the study. Thus, grounded theorists try to find answers to questions that are important but not yet answered.

Gall, et. al (1996) define theory as "an explanation of the commonalities and the relationships among observed phenomena in terms of the causal structures and processes that are presumed to underlie them. Grounded theorists like other theorists, aim to identify and describe those plausible relationships among concepts and sets of concepts.

Data collection is flexible, characterised by openness to changing conditions. Grounded theorists have used historical records, interviewing and observation strategies to collect their data. Generally, data are collected from more than one unit because grounded theorists hope to maximise similarities and differences among information obtained. For this reason, these studies are sometimes referred to as multi-case studies because several teachers, nurses, communities etc. are studied. This sampling of different units for the purpose of maximizing information is called theoretical sampling.

Analysis in grounded theory is composed of three major types of coding: Open coding, axial coding and selective coding. Open coding refers to the process of breaking down, examining, comparing, conceptualising and categorizing data. Axial coding refers to a set of procedures whereby data are put back together in new ways after open coding by making connections between categories. Selective coding refers to the process of selecting the core category systematically relating it to other categories, validating those relationships and filing in categories that need further refinement and development. Data collection and analysis are tightly interwoven.

These levels of coding comprise constant comparative method of analysis, defined as the continual process of company data segments and data codes within and across categories. A category is an abstract name for the meaning of similar topics. A pattern is a relationship among categories. The relationship between two or more concepts generates a theory. Because of the problems inherent in building theory, grounded theorists are more interested in patterns of interaction between and among people than in individual perspective as such.

Strauss and Corbin (1994) indicate that "the concept relationships developed through grounded theory are stated as propositions and are presented in discursive form. Discursive presentation captures the conceptual density and conveys descriptively also the substantive content of a study".

3.1.3 Correlation Studies

Correlation is the relationship between two or paired variables or two or more sets of data. The degree of relationship is measured and represented by the coefficient it may be identified by either the letter (r), the Greek letter (l) or other symbols depending upon the data distributions and the way the coefficient has been calculated. For example, students who have high intelligence quotients tend to receive high scores in mathematics tests, whereas those with low IQs tend to score low. When this type of relationship is obtained, the factors are measured, intelligence and scores on mathematics tests are said to be positively correlated. Sometimes, variables are negatively correlated when a large amount of one variable is associated with a small amount of the other. As one increases, the other tends to decrease. When however the relationship between the two sets of variables is a pure chance relationship, then there is no correlation. Examples of pairs that are usually positively correlated are:

- Intelligence and Achievement
- Height and Shoe size

The degree of linear correlation can be represented quantitatively by the coefficient. A perfect positive correlation is +1.00 white a perfect negative correlation is – 1.00. A complete lack relationship is 0. Rarely, if ever, are perfect coefficients of correlation +1.00 or –1.00 encountered, particularly in relationships that tend to appear fairly consistently – there are variations or exceptions that reduce the measured coefficient from a –1.00 to +1.00 towards zero. A definition of perfect positive correlation specifies that for every unit increase in one variable, there is a proportional unit increase in the other. The perfect negative correlation specifies that for every unit increase in one

variable, there is a proportional unit decrease in the other. That there can be no exceptions explains why coefficients of +1.00 or –1.00 are not encountered in relating human traits. The sign of the coefficient indicates the direction of the relationship and the numerical value of strength.

4.0 CONCLUSION

In this unit, you have learnt that ethnography is a method of field study that adopts the participant observer method, focuses on naturally occurring processes/changes, data collected through structured interviews, artifact/document collections, data analysis by constant comparative methods, normally reported by holistic description of everyday events. Phenomenology describes an experience from the participant's point of view, studies individuals and focuses on life experience, adopts in-depth unstructured interviews, sample size of 5 – 10 people. Phenomenology also report searches for themes and patterns across participants report thematic narratives. Grounded theory –derives a theory that links participants' perspective to general theories. Studies process and focuses on interaction, data drawn from records, interviews and observations, analysis by constant comparative method, report by analytical story.

Correlation deals with the relationship between two or more variables Perfect correlation is +1.00 or –1.00. When increase in one causes proportional increase on the other, the coefficient of correlation is +1.00, but when one decreases and the other increases, the coefficient is –1.00. When there is no relationship, the coefficient is zero correlation and does not mean causation.

5.0 SUMMARY

In this unit, you have studied types of research, you have added more research, and you have added more research as methodologies namely: ethnography, phenomenology, grounded theory and correlation to your knowledge of research of methodologies. You will do well to master the methods properly as you need them in choosing and carrying out your study.

6.0 TUTOR-MARKED ASSIGNMENT

Choose a research topic each on ethnography and phenomenology and describe clearly how you would carry out the study in not more than four pages.

7.0 REFERENCES/FURTHER READING

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MODULE 4 TYPES OF RESEARCHES

UNIT 1 HISTORICAL RESEARCH

CONTENTS

1.0 INTRODUCTION

Historical research has been known a long time; possibly longer than most other types of research. When we think of historical research, a process of searching for, summarising and interpreting information from the past comes to mind. The past may be any time as recent as within the immediate preceding year or it may go back several centuries. Historical research differs from other studies because it cannot be classified as either quantitative or qualitative.

Historical analysis may be directed toward an individual, an idea, a movement or an institution. However, none of these objects of historical observation can be considered in isolation. People cannot be subjected to historical investigation without some considerations of their interactions with the ideas, movement and or institutions of their times. Historical approach to research will be discussed under the following subheadings: general explanation of historical research, sources of data,

history and science, the historical hypothesis and problems of historical research.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of events
- describe external and internal evidence
- state the historical time
- compare historical periods
- formulate hypotheses for historical research
- identify sources of historical data
- analyse historical data
- apply historical findings in relevant classroom issues.

3.0 MAIN CONTENT

3.1 Meaning of Historical Research

Historical research is a systematic process of describing, analysing and interpreting the past based on information from selected sources as they relate to the topic under study. History is a transcript of the restless and ever flowing stream of events and the changes in human life and its institutions, its languages, customs, art, philosophies and the lives of those who command the attention of their contemporaries – the great individuals who start their hour upon the stage and are heard no more (Leedy, 1997).

The main issue of the historical method, like other types of research, is not the accumulation of facts, but the interpretation of the facts. The interpretation of information is the main issue in any form of research.
Naturally, events appear to happen without any apparent sequence, but a study of any chain of events will reveal "patterns of rationality" that make historical facts seem meaningful. History is always dynamic therefore it defines the role of the historical researcher. Historical researcher makes in-depth investigation. To establish the meaning and relationship of events, researchers should strive to get close to the source of the events. This researcher does this by relying on documentary sources; also they at times study artifacts either alone or with documentary evidence. Where possible, the researcher relies on only the primary source of information to get to the root of the matter.

Primary data on the other hand consists of such original information about people who made history and influenced human events as events

they influence and that influenced them. The contemporary scene of their days must be reconstructed as nearly as possible. The primary data therefore consists of portraits, a record of the words they wrote and are reported to have been spoken, the testimony of their friends and acquaintances, the personal records they left behind, the objects they used, the houses and towns where they worked and affected events important in their times and significant in their lives.

According to Leedy (1997), the use of primary data tends to ensure the integrity of the study and strength its reliability.

SELF-ASSESSMENT EXERCISE 1

1. What are the main tasks of the historical researcher?
2. Name three sources of primary data.

3.2 History and Science

According to Best and Khan (1995), opinions differ as to whether or not the activities of the historian can be considered scientific or whether there is such a thing as historical research. Those who contend that historical research may have the characteristics of scientific research activity argue as follows:

(i) The historian delimits a problem, formulates hypotheses or raises questions to be answered, gathers and analyses primary data, tests the hypotheses as consistent or inconsistent with evidence and formulates generalisations or conclusions;

(ii) Although the historian may not have witnessed an event or gathered data directly, he/she may have the testimony of a number of witnesses who have observed the event from different vantage points. The historian therefore rigorously subjects the evidence to critical analysis in order to establish its authenticity, truthfulness and accuracy;

(iii) In reaching conclusions, the historian employs the principles of probability similar to those used by physical scientists;

(iv) Although it is true the historian cannot control the variables directly, this limitation also characterises most behavioural research as particularly investigations in sociology, social psychology and economics;

(v) The observation of historians may be described in qualitative or quantitative terms depending on the subject matter and the approach of the historian. In general, the traditional approach is qualitative while the reformist uses quantitative analyses. The traditional qualitative approach in many historical studies does not preclude the applications of scientific methodology.

Those who take negative position advance the following reasons:

a. Although the purpose of science is prediction, the historian cannot usually generalise on the basis of past event. Because past events were often unplanned or did not develop as planned, because there were so many uncontrolled factors and because the influence of one or a few individuals was so crucial, the same pattern of factors is not repeated;

b. The historian must depend upon the reported observation of others, often witnesses of doubtful competence and sometimes of doubtful objectivity;

c. The historian is much like a person trying to complete a complicated jigsaw puzzle with many of their parts missing. On the basis of what is often incomplete evidence, the historian must fill in the gaps by inferring what has happened and why it happened;'

d. History does not operate in a closed system such as may be created in the physical science laboratory. The historian cannot control the conditions of observation nor manipulate the significant variables.

SELF-ASSESSMENT EXERCISE 2

From the argument for and against stated above, justify your stand on this issue in not more than three sentences.

3.2.1 Internal and External Evidence

The information about historical research can be subjected to two types of evaluation. You may judge whether the document is authentic, or you may decide if indeed it is not authentic, what the document or the statement within the document means. Historical researchers describe the approaches to data that are concerned with these two problems as reviewing the data to determine their internal or external evidence and subjecting them to internal and external criticism.

Evidence is always concerned with problem from the viewpoint of the data; criticism is concerned with the same problem from the psychological attitude of the researcher. Therefore, evidence and criticism are interchangeable. It is very important that a document is genuine. Establishing the genuineness of documents is a study in itself and involves carbon dating, handwriting analysis, identification of ink and paper, vocabulary usage and writing style among others.

The internal evidence of a historical research is concerned with the genuineness of a manuscript or statement and the research asks such question as: what does the statement or word mean? What was the author attempting to say? What thought was the author trying to convey and what inference or interpretations could be extracted from these? What is the relevance or meaning of these words or statement? This is the main concern of internal evidence.

Social scientific and educational researchers use both external and internal criticism, but particularly internal criticism. For example, if an author of a research report comes to an erroneous conclusion, it is clearly the task of other researchers to correct the error.

SELF-ASSESSMENT EXERCISE 3

What are the two types of evaluation a historical research addresses? State two questions asked to elicit information for internal evidence.

3.3 Historical Hypotheses

Research problems may be stated in a variety of ways for historical research studies. They may or may not include specific hypotheses and/or questions. When hypotheses are stated, they usually are not stated in a statistical sense, although statistical information from the past could be used to support or refute hypotheses. Rather in historical research, hypotheses are conjectures about the characteristics, causes or effects of the situation, issue or phenomenon under study. Nevins (1962) illustrates the use of hypotheses in the historical research of Edward Channing in answering the question “Why did the confederacy collapse in April, 1865?

Channing formulated four hypotheses and tested them based on evidence gathered from letters, diaries and official records of the army and the government of the confederacy. He hypothesised that the confederacy collapsed because of:

i. the military defeat of confederacy army;
ii. the dearth of military supplies;
iii. the starving condition of the confederal soldiers and the civilians; and
iv. the disintegration of the will to continue the war.

According to Best and Khan (1995), Channing produced evidence that seemed to refute the first three hypotheses as follows:

- More than 200,000 well-equipped soldiers were under arms at the time of the surrender, the effect of production of powder and arms provided military supplies to continue the war and enough food was available to sustain the fighting men and civilians.

- Channing concluded that hypothesis iv. the disintegration of the will to continue the war was substantiated by the excessive number of desertions of enlisted men and officers. This is an example of historical study in which hypotheses were explicitly stated.

3.3.1 Hypotheses in Educational Historical Research

Hypotheses may be formulated in historical investigations of education. Some examples are:

- The science education innovations of the 1950s and 1960s were based upon practices that previously had been tried and discarded;
- The activities of social science inspectors have no significant effect upon the improvement of facilities (men and materials) in the 80s.

Although the hypotheses are not always explicitly stated in historical studies, they are usually implied. The historian gathers evidence and carefully evaluates its trustworthiness. If the evidence is compatible with the consequences of the hypothesis, it is confirmed, if the evidence is not compatible or negative, the hypothesis is not confirmed. It is through such synthesis that historical generalisations are established. The activities of the historians, when education is his/her field of inquiry, are no different from those employed in other fields. The sources of evidence may be concerned with schools, educational practices and policies, movements or individuals but the historical processes are the same.

SELF-ASSESSMENT EXERCISE 4

Choose a historical education topic and formulate three testable hypotheses.

3.4 Sources of Data

The sources of historical information are commonly classified as primary and secondary. A primary source is an original or first-hand account of the event or experience. They are eye-witness accounts. They are reported by an actual observer or participant in an event. Secondary sources are accounts of an event that were not actually witnessed by the reporter. The reporter may have talked with an actual observer or read an account by an observer, but his or her testimony is not that of an actual participant or observer. Secondary sources may sometimes be used, but because of the distortion in passing on information the historian uses them only when primary data are not available.

3.4.1 Primary Sources

Generally, primary sources of data are of such materials as documents, relics or remains and oral testimony. Some examples of these primary sources as they relate to educational studies are stated below:

(a) Official Records and Other Documentary Materials

Examples of these are records and reports of legislative bodies and state departments of public instruction; principals, vice chancellors, deans, departmental heads, educational committee, minutes of school boards, professionals and periodicals, bulletins, courses of study, curriculum guides, textbooks, examination report cards, pictures of teacher and pupils, personal files, samples of students' work and recordings among others.

(b) Oral Testimony

Included in this category are – interviews with administrators, teachers and other school employees, students and relatives, school patrons, or lay citizens and member of governing bodies.

(c) Relics

Included are buildings, furniture, teaching materials, equipment, decorative pictures, textbooks, examination and samples of students work.

3.4.2 Secondary Sources

Secondary sources are the reports of a person who relates the testimony of an actual witness of participant in an event. The writer of the secondary source was not at the scene of the event, but merely reports what the person who was there said or wrote. Secondary source of data are usually of limited worth for research purposes because of the errors that may result when information is passed from one person to another. Most history textbooks and encyclopedia are examples of secondary sources, for they are often several times removed from the original first-hand accounts of events.

Some types of materials may be secondary sources for some purposes and primary sources for another. For example, a senior secondary school science textbook is ordinarily a secondary source of information. But if the study is the changing phases of instructional materials in Nigerian science secondary schools, the science textbooks would become a primary source.

SELF-ASSESSMENT EXERCISE 5

State the two major sources in historical studies and give three educationally-related examples of each of the sources.

3.5 Handling of Historical Data

You must have discovered that most of the data for historical studies are gathered from documents and are studies in terms of hundreds and note-cards. It is necessary for the researcher to have some means of gathering and controlling the data. In historical research, perhaps more than in any other type of research, the investigator can soon become lost in morass of notes, note cards, bibliography, cards and memoranda. For most beginners, the problem is always how to organise the information into useful and meaningful phases for interpretation.

Historical data collection demands a systematic plan, not only for the collection of the data but also for retrieving and analysing them. Before beginning historical research therefore, you should have a specific plan for the acquisition, organisation, storage and retrieval of the data.

4.0 CONCLUSION

In this unit, you have learnt that:

- historical research deals with meaning of past events;
- the information about historical research can be subjected into two forms of evaluation namely: internal and external evidence;
- there are diverging views on whether historical research is scientific or can be generalised;
- hypotheses can be formulated for historical research; and
- there are primary and secondary sources of data and for historical research, primary data are very important;
- owing to morass of information often gathered for historical research, organisation and management of data is very important.

5.0 SUMMARY

In this unit, you have studied the historical research in the effort to expose you to some types of educational research. In the next unit, you are going to learn about survey studies.

6.0 TUTOR-MARKED ASSIGNMENT

1. What is historical research?
2. Is historical research scientific?
3. Describe how you would carry out a study on "Innovation in Science Education in Nigeria in the seventies.

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UNIT 2 SURVEY RESEARCH

CONTENTS

1.0 INTRODUCTION

In the last unit, you read that historical research is different from the study of history. You were informed that historical research deals with the meaning of historical events. In the desire to expose you to as many types of educational research methodologies as possible, will be discussed in this unit survey methodology will be discussed in this unit. Practically all adults have been involved in surveys at sometime or another. People are surveyed through attitudes, opinions and perceptions and often, they are asked to evaluate something.

The aim of any survey is to obtain information which can be analysed and patterns extracted and comparison made. In surveys, all respondents are asked the same question while the same circumstances are assumed to prevail. These surveys focus on numerous factors of school operation, the community's perception of the schools and how well they are being operated.

Information, most of the time, can be gathered by means of self-completed questionnaire, or by means of questionnaire, schedules or checklists administered by an interviewer. Whatever method of information gathering is selected, the aim is to obtain answers to the same questions from a large number of individuals to enable the researcher not only to describe, but also to compare and relate one characteristic to another and to demonstrate that certain features exist in certain categories.

Surveys can provide answers to such questions as What? Where? When? and How? But it is not so easy to find out why? Causal relationships can rarely, if ever, be proved by survey method. The main emphasis is on fact finding and if a survey is well-structured and piloted, it can be a relatively cheap and a quick way of obtaining information.

In this unit, you will study survey research methodology under the following subheadings: meaning of survey, characteristics of survey, techniques of gathering data, types of instrumental application of survey research, and advantages and disadvantages of survey research.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain the meaning of survey research
- describe the characteristics of survey
- identify the methods of gathering data for survey
- apply the results of survey studies in the classroom
- list the advantages and disadvantages of survey
- compare survey methodology with other methods of research.

3.0 MAIN CONTENT

3.1 Meaning of Survey Research

A survey is a data collection technique in which information is gathered from individuals called respondents by having them respond to questions. This is probably the most widely used research methodology. The survey method gathers data from a relatively large number of cases at a particular time. It is not concerned with characteristics of individuals but as generalised statistics that result when data are abstracted from a number of individual cases. It is essentially cross-sectional.

Survey provides such information that each statement pictures a prevailing condition at a particular time. The survey requires an imaginative planning, careful analysis and interpretation of the data gathered and logical and skillful reporting of the findings.

Generally, a survey as a descriptive research methodology, describes and interprets what is. It is concerned with conditions or relationships that exist, opinions that are held, processes that are ongoing, effects that are evident or trends that are developing.

It is primarily concerned with the present, although it often considers past events and influences as they relate to current conditions.

The survey is included in the quantitative tradition rather than the qualitative because descriptive researchers tend to convert their data into numerical indices and to employ statistical analysis technique to generalise their findings from a sample of the respondents to a population.

The method of research that looks with intense accuracy at the phenomena of the moment and then describes what the researcher sees is called descriptive survey.

SELF-ASSESSMENT EXERCISE 1

Explain two concerns of survey research.

3.1.1 Characteristics of Descriptive Survey

The characteristics of the descriptive survey are as indicated below:

- The principal means of collecting data is through observation technique to ensure discreteness of the population by carefully choosing, clearly defining and specifically delimiting to precise parameters the population for the study;
- Data in descriptive survey research are particularly susceptible to distortion through the introduction of bias into that research design. Particular attention should be given to safeguarding the data from the influence of bias.
- Although the descriptive survey method relies on observation for the acquisition of the data, those data must then be organised and presented systematically so that valid and accurate conclusions can be drawn from them.
- Surveys typically involve collecting data representative of populations too enormous to be dealt with by other methods. Indeed, the generalisability of survey findings is another major attraction of the method.
- All surveys, involve presenting the respondents with a series of questions to be answered. These questions may tap matters of facts, attitudes and opinions or future expectations. The questions may be simple single-item measures or complex multiple-item scales.
- In whatever form, however, survey data are basically what people say to the investigator in response to a question; and
- Data can be collected in survey research in two basic ways- through questionnaire or interviews.

SELF-ASSESSMENT EXERCISE 2

State two characteristics of a survey research.

3.1.2 Methodology of Survey

The methodology of conducting a survey involves a series of detailed steps, each of which should be carefully planned. The initial step is to define the research problem and to begin developing the survey design. The definition of the research problem should include a good background in the variables to be studied, which of course, includes the review of literature. Variables included in the survey must be operationally defined and the investigator should have information about the relationships of any sociological and psychological variables that may be involved. This information is valuable for selecting measuring instruments, such as tests for the survey.

The next step is the development of the sampling plan, if sampling is to be used rather than the entire population. Various factors must be considered. The population to be sampled must be defined and the units must be identified for sample population. The sample must be selected so that valid inferences can be made to the population and to any sub-population.

Sampling procedure can be quite complex and acquiring the sample may require considerable effort and resources; the next major step is the preparation for data collection. For surveys involving interviews or questionnaires, this is a major step, because the instruments must be conducted.

3.1.3 The Questionnaire

A commonplace instrument for observing data beyond the physical reach of the observer is the questionnaire. The questionnaire may be sent to people thousands of kilometres away, whom the researcher may never see. Therefore, the educational researcher who collects data with a questionnaire and the physicists who determine the presence of radioactive substance with Geiger Counter are just about the same degree of remoteness from their respective sources of data. He neither sees the source from which the data originate.

According to Leedy (1997), the questionnaire is a totally impersonal probe. Because of the impersonality associated with the questionnaire, four practical guidelines govern its use as a tool. The language must be immediately clear; communication is a deceptive skill. What is crystally clear to you may be meaningless to another person. The first guideline,

therefore, for questionnaire construction is that the assumption underlying the question must be spelt out clearly.

Initial drafts of a questionnaire should be "tried out" with a pilot run or trial run. Such a try out should be done with individuals similar to the intended respondents. The purpose of a pilot run is to check for ambiguity, confusion and poorly prepared items. Pilot run feedbacks can be very useful for finalise the instruments.

Questionnaire should be designed to fulfill a specific research objective. Certainly, it is necessary to identify the specific types of data that will be generated by the questionnaire early in the construction of the items and it is also necessary to consider how data will be tabulated, summarised and analysed. The procedures by which data are to be analysed should be identified. The survey must produce data that can be used to test the research hypotheses or answer the questions raised by the research problem.

Questionnaires succeed as their success is planned. The letter to the respondent should describe the potential value of the study. The letter should emphasise the importance of the study to the addressee. Without the benefit of common courtesy of our own demand on others, poorly framed letter may be another reason for poor return of questionnaires. Planning is essential for tabulating questionnaires to be developed for mailing to large samples of participants. It is advisable, to consider how the responses will be tabulated after their return. These issues will be
revisited under the heading "construction" of questionnaire later in this course.

SELF-ASSESSMENT EXERCISE 3

State two qualities of a good questionnaire.

3.2 The Interview

Clearly allied to the questionnaire is the structured interview. A structured interview includes a series of closed form questions similar to those used in a questionnaire. Semi-structured interviews go one step further by following these closed form questions with probes designed to obtain additional, clarifying information. Regardless of which form is used, interviewing involve much more than just asking questions. The questions for the interview should be carefully planned and the words should be accurate as the items in the questionaire. Furthermore, it should be pilot tested just like the questionnaire, to ensure that the questions are clear, precise and free from bias.

Planning is necessary for interview to ensure that the set objectives will be achieved. If an interview schedule is used, the interview will progress in accordance with the schedule. As needed, the interviewer will use probes or follow up questions that are intended to elicit clearer and more complete responses. In some cases, suggestion for probes will be contained in the interview schedule. In less structured interviews, interviews must be prepared to develop and use their own probes. Probes can take the form of a pause in conversation that encourages the respondent to elaborate, or a probe could be an explicit request to clarify or elaborate on something. A major concern of any probe is that it does not bias the respondent's answer by suggesting how he or she should answer (Fowler and Mangion, 1990).

Also, interview as a means of eliciting data will be discussed in greater detail later in the course.

3.3 Application of Survey Research

The educators, the teachers, inspectors and researchers can learn a lot about science within the school system, without contacting every child and every teacher in the school system. The sampling methods developed in survey research can be very useful. Samples are sufficient for many purposes and such studies could provide much needed information for positive change and development.

Interview of random samples of pupils, teachers, parents etc. could be conducted on such issues as perception of the quality of science education in the country, the whole area of attitudes to science. Pupils' view about their science teachers to mention but a few could be carried out. The fears and anxieties of parents and general public about science in the school could be determined to alleviate such fears. The important factor is that the survey should be properly planned and executed.

Survey research is probably best adapted to obtain personal and social facts, beliefs and attitudes. It is significant that although, a lot of words are spoken and written about education in general and science education in particular, most data are not available to substantiate such statements.

SELF-ASSESSMENT EXERCISE 4

Discuss one educational value of survey research.

3.4 Advantages and Disadvantages of Survey Research

Survey research has the advantage of wide scope: a lot of information can be obtained from a large population. A large population or a large school system can be studied with much less expense than that incurred by a census. Compared with other research methodologies, survey research is relatively economical. Also, because it uses existing educational facilities and personnel to reduce cost, survey research data are accurately within sampling error.

One major disadvantage is that survey information does not penetrate very deeply below the surface. The scope of the information sought is usually emphasised at the expenses of the depth. Survey research takes a lot of time and money.

Interviews require skill, time and money. Also, survey research requires a good deal of research knowledge and sophistication.

The survey investigator must be familiar with sampling question and schedule construction, interviewing analysis of data and other technical aspects of survey.

4.0 CONCLUSION

In this unit, you have learnt that survey is a data collection technique in which information is gathered from individuals called respondents.

Survey has specific characteristics that distinguish it from other research methodologies e.g. the population for the survey must be carefully chosen, clearly defined and specifically delimited to set precise parameter for ensuring discreteness to the population.

- Techniques for gathering data include: questionnaires, interviews and checklists;
- Survey research is a useful tool for educational applications;

The methodology has both advantages and disadvantages, has a wide scope and requires special skills and it takes a lot of time and money.

5.0 SUMMARY

Again, you have added another research methodology to the one you have already studied. N**o**te that survey is regarded as non-experimental research. It is the first quantitative research methodology you have studied in this course.

6.0 TUTOR-MARKED ASSIGNMENT

1. Analyse the main focus of survey research.
2. Describe the necessary steps you would take to carryout a study with the topic: "Attitude of Junior Secondary School students to Integrated Science".

7.0 REFERENCES/FURTHER READING

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UNIT 3 EXPERIMENTAL AND QUASI-EXPERIMENTAL RESEARCH I

CONTENTS

1.0 INTRODUCTION

The word experiment is used quite freely in our society and therefore, it has a broad, quite familiar meaning. We talk about experimental programmes and experimental drugs, for example. These involve a new approach or procedure, or new ingredients to see what the effects will be when something is tried; we refer to this as an experiment or to the process as experimenting.

In educational research, we use the same basic concept for an experiment, that is, something is tried to determine its effects. That something has one or more independent variable (s) manipulated to determine the effects. An independent variable manipulated in an experiment is called an experimental variable. In its simplest form, the experimental study attempts to control the entire research situation except for certain input variables that then become suspect as the cause of whatever change has taken place within the investigative design.

The matter of control is so basic to the experimental study that it is frequently referred to as the control group – experimental group design. The study begins as far as possible with matched groups. These groups are randomly selected and paired so that, as far as possible, within the limits of the evaluative instruments available, each group resembles the other on as many characteristics as possible, especially those that are critical to the experiment.

Experimental Group – Control Group

Though it is assumed that at the beginning of the experiment, both groups have identical characteristics values and status, equivalence is more theoretical than real. Because of this, the group is referred to as "matched group", or it could be said that the groups are matched on the basis of X, Y and Z; when X, Y and Z are the parameters that provide the basis for matching.

This unit will be discussed under the following subheadings: characteristics of the experimental method, classification of experimental designs, variables one-shot experimental case study, one group pretest-Post-test design, pretest – Post-test control group design, Solomon four group design, non-randomized control group – pretest, Post-test design, time series experiment and control group time series design.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- state the characteristics of the experimental method and recognise the classification of experimental design
- identify the dependent and independent variables in a research question objectives
- explain what are extraneous variables
- define the meaning of experimental validity
- state and describe the threats of internal experimental validity
- criticise experimental research reports.

3.0 MAIN CONTENT

3.1 Characteristics of the Experimental Method

Before specific experimental designs are introduced, some general criteria for a well-designed experiment will be considered. Essentially, the characteristics that make for a good research design also apply to the design of an experiment. The criteria are listed here with a brief comment for each criterion to explain what it means:

i. **Adequate Experimental Control** – This means that there are enough constraints on the conditions of the experiment so that the researcher can interpret the results. The experimental design is so structured that if the experimental variable has an effect, it can be detected. This may also mean controlling other variables through

randomisation or by building them into the design as independent variables.

ii. **Lack of Artificiality** – This criterion is especially important in educational research if the results of the experiment are to be generalised to a non-experimental setting – for example, a classroom. It means that the experiment is conducted in such a way that the results will apply to the real educational world. We do not want the artificial or atypical characteristic of an experiment to cause the experimental effects.

iii. **Basis for Comparison** – There must be some way to make a comparison to determine whether or not there is an experimental effect. In some experiments, a control group is used – a group that does not receive an experimental treatment. The control group in an instructional experiment usually consists of a group of students taught by a traditional method. Certainly not all experiments require control groups. Comparisons can be made between two or more experimental treatments and on occasion with some external criterion.

iv. **Adequate Information from the Data** – The data must be adequate in order to test the hypotheses of an experiment. The data must be such that the necessary statistics can be generated with enough precision to make decisions about hypotheses.

v. **Uncontaminated Data** – the data should adequately reflect the experimental effects. They should not be affected by poor measurement errors in the experimental procedure. The individuals from the various groups should not interact in such a way as to cancel the experimental effects or to cause misrepresentation of the experimental effects.

vi. **No Confounding of Relevant Variables** – This criterion is closely related to adequate experimental control group. There may be other variables operating that have an effect on the dependent variable. If so, these effects must not be misinterpreted as experimental effects. Their effects must be separated or controlled, usually through the experimental design.

vii. **Representativeness** – Representativeness usually means to generalise the experimental results to some individuals, conditions, methods and so forth. To obtain representativeness, experimenters commonly include some form of random selection of subjects from the population to which they intend to generalise.

viii. **Parsimony** – The criterion of parsimony means that, with all other characteristics equal, a simpler design is preferred to a more complex one. Of course, a design must be complex enough for the purposes of the experiment, but complexity is not encouraged for its own sake. The simpler design is usually easier to implement and possibly easier to interpret.

Experiments, like any other types of educational research, are susceptible to technical and procedural errors. The development of an appropriate experimental design and its adequate implementation require a considerable and careful planning, but they provide the best safeguard against errors. Experimental designs require simultaneous attention to a variety of details. This planning is done prior to conducting the experiment.

SELF-ASSESSMENT EXERCISE 2

What is a research design?

3.2 Variables – Independent and Dependent Variables

Variables are the conditions or characteristics that the experimenter manipulates, controls or observes. They can be divided into two, namely: independent and dependent variables.

The independent variables are the conditions or characteristics that the experimenter manipulates or controls in his or her attempt to ascertain their relationship to observed phenomena. The dependent variables are the conditions or characteristics that appears, disappears or changes as the experimenter introduces, removes or changes the independent variables (Best and Khan, 1995).

In educational research, an independent variable may be a particular teaching method, a type of teaching material, a reward or a period of exposure to a particular condition or an attribute such as: sex or level of intelligence. The dependent variable may be a test score, the number of errors in a comprehensive exercise etc. The dependent variables are the measured changes in pupils' performance attributable to the influence of the independent variable.

There are two types of independent variables: treatment and orgasmic or attribute variables. Treatment variables are those factors that the researcher manipulates and to which he or she assigns subjects. Attribute variables are those characteristics that cannot be altered by the experimenter such as: age, sex, race or intelligence quotient (IQ). The

experimenter can decide to include them or remove them as variable to be studied.

SELF-ASSESSMENT EXERCISE 2

Identify the independent and dependent variables in a study titled "The effect of remedial mathematics on students' science achievement".

3.3 Confounding Variables

Confounding variables are those aspects of a study or sample that might influence the dependent variables (outcome measure) and whose effects may be confused with the effect of the independent variable. Confounding variables are of two types: extraneous variables and intervening variables.

i. Intervening Variables

In experimental research, certain variable that cannot be controlled or measured directly may have an important effect upon the outcome. They intervene between the cause and the effect. In an achievement test, the researcher may suspect that certain variable may be influencing the student's performance though they may not be observed directly, such factors as anxiety, fatigue, motivation and English comprehension ability. These are difficult to define operationally, but you cannot ignore them, therefore, they must be controlled through the use of appropriate designs.

ii. Extraneous Variables

Extraneous variables (i.e. variables not manipulated by the researcher) that may have a significant influence upon the results of a study. Many research results are questionable because of the influence of these extraneous variables. In a study of teacher's competence and pupils' performance, different teachers and whole classes will be used. Such variables as academic ability, teacher personality, age and readiness, constitute extraneous variables that could affect the result of the study. It should be noted that for an extraneous variable to confound the result of a study, it must be correlated strongly enough with both the independent and dependent variables that its influence can be mistaken for that of the independent variables. It is almost impossible to eliminate the influence of the extraneous variable totally, but a good design could minimise its influence.

iii. Controlling Variables

Confounding Variables that are of interest to the researcher can be controlled by building them into the study as independent variable. For example, a researcher comparing two teaching methods may wish to control teacher capabilities by making it an independent variable. Several variables that are not of interest to the research may be removed or their influence minimised as follows:

- **Removing the Variable:** Variables may be controlled by removing them completely. For example, teacher concerns for the good performance of his/her pupil could be eliminated by using a neutral teacher to supervise the examination.

- **Randomisation:** Randomisation involves pure chance selection and assignment of subjects to experimental or control group. This is a method whereby everyone selected for the study has equal chance of being assigned to either the experimental or control group e.g. use of tossing the coin.

- **Matching Cases:** Where randomisation is not feasible, selecting pairs of individuals with identical or nearly identical characteristics and assigning one to experimental or control reduces the influence. Where the variables are more than one, matching may not effectively solve the problem.

- **Balancing Cases or Group Matching:** Balancing cases consists of assigning subjects to experimental and control groups in such a way that the means and variances of the groups are as nearly equal as possible.

- **Analysis of Variances:** This method permits the research to eliminate initial differences on several variables between the experimental and control groups by statistical methods. The use of pretest mean scores as covariance is more effective than the matching process. You should note that these methods of controlling the extraneous variable need many examples to make them meaningful and comprehensible, but owing to the scope of this work, it is not possible to do so. You should consult research method textbooks for more examples.

SELF-ASSESSMENT EXERCISE 3

What is the best way of controlling extraneous variables for group of people in the experimental and control group?

3.4 Experimental Validity

The criteria of a well-designed experiment can be summarised as the characteristics that enhance experimental validity. Experimental validity is used here as defined by Campbell and Stanley (1963) and Cook and Campbell (1979), and is said to be of four types: internal, external, construct and statistical conclusion.

Internal validity refers to the validity of the cause and effect inference linking the independent variable and the dependent variable. It questions whether the experimental treatment really makes a difference in the dependent variable. To answer this question, the researcher must be confident that factors such as extraneous variables have been controlled and are not producing an effect that is being mistaken as an experimental treatment effect.

External validity of an experiment deals with the generalisability of the results of the experiment. In what populations, variables, situations and so forth, do the results generalise? Generally, the more extensively the results can be generalised, the more useful the research, given that there is adequate internal validity.

Construct validity deals with the definitions of the independent and the dependent variables in an experiment and in the ways that these variables are operationalised in the experimental setting. The concern is that the constructs that are investigated could be construed to be different constructs.

Statistical conclusion validity refers to the validity of the decision that there exist a statistically significant difference between the experimental group and the control group. This is the first step in deciding whether the experimental treatment has had an effect. A mistake at this point will lead to an inaccurate conclusion about the impact of an independent variable on the dependent variable.

3.4.1 Threats to Experimental Validity

Experimental design should enhance experimental validity, but experimental validity does not depend on experimental design alone. The specifics of the experiment have an influence and a number of things can happen to threaten experimental validity both internal and external.

Campbell and Stanley (1966) have summarised the threats to experimental validity identifying 12 threats, eight to internal validity and four to external validity. Table 12.1 lists and describes most of these

threats and provides an example on how each could occur. Because these are experiments, all examples assume that some experimental treatment has been administered.

***Table 3.1*: Threats to Experimental Validity**

S/N	THREATS	EXAMPLES
	Internal Validity	
1.	History – unanticipated events occurring while the experiment is in progress that affect the dependent variable.	During a relatively short instructional experiment, one group of subjects misses instruction due to a power failure at the school.
2.	Maturation – processes operating within the subject as a function of time.	In a learning experiment, subject performance begins decreasing after about fifty minutes due to fatigue.
3.	Testing – the effect of taking one test on the scores of a subsequent test.	In an experiment in which performance on a logical reasoning test is the dependent variable, a pretest cues the subjects about the Post-test.
4.	Instrumentation – an effect due to inconsistent use of the measuring instruments.	Two examiners in an instructional experiment administered the Post-test with different instructions and procedures.
5.	Statistical regression – an effect caused by a tendency for subjects selected on the basis of extreme scores to regress toward an average performance on a subsequent test.	In an experiment involving reading instruction, subjects grouped because of poor pretest reading scores show considerably greater gains than the average and high readers.
6.	Selection – an effect due to the groups of subjects not being randomly assigned to groups; a selection factor is operating such that the groups are not equivalent.	The experimental group in an instructional experiment consists of a high-ability class, while the control group is an average-ability class.

1 1 3

7.	Mortality – an effect due to subjects dropping out of the experiment on a non-random basis.	In a health experiment designed to determine the effects of various exercises, those subjects finding exercise most difficult stop participating.
8.	Selection-maturation interaction – an effect of maturation not being consistent across the groups because of some selection factor.	In a problem-solving experiment, intact groups of junior high school students and senior high students are involved. The junior high students tire of the task sooner than the older students.
	External Validity	
1.	Interaction effect of testing – pretesting interacts with the experimental treatment and causes some effects such that the results will not generalise to an unpretested population.	In a physical performance experiment, the pretest cues the subjects to respond in a certain way to the experimental treatment that would not be the case if there were no pretest.
2.	Interaction effects of selection biases and the experimental treatment – an effect of some selection factor of intact groups interacting with the experimental treatment that would not be the case if the groups were formed randomly.	The results of an experiment in which teaching method is the experimental treatment, is effective with high achievers.
3.	Reactive effects of experimental arrangements – an effect that is due to the artificial or novel experimental setting. (Note that this can also threaten internal validity).	An experiment in remedial reading instruction has an effect that does not occur when the remedial reading program is implemented in the regular classroom.
4.	Multiple-treatment interference – when the	An experiment in remedial reading instruction has an effect

	same subjects receive two or more treatments (as in a repeated measures design)…there may be a carryover effect between treatments such that the results cannot be generalized to single treatments.	that does not occur when the remedial reading program is implemented in the regular classroom.
	Construct Validity	
1.	Inadequate preoperational explication of constructs – insufficient definition of the independent and/or dependent variables.	Two teachers implement individualized instruction in very different ways because they lack a precise definition of the term.
2.	Mono-operation bias – only one form of the experimental variable is implemented.	An experiment concerning the effect of feedback includes only written feedback.
3.	Mono-method bias – only one form of the dependent variable is implemented.	An experiment on reducing test anxiety uses only a paper-and-pencil self-report of anxiety.
4.	Hypothesis-guessing within experimental condition – participants behave differently when they know they are part of an experiment. (Note that the behavior of subjects can also threaten internal validity).	Subjects in an experimental program interact differently when they know they are being studied.
5.	Confounding constructs and levels of constructs – drawing conclusions about variables when some levels of the variable are absent.	A researcher concludes that music enhances exercise programs when this is only true for certain kinds of music.

	Statistical Conclusion Validity	
1.	Low statistical power – using a sample size that is too small to detect differences between groups.	A researcher concludes that two instructional approaches are equally effective when an experiment with five students in each group yields no significant differences.
2.	Violated assumptions of statistical tests – failing to meet the underlying assumptions.	A researcher reports means and variances of nominal scaled data such as ethnicity.
3.	Finding and the error rate problem – capitalizing on chance findings.	A researcher compares two methods on fifty dependent variables and bases conclusions on two significant findings.
4.	Reliability of measures – using technically inadequate measures.	A psychologist finds no difference between boys' and girls' recall of memories of infancy.

SELF-ASSESSMENT EXERCISE 4

What is experimental validity?

4.0 CONCLUSION

In this unit, you have learnt that the experimental study goes by various names, such as: cause and effect method, laboratory method, pretest – Post-test control group design. The experimental method deals with cause and effects.

An experiment involves the comparison of the effects of a particular treatment with that of a different treatment or no treatment. There are two types of variables – independent and dependent variable. Confounding variables are those that can influence the dependent variable. Extraneous variables are those uncontrolled by removing the variable matching, group matching and analysis of variance. Experimental validity, is whether the instrument measures, what it intended to measure. There are two types of validity: internal and external validity. Threats to internal validity include: maturation,

testing, history, selection, experimental attrition and statistical regression.

5.0 SUMMARY

In this unit, you have started work on experimental design which is a very important aspect of research method in education. You have learnt about the important issues that are very necessary for effective understanding of experimental design. In the next unit, you will study experimental design.

6.0 TUTOR-MARKED ASSIGNMENT

1. Discuss the relevance of any two variables that plays some roles in experimental research design.
2. Explain the validity of an instrument.

7.0 REFERENCES/FURTHER READING

Best, J.W. & Khan, J.V. (1995). *Research in Education* (7th Edition). New Delhi: Prentice Hall. PP 20 – 23.

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MODULE 5 TYPES OF RESEARCHES II, POPULATION AND SAMPLE

UNIT 1 EXPERIMENTAL AND QUASI-EXPERIMENTAL RESEARCH II

CONTENTS

1.0 INTRODUCTION

You will note that the last unit was titled "Experimental and Quasi-Experimental Research I". This suggests that the present unit is part of and a continuation of the previous unit. You are therefore, advised to revise the last unit before you embark on studying the present unit.

Some of the facts you studied in the last unit will be mentioned here as a preparation for the present study. At the beginning of the experiment, it is assumed that Experimental Group is equal to (=) Control Group. An experiment involves the comparison of the effects of a particular

treatment with that of a different treatment or of no treatment. Also, you were told that variables are the conditions or characteristics that the experimenter manipulates, controls or observes.

You also learnt that variables that are not of interest to the experimenter may be removed or their influence reduced by removing the variables, randomisation matching, group matching or analysis of variance. For an experiment to have internal validity, the fact that have been manipulated should have a genuine effect on the observed consequences while external validity deals with the generalisability of the findings and threats to internal validity are brought about by the following factors: maturation, history, testing, instrumentation, statistical regression, selection and experimental attrition. You should make sure that the facts reviewed here are quite clear to you before you proceed with this unit.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- classify experimental designs
- identify appropriate experimental design for a chosen study
- apply the results of experimental design in the classroom
- criticise experimental research results
- describe a particular research design.

3.0 MAIN CONTENT

3.1 Classification of Experimental Design

There are three categories of experimental designs, namely: pre-experimental designs, the true experimental designs and the quasi-experimental designs. The non/quasi-experimental designs lack both the random assignment to conditions and the control group that are such a central part of the good experimental designs. While they are sometimes useful, they illustrate some inherent weakness in terms of establishing internal validity. The better designs are called true experimental designs. The strength of experiments as research techniques is that they are designed to enable us make inference about the causality. The element that makes this possible is the control.

In experiments, the researcher has considerable control over determining who participates in a study, what happens to them and under what condition it happens. In order to appreciate the importance of this, some of the key terms in experimental research are discussed at below.

At the core of experimental research is the fact that the investigator exposes the people in an experiment, commonly referred to as experimental subjects to some conditions or variables called the experimental stimulus. The experimental stimulus or experimental treatment is an independent variable directly manipulated by the experimenter in order to assess its effect on behaviour. Recall as it has been discussed earlier and again in Unit 12 that independent variables are those variables in a study that are hypothesised to produce changes in another variable. The variable affected by the independent variable is the dependent variable – so called because its value is dependent on the value of the independent variable.

An experimental group is a group of subjects who are exposed to the experimental stimulus. Experimental condition is the term used to describe the group of people who receive the experimental stimulus. The third is the quasi-experimental design. The logic underlying experimentation is illustrated by means of a series of symbols. The following symbols are commonly used to describe experimental designs:

O = an observation or measurement of the dependent variable;
X = exposure of the people to the experimental stimulus or independent variable;
R = random assignment to conditions.

In addition, the symbols constituting a particular experimental design are presented in time sequence, with those to the left occurring earlier in the sequence than those further to the right.

If OXO is a simple experiment, it can be described thus:

In this experiment, the researcher measures the dependent variable (this is called pretest), exposes the subjects to the independent variable and then re-measures the dependent variable. So one major way for assessing whether the independent variable in an experiment has had an effect or not is to make a comparisn of the pretest scores or measures with the Post-test. The symbols O, X, R will be used in discussing the different types of design.

SELF-ASSESSMENT EXERCISE 1

1. Name the three classes of experimental designs.
2. What are the meaning of R, X, and O as symbols used in experimental design?

3.2 Pre-experimental Designs

This will be discussed under the following sub-topics.

3.2.1 One Group Pretest – Post-test Design 0 x 0

This is a type of experiment in which a single group has a pre-experimental test, it administers the experimental treatment and is given the same test. A science teacher wanted to find out the effect of using a particular method in teaching his/her pupils. He/She gave them a test before using the method. After using this method consistently for at least six weeks; he/she varies the test items either by rearranging the numbering or by rephrasing some of the items. The test is re-administered. Any effect observed is attributed to the treatment which is the new teaching method.

It is necessary to mention that there are series of weakness in this design. With the exception of attrition and selection which are irrelevant owing to the lack of a control group, the design is subject to the other five threats to internal validity. If a historical event related to the dependent variable intervenes between the pretest and the Post-test, its effect could be confused with those of the independent variable. Maturation pretest and the Post-test scores, if paper and pencil tests are used, a shift of scores from pretest to Post-test could occur owing to testing effects.

Regardless of the measurement used, instrumentation changes could produce variations in the pretest – post-test as a result of regression towards the mean. In all, these variations on the dependent variable produced by one or more of these validity treats could be mistaken for variation due to the independent variable.

3.2.2 Static Group Comparison

The static group comparison is used to determine the influence of variable on one group and not on another.

Group I x O
Group II – O

In this case, there are two groups; the experimental group is exposed to treatment, X, the control group is not. There is no provision for establishing the equivalence of the experimental and control group and this is a very serious limitation. A researcher gave homework on the topic He/She is teaching for a period of one month to a class and gave no homework at all to another class. At the end of one month, he

administered the same achievement test to both classes. The major validity threat to this design is selection.

SELF-ASSESSMENT EXERCISE 2

Provide a pre-experimental design for observing the effect of regular correction of pupils' mistakes in mathematical problem solving.

3.3 True Experimental Design

In true experiment, the equivalence of the experimental and control groups is provided by random assignment of subjects to experimental and control groups. Although it is difficult to arrange a true experimental design, particularly in school-classroom research, it is the most effective type of design and should be used whenever possible. Three experimental designs are discussed under this section.

3.3.1 The Pretest – Post-test Control Group

Experimental Group I RO_1 XO_2
Control Group II RO_1 – O_4
X Gain = $O_2 – O_1$
– Gain = O_{1-4}
O_1 x O_3 pretests
O_2 x O_4

This design utilises a true control group, including random assignment to equalise the comparison group, which eliminates all the threats to external validity except perhaps experimental attrition. Because of this, we can have considerable confidence that any difference between experimental and control group on the dependent variable is due to the effect of the independent variable. Most of the threats are minimised in this design. History is removed because both groups experience the same events except for the experimental stimulus. Because the same amount of time passes for both groups, maturation effects can be assumed to be equal, both groups are pretested therefore any testing influences on the post-test should be the same. Instrumentation effects are controlled because any unreliability in the measurement process that could cause a shift in scores from pretest to post-test should be the same for the groups. Randomisation controls threat of selection by making sure that the comparison groups are equivalent. Attrition is the only threat that is not controlled due to its nature because people die, move away, get disinterested etc. For analysis, gain scores may be compared and subjected to a test of the significance of the difference between means. Pretest scores can also be used in analysis of covariance to

statistically control any difference between the groups at the beginning of the study.

3.3.2 The Solomon Four – Group Design

R O X O
R O – O
R X O
R – O

This combines the two group design previously discussed, the Post-test only and the pretest-Post-test. It is therefore possible to evaluate the effects of testing history and maturation. Analysis of variance is used to compare the four Post-test scores and analysis of covariance to compare the gains. The advantage of the Solomon Four Group design is that it enables the researcher to check on possible effects of pretesting, because some groups are pretested and others not. It is possible that pretesting affects the Post-test score or that pretesting interacts with the experimental treatment. That is, the effect of the experimental treatment is not the same in pretested and non-pretested groups. Because pretesting is not the rule in actual classroom practice, this is often an important consideration for validity. A major difficulty in this design is finding enough subjects to assign randomly to four equivalent groups.

3.3.3 The Pretest – Only Control Group Design

R X O
R – O

This design is one of the most effective ways in minimising the threats to experimental validity. It differs from the static group comparison design in that experimental and control groups are equated by randomisation. At the conclusion of the experiment, the difference between the mean test scores are subjected to test of statistical significance of variance analysis with a chosen topic to provide a paradigm for a true experimental design.

SELF-ASSESSMENT EXERCISE 3

Choose a topic in your area and provide a paradigm for a true experimental design.

3.4 Quasi-Experimental Designs

These designs provide control of when and to whom the measurement is applied, but because random assignment to experimental and control

treatment has not been applied, the equivalence of the group is not assumed.

3.4.1 The Non-Randomised Control Group Pretest-Post-test Design

The non-randomised control group pretest – Post-test design configuration is similar to the pretest – Post-test; true experimental group except for randomisation.

O X O
O X O

This design is often used in classroom experiments when experimental and control groups are such naturally assemble group as intact classes may be similar.

3.4.2 The Time Series Design

The time series design consists of taking a series of evaluation and introducing a variable or a new dynamic into the system after which another series of evaluation is made. If a substantial change results in the second series of evaluation, it may be reasonably assumed that the cause of the difference in results was the factor introduced into the system. In this paradigm, O, – 4 are different from $O_5 – O_8$.

3.4.3 Control Group Time Series

In control group time series, a variant of the time series design accompanies it with a parallel set of observations, but without the introduction of the experimental factor. This design would then take a configuration like the following:

O → O → O → X → O → O → O → O →
O → O → O → – O → O → O → O →

Such a design tends to ensure greater control for internal validity. The advantage of a design of this construction is that it adds one further guarantee toward internal validity in drawing conclusion with respect to the effect of experimental factor.

SELF-ASSESSMENT EXERCISE 4

What is the major difference between True experimental and Quasi experimental Design?

4.0 CONCLUSION

In this unit, you have learnt that experimental design can be classified into three major groups mainly: pre-experimental designs, true experimental designs and quasi experimental designs.

Examples of the various designs are:

Pre-experimental: One group pretest – post-test design.

True experimental: Pretest – post-test control group design Solomon four group design.

Quasi experimental: Non-randomised control group time series experimental design control group time series design.

5.0 SUMMARY

You should note that the major difference between true experimental design and others is the randomness of the sample. In the next unit, you are going to study Ex-post facto and evaluation research.

6.0 TUTOR-MARKED ASSIGNMENT

Describe how you would carry out a true experimental study using any topic of your choice (Try to use all the knowledge you have acquired in this course so far).

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UNIT 2 EX-POST FACTO RESEARCH AND EVALUATION RESEARCH

CONTENTS

1.0 INTRODUCTION

The preceding unit dealt with experimental and quasi-experimental studies. In educational studies, a lot of emphasis is placed on empirical studies and the experimental method provides most of such studies.

In this unit, effort will be made to present some further explanation of correlation studies as a research design and link it up with Ex-Post Facto designs. Some authors describe Ex-Post Facto design as an experimental design in a reverse direction. Generally, Ex-Post Facto research is a sub-type of the non-experimental method. The method observes existing conditions and searches back through the data for plausible causal factors. It adopts the deductive approach in which the crime is discovered and the cause or motivation for crime is sought.

Evaluation research often addresses two basic goals: formative evaluation and summative evaluation. Though this unit will briefly discuss assessment and evaluation in terms of descriptive research, it will concentrate on programme evaluation.

In this unit, therefore, you will study Ex-Post Facto facts approach under correlation design; definition; difference between experimental research and ex-post facto research, self-selection, evaluation limitation, and value of ex-post facto research while under evaluation. The study will briefly mention the assessment of school, formative and summative evaluation and programme evaluation in particular.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain correlation design
- define ex-post facto research
- state self-selection
- discuss limitations and value of ex-post facto research
- explain assessment and evaluation research
- carry out programme evaluation
- apply the strategies to classroom situation.

3.0 MAIN CONTENT

3.1 Correlation and Ex-Post Facto

This will be discussed under the following sub-topics.

3.1.1 Correlation Design

Correlation designs are usually attempts to establish relationship between two sets of data. The situation is often represented by this type of diagram:

$$O_a = O_b$$

Often, researchers believe that if they show that a positive relation exists between two factors, then it means that one factor is the cause of the other.

Correlation does not mean causality. That one can demonstrate a statistical positive correlation between two sets of data does not by anyway mean any causality between them. The diagram below illustrates the possible forms within any correlation situation.

Given two variables O_x and O_y when Ox is the independent variable, then three conditions might be drawn with respect to these data thus:

(i) O_x has caused O_y; $O_x \rightarrow O_y$
(ii) O_y has caused O_x; $O_y \rightarrow O_x$
(iii) Some unknown third variable is responsible for both O_x and O_y; $O_x = O_y$.

SELF-ASSESSMENT EXERCISE 1

Does high positive correlation mean causality? Yes / No. Explain your answer.

3.1.2 Ex-Post Facto Studies

Ex-post facto studies are not experimental studies. Control is one condition that is characteristic of the experimental method. But after an event has already happened, definitely, it cannot be controlled any more.

3.2 Definition of Ex-Post Facto Design

Ex-post facto means "from a thing done afterwards" and when ex-post facto research is done, variables are studied in retrospect in search of possible relationships and effects. There are no variables deliberately manipulated by the researcher. Ex-post facto research goes by different names.

Krathwohl (1993) includes ex-post facto research as part of "after-the-fact, natural experiments". These are not experiments in the sense that the researcher manipulates variables, but under natural conditions in which there are operating independent and dependent variables. Causal-comparative research is another term sometimes used for this type of research. Essentially, causal-comparative research explores effects between variables in a non-experimental setting. It is more a way of analysing research data than a separate research method. Ex-post facto research is systematic empirical inquiry in which the researcher does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable. Inferences about relations among variables are made without direct intervention, from concomitant variation of independent and dependent variable (Kerlinger, 1977).

3.2.1 Basic Difference between Experimental Research and Ex-Post Facto Research

The basic structure in which the experimental scientist operates is simple. He/She hypothesises if x increases, then y also increases. Depending on circumstances and his/her personal predilection in research design or measure x, he/she then observes to see if concomitant

variation, the variation expected or predicted from the variation in x occurs. It is noteworthy that the scientists predicts from a controlled x to y.

In ex-post facto research, direct control is not possible. Neither experimental manipulation nor random assignment can be used by the researcher. For example, if you want to study "The cause of mass failure in chemistry during the last West African Examination Council's examination", the incident has already taken place and there is no way you can control any of the possible variables, such as: studies, readiness, teachers' concerns, supply of necessary facilities etc.

The most important difference between experimental research and ex-post facto research is 'control' or manipulation of variables. In the experimental case, the researcher at least has manipulative control. He/She has at least one active variable. If an experiment is a 'true' experiment, he/she can also exercise control by randomisation. He/She can assign subjects to groups at random or she can assign treatment to groups at random.

In ex-post facto research situation, this kind of control of the independent variable is not possible. The investigator must take things as they are and try to disentangle them.

SELF-ASSESSMENT EXERCISE 2

What are the two major differences between ex-post facto research and experimental research?

3.2.2 Self-Selection and Ex-Post Facto Research

In any ideal social studies and humanities research world, the random assignment of subjects to groups and the drawing of random samples of subject, treatment to groups would always be possible. In the real world, however, one, two or even all the three of these possibilities do not exist. But it is not possible in ex-post facto research to assign subjects at random. Thus, subjects can assign and select themselves to groups, on the basis of characteristics other than those in which the investigator may be interested. The subjects and the treatments come as they were already assigned to the group.

Self-selection occurs when the members of the group being studied are in the group, in part, because they differentially possess traits or characteristics extraneous to the research problem, characteristics that possibly influence or are otherwise related to the variable of the research problem. There are two kinds of self-selection: into samples and into

comparison groups. The latter occurs when subjects are selected because they are in one group or another – science educators and non-science educators, integrated science students and non-integrated science students, science students that score above credit in the test and those that did not. That is, they are selected because they possess the dependent variable in greater or lesser degree.

Self-selection into samples occurs when subjects are selected in non-random fashion into a sample. The usual ex-post facto study uses group that exhibit differences in the dependent variable. But the two cases are basically the same, since the group membership on the basis of a variable always bring selection into the picture.

SELF-ASSESSMENT EXERCISE 3

What are the two types of self-selection?

3.2.3 The Limitation of Ex-Post Facto Interpretation

Ex-post facto research has three major weaknesses, two of which have already been mentioned. They are:

i. the inabilities to manipulate;
ii. the lack of power to randomise, and
iii. the risk of improper interpretation, other things being equal.

Ex-post facto research lack control, this lack is the basis of the third weaknesses: the risk of improper interpretation. One danger with ex-post facto research is that a prediction may be quite spurious, but its plausibility and conformity to preconception may make it easy to accept. Ex-post facto research is conducted without hypotheses and predictions, research in which data are just collected and then interpreted could mislead.

3.3 The Value of Ex-Post Facto Research

Despite its weakness, much of ex-post facto research must be done simply because many research problems in the social sciences and education do not lend themselves to experimental inquiry. A little reflection on some of the important variables in educational research – intelligence, teacher personality, home background etc. will show that they cannot be manipulated. Controlled inquiry is possible, but true experimentation is not.

SELF-ASSESSMENT EXERCISE 4

State the greatest weakness of ex-post facto research.

3.4 Descriptive Study

A descriptive study describes and interprets what is, it is concerned with conditions or relationships that exist, opinions that are held, processes that are going on, effects that are evident, or trends that are developing. It is primarily concerned with the present, although it often considers past events and influences as they relate to current conditions. This unit will discuss descriptive studies that use quantitative methods.

- **Assessment:** Assessment describes the status of a phenomenon at a particular time. It describes without value judgement a situation that prevails, attempts no explanation of underlying reasons and makes no recommendations for action. It may deal with prevailing opinion, knowledge, practices or conditions. As it is ordinarily used in education, assessment describes the progress students have made toward educational goals at a particular time. It does not generally provide recommendations, but there may be some implied judgment on the satisfactoriness of the situation or the fulfillment of society's expectation.

- **Evaluation:** Evaluation is a process used to determine what has happened during a given activity or to an institution. The purpose of evaluation is to see if a given programme is working, if an institution is successful according to the goals set for it, or if the original intent is being successfully carried out. To assessment, evaluation adds the ingredient of value judgement of the social utility, desirability or effectiveness of a process, product or programme and it often includes a recommendation for some course of action. School surveys are usually evaluation studies; educational products and programs are examined to determine their effectiveness in meeting the accepted objective, with some recommendations for construction action.

The rest of this unit will concentrate on educational evaluation studies – school surveys.

SELF-ASSESSMENT EXERCISE 5

What is the main objective of an educational assessment exercise?

3.5 International Assessment and School Surveys

This will be discussed under the following sub-topics.

3.5.1 International Assessment

The International Association for the Evaluation of Educational Achievement with headquarters in Stockholm, Sweden, has been carrying out an assessment programme in a number of countries since 1964. The first study, the International Study of Achievement in Mathematics (Torsten, 1967) compared achievement in twelve countries. Short answer and multiple choice tests were administered to 13-year-olds and to students in their last year of the upper secondary schools, prior to university entrance. More than 132,000 pupils and 5,000 schools were involved in the survey. Japanese students excelled above all others. Although the purpose of **Assessment** is not to compare school systems, the data led observers to make such comparisons. Other assessments have been carried out and the number of participating countries has been increased to twenty-two.

Earlier, the meaning of educational assessment was explained to you. In addition, you have been provided with an example of educational assessment. It is hoped you could now carryout educational assessment with your local government area or the nation.

3.5.2 School Surveys

According to Best and Khan (1995), what has traditionally been called school survey, is usually an assessment and evaluation study. Its purpose is to gather detailed information to be used as a basis for judging the effectiveness of the instructional facility, curriculum teaching and supervisory personnel and financial resource; in terms of best practices and standards in education.

Many city, township and country school systems have been studied by this method for the purpose of determining status and adequacy. These survey evaluations are sometimes carried on by an agency of a University in the area like IEA in Ibadan. Individuals could embark on this on a smaller scale.

3.6 Programme Evaluation

The most common use of evaluation is to determine the effectiveness of a programme and sometimes the organisation. The school surveys described earlier are evaluation only of the organisation.

Programme evaluations, while often including the organisation, focus primarily on programme effectiveness result. As Kaufman and Thomas (1980) put it: Evaluation deals with results, intended or unintended. The questions asked during evaluation are usually the same. Regardless, of the context, evaluation seeks:

i. What are the goals and objectives of the organisation?
ii. What should be the goals and objectives of the organisation?
iii. What results were intended by the programme, project, activity or organisation?
iv. What results were obtained from the programme by the organisation?
v. What were the values and usefulness of the method and means used to achieve the results?
vi. How well was the programme organisation administered and managed?
vii. What, if anything, about the programme organisation should be changed?
viii. What, if anything, about the programme organisation should be continued?
ix. Should the organisation exist at all?

Evaluation is more than testing or measuring, it includes asking/answering basic questions about efforts and results. In many cases of educational programme, the major issues are: goals and objectives of the organisation, student learning. The focus is often on, what is being taught how it is being taught and most importantly, whether the subject matter was learned.

Therefore, evaluations of school-based programmes are concerned with two aspects of the evaluation process that is formative and summative evaluations.

Summative Evaluation – is what most people think of when they consider evaluation. Their primary purposes are to determine grades, judge teaching competence and compare curricula.

Formative Evaluation – the main purpose of formative observation is to determine the degree of mastery of a given task and to pinpoint the part of the task not mastered.

SELF-ASSESSMENT EXERCISE 6

Explain three major issues in educational evaluation.

4.0 CONCLUSION

In this unit, you have learnt that:

- Positive correlation does not mean causality;
- Ex-post facto studies are not experimental studies because they lack control and randomness;
- Lack of control or manipulation is the major difference between ex-post facto and experimental study;
- Two types of self-selection into groups and into samples were identified;
- Ex-post facto has three limitations, namely: lack of manipulation, lack of power to randomise and risk of improper interpretations; and
- Assessment and evaluation could be described as descriptive quantitative study.

5.0 SUMMARY

With the discussion on ex-post facto and evaluation research methodologies, you have now completed studies on the types of research methodologies. Using your knowledge of types of research, you can now move to the next stage which deals with methodologies for carrying out research. You will start your study in this section with population and sample which constitute the next unit.

6.0 TUTOR-MARKED ASSIGNMENT

1. Describe the study on how you would evaluate the teaching of primary science in your Local Government Area.
2. Choose any five ex-post facto research topics and write two research questions you will use in each case (You may wish to review the unit on research questions).

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UNIT 3 POPULATION AND SAMPLE

CONTENTS

1.0 INTRODUCTION

In Unit 14, you were infomed that the discussion on types of research has been concluded. In this unit, you are going to study population and sample.

Population parameters and sampling techniques are of paramount importance and are regarded as very critical factors for the success of most educational studies. The primary purpose of research is to discover principles that have universal application, but to study population to arrive at generalisation is often times impracticable, if not impossible. Some populations are so large that their characteristics cannot be measured before the measurement could be completed, the population itself would have changed. Imagine a study of attitude of all Nigerian primary school teachers toward primary science. The study of a population of this size would require the services of thousands of researchers, the expenditure of millions of Naira and hundreds of thousands of working hours.

Fortunately, the process of sampling makes it possible to draw valid inferences or generalisations on the basis of careful observation of variables within a relatively small proportion of the population.

In this unit, you are going to study the population and sample under the following sub-topics: definition of population and characteristics of population, sampling, sample size, kinds of sampling and sampling frames.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- define a population
- explain what a sample is
- state the reasons for sampling
- list the different types of sampling techniques.

3.0 MAIN CONTENT

3.1 Population and Samples

Best and Khan (1995) define population thus: "A population is any group of individuals that have one or more characteristics in common that are of interest to the researcher. The population may be all the individuals of a particular type or a more restricted part of that group. All primary school pupils, all female secondary school teachers, all university science educators may be a population".

A sample is a small proportion of a population selected for observation and analysis. By the characteristics of the sample, one can make certain inferences about the characteristics of the population from which it is drawn. Contrary to some popular opinion, samples are not selected haphazardly, they are chosen in a systematically random way, so that chance or the operation of probability can be utilised.

A sample is drawn from a population which refers to all possible cases of what one is interested in studying. In most educational studies, the target population is often people who have some particular characteristic in common, such as: all teachers, all vice – chancellors, all politicians etc.

A population is not always made up of people; it could be integrated science laboratories in Bauchi State, all chemistry textbooks used in Nigeria etc. A sample consists of one or more elements selected from a population. The manner in which the elements are selected for the sample has great implications for the scientific utility of the research based on that sample. To select a good sample, you need to define clearly the population from which the sample is to be drawn. Failure to define the population clearly can make generalising from the sample observations highly ambiguous and result in drawing inaccurate conclusions.

SELF-ASSESSMENT EXERCISE 1

Discuss how samples are chosen?

The definition of a population should specify four things – content, unit, extent and time. The content of the population refers to the particular characteristics that members of the population have in common. The unit indicates the units of analysis. The extent of the population refers to its special or geographic coverage. The time factor refers to the temporal period during which a unit would have to possess the appropriate characteristics in order to qualify for the sample.

An example of a population could be all third year junior secondary school students in Oshodi/Isolo Local Government Area of Lagos state, all the schools within the space covered by this area. The content is every member of the population must study integrated science and should be in JSS 3. Though all the students are in JSS 3, it is likely that some students must have transferred from other schools to schools within the Oshodi/Isolo Local Government Area. The time factor may be a decision of the researcher to choose the sample from only those who started their schooling in the schools within the Local Government Area which means that, to be selected from the population, the students should have spent some years in any of the schools within the Local Government Area.

SELF-ASSESSMENT EXERCISE 2

List any two factors that are covered when defining a population. Are all the factors necessary for all studies?

3.2 The Purpose of Sampling

A major reason for studying the sample rather than the entire population is that the population often times very large and it is not feasible to study it for example, if a study of teachers consisted of all teachers in Nigeria, it is not really possible to study each teacher in the entire country; the time and weight of report will be very prohibitive. Sampling allows you to study a workable number of cases from the large group to derive findings that are relevant to all members of the groups.

A second reason for sampling is that information drawn from an entire group maybe too bulky and tedious to realise. For example, if the study requires assistants, a sample will enable you to select few qualified and committed assistants as against a large number of assistants who might not do the work properly. Few properly paid assistants are likely to do the work more effectively than a large number of uncommitted ones.

Also, it offers opportunity for better control. An improperly drawn sample renders the data collected virtually useless. An important consideration regarding samples is how representative they are of the population from which they are drawn. A representative sample is one that accurately reflects the distribution of relevant variables in the target population. You should always assess the representativeness of a sample in order to make accurate conclusion.

SELF-ASSESSMENT EXERCISE 3

What is the most important reason for sampling in educational research?

3.3 Types, Methods and Procedures for Sampling

One basic rule holds whenever a researcher considers methodology in relation to data. It does not matter whether the methodology concerns sampling, statistical procedure or any other type of operation. According to Leedy (1977), the general rule is: Look carefully at the nature of and the quality of the data. It is noteworthy that not all data lend themselves to sampling. It is only appropriate whenever large populations that have outward semblance of homogeneity are to be studied. Sampling can be divided into two major categories, namely: probability and non-probability sampling.

Probability Sampling

In this type of sampling, the researcher can specify in advance that each segment of the population will be represented in the sample. This is the distinguishing characteristic or feature that sets it apart from non-probability sampling. The composition of the sample is derived by selecting units from those of a much larger population.

In survey studies, the way the sample units are selected is important. Generally, the components of the sample are chosen from the larger population by a process known as randomisation. Such a sample is known as a random sample. Other types of probability sampling are: systematic sampling, stratified sampling, proportionate and disproportionate sampling and area sampling.

Non-Probability Sampling

In non-probability sampling, the researcher has no way of forecasting, estimating or guaranteeing that each element in the population will be represented in the sample. Non-probability sampling can be divided into two types, namely: convenience or accidental sampling and quota sampling.

Convenience or Accidental Sampling

Convenience sampling makes no pretence of being representative of population. It takes the units as they arrive on the scene or as they are presented to the researcher by chance. No attempt is made to control bias.

Depending on the purpose and the researcher's awareness of the crudity of this type of sampling, convenience sampling may be appropriate to some less demanding kinds of data collection.

Quota Sampling

It is a variant of convenience sampling. It selects respondents in the same ratio as they are found in the general population. For example, supposing you want to interview 30 students of science each from two nearby schools over an issue like: special levy for science laboratory work.

Quota sampling demands that you just select the first available 30 students from each school. The only assumption is that the numbers of science students in both schools are approximately equal. This is also an unregulated type of sampling. It has no limitation except the size of each category. You have no probability of how the 30 will arrive at your interview site.

Other types of non-probability sampling are: Availability Sampling, Snowball Sampling, Purposive Sampling and Dimensional Sampling.

The ultimate objective of any research is to collect data (information) so as to provide some useful principles, theories and generalisations. The importance of valid and reliable data in research work requires no emphasis whatsoever. As a result of this, each of the sampling procedures will be discussed in greater detail.

SELF-ASSESSMENT EXERCISE 4

Using an example each, show the major difference between probability and non-probability sampling.

3.4 Probability Samples

Every sample approach is expected to provide a representative sample. But the concern of a researcher is to be as certain as possible that his/her sample is a representative. Sampling approaches that make use of the probability theory can both greatly reduce the chances of getting a non-

representative sample and what is more important, permit the researcher to estimate precisely the likelihood that a sample differs from the true population by a given amount. In probability samples, each element in the population has equal chance of being selected by the researcher. The calculated sampling error is an estimate of the extent to which the values of the sample differs from those of the population from which it is drawn.

3.5 Non-Probability Samples

Probability samples are not required or even appropriate for all studies. Some research studies, by their nature, are suited for non-probability samples, samples in which the researcher does not know the probability of each population being included in the sample. Although non-probability samples can be very useful, they do have some important limitations.

First, without the use of probability in the selection of elements for the sample, no real claim of representative can be made. There is simply no way to ascertain precisely what population, if any, a non-probability sample represents. This greatly limits the ability to generalise findings beyond the level of sample cases.

A second limitation is that the degree of sampling error remains unknown and unknowable. With no clear population being represented by the samples, there is nothing with which to compare it. It also means that the techniques for estimating sample size are not applicable to non-probability samples. The only factor impacting on sample size for non-probability samples is that sufficient case can be selected to allow the types of data analysis that are planned.

A third limitation of non-probability samples involves statistical test of significance. These commonly used statistics (to be discussed later) indicate to the researcher whether relationships found in sample data are sufficiently strong and generalisable to the whole population. All these tests incidentally are based on laws of probability and assume that a random process is utilised in selecting the sample elements. Therefore, non-probability samples do not qualify for test of significance.

All these limitations do not mean that non-probability sample have no use whatsoever. They are very useful when the objective of the study is to determine whether there is a relationship between independent and dependent variable and there is no intent to generalise the results from the sample to larger population. If generalising sample results to a population is a major goal of a study, then non-probability samples must be used with minimum care because they can produce very misleading

results. It should be noted that it is not the size of the sample that makes for accurate results, rather the procedures used for selecting elements into the samples are.

SELF-ASSESSMENT EXERCISE 5

State two limitations of a non-probability sample.

4.0 CONCLUSION

In this unit, you have learnt that:

- a population is any group of individual that have one or more characteristics in common that are of interest to the researcher;
- a sample is a small proportion of a population selected for observation and analysis;
- four factors associated with population are: content, unit, extent and time;
- sample is studied because population could be very large and near impossible to study;
- carefully selected representative sample tends itself to generalization of findings;
- there are two major sampling techniques;
- probability sampling techniques comprise: random sampling, systematic sampling, stratified sampling, proportionate and disproportionate sampling;
- sampling is of two types: convenience or accidental and quota. Other major types of non-probability sampling are: availability sampling; snowball sampling, purposive sampling and dimensional sampling; and
- non-probability sampling has some limitations which include level of generalisability of finding and acceptability of findings.

5.0 SUMMARY

You will notice that in this unit you have only been introduced to what may be called the terminology for population and sample, and their characteristics.

In the next unit, you are going to study sampling procedures, which will deal with detailed operation of processes of each of the sampling techniques.

6.0 TUTOR-MARKED ASSIGNMENT

1. Define population and sample.
2. Describe the major types of sampling techniques and give three examples of each.
3. "The non-probability sampling techniques should be used sparingly and with caution". Discuss this statement.

7.0 REFERENCES/FURTHER READING

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MODULE 6 SAMPLING AND DATA COLLECTION TECHNIQUES

UNIT 1 SAMPLING TECHNIQUES

CONTENTS

1.0 INTRODUCTION

In the last unit, we studied population and sample types, sampling techniques, mainly probability and non-probability sampling techniques. Each of these techniques has a number of sampling approaches under it, for example, probability sampling has such sampling techniques as: systematic, stratified and area. Non-probability sampling has two major areas: accidental or convenience and quota sampling techniques.

The limitation of non-probability sampling techniques was highlighted thus: no real claim of representativeness can be made because the sample does not assure each population element a known chance of being selected. The degree of sampling error remains unknown and unknowable and for meaningful results and acceptability of the findings should not be generalised beyond the sample.

In this unit, you will study in greater depth the different types of probability and non-probability sampling techniques. You will also be exposed to sampling designs.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify and use probability sampling techniques
- apply non-probability sampling techniques to appropriate studies
- compare the effectiveness of probability and non-probability sampling techniques in research
- state the various stages in sampling designs
- discuss sampling techniques used in research reports.

3.0 MAIN CONTENT

3.1 Probability Sampling Techniques

In this section of the unit, we shall study, in details, each of the probability sampling techniques. These are: random sampling, systematic sampling and area sampling.

Sampling Design

All sound research begins with a careful consideration of the data. The nature of the data is expected to determine the methodology of the investigation. This fact is also applicable to sampling. You do not go out to sample for the sake of sampling. Careful consideration of the target population is most important. The researcher should select from the general population a sample that will be both logically and statistically defensible.

The first step in selecting any sampling design is to analyse carefully the integral characteristic of the target population. In view of this, the researcher could then select the sampling technique most appropriate for the population type. To describe these sampling technique details, you need to understand the general characteristics of a population. These are:

- the population may be generally homogenous, the separate units may be similar in observable characteristics;
- the population may contain definite strata but each stratum may differ from every other stratum by a proportionate ratio of its separate units;
- the population may consist of cluster whose characteristic are similar, but whose units characteristics are as homogenous as possible.

According to Leedy (1997), in all sampling, the following three processes are indigenous to the selection of the sample:

- the population must be identified, an analysis must be made of its structure, and an assessment made of its characteristic;
- the process of randomisation must be outlined, and the selection of the sample from the total population must be made in accordance with a method of randomisation;
- the data must be extracted from the sample population.

SELF-ASSESSMENT EXERCISE 1

List two general characteristics of a population.

3.1.1 Random Sampling

The concept of randomness is fundamental to scientific observation and research. it is based on the assumption that, while individual events cannot be predicted with accuracy, aggregate events can. For example, although it may not predict with great accuracy an individual's academic achievement, it will predict the average academic performance of a group. Randomisation has two important applications in research:

i. to select a group of individuals for observation who are representative of the population about which the researcher wishes to generalise; and
ii. to equate experimental and control groups in an experiment. Assigning individuals by random assignment is the best method of providing for their equivalence.

It is important to note that a random sample is not necessarily an identical representation of the population. Characteristics of successive random sample drawn from the same population may differ to some degree, but it is possible to estimate their variation from the each other.

The variation known as **sampling error,** does not suggest that a mistake has been made in the sampling process. Rather, sampling refers to the chance variations that occur in sampling with randomisation, these variations are predictable and taken into account in data analysis techniques.

i. The Simple Random Sample

The individual observations or individuals are chosen in such a way that each has an equal chance of being selected, and each choice is independent of the other. If you wish to select hundred students from a list of five thousand students in a college, all you need to do is to assign a number to each of the students, fold their numbers and place them in a basket, after shuffling them properly, you ask one of the students or you do it yourself and select any hundred from the basket. You will discover that each of the five thousand students had equal chance of being selected.

ii. Random Numbers

The use of table of random numbers is a more convenient way of selecting a random sample, or assigning individuals to experimental control groups so that they are equated. Due to time and space, the table of random numbers cannot be presented here, but it is perhaps the most frequently used method of random selection of a sample.

You can, however, find the table of random numbers in any Standard Educational Research Textbook. You are advised to get one and seek assistance on how to use the Tale of Random Numbers.

3.1.2 Systematic Sampling

If a population can be accurately listed as finite, a type of systematic selection will provide an approximate random sample. A systematic selection consists of the selection of the nth term from a list. For example, if a sample of one hundred people is to be selected from a list of 100,000 people, the first name would be selected randomly from the list. This can be done by tossing coin and decide to start with an even number, if it is head or odd number then every thousandth number would be selected until the desired number is selected. If the desired number has not been selected, the count would continue from the beginning again until the desired number is obtained. For example, if you have a school admission register of 100,000 people, you could select the required 100 candidates using this procedure.

SELF-ASSESSMENT EXERCISE 2

You are required to select 3,000 candidates for a study from 600,000 possible candidates:

i. Which procedure would you use?
ii. Why would you choose the particular procedure?

3.1.3 The Stratified Random Sampling

With simple random and systematic sampling, the target population is treated as a single unit when sampling from it. In stratified sampling, the unit is divided into smaller subgroups called strata before drawing the sample, and then separate random samples are drawn from each of the strata. In this sampling procedure, you could have proportionate stratified sampling and disproportionate sampling. Each is briefly described below:

(a) Proportionate Sampling

In this sampling procedure, the size of the samples taken from each stratum is proportionate to the stratum's presence in the population. For example, you want to study the effect of religious belief on the performance of students in a course on evaluation. If there were 600 Christians, 400 Muslims and 200 Traditional worshippers in the class, it means you will select the sample of 180 students based on the proportion of each of the strata that is in the ratio of 3:2:1 and that will be 90 Christians, 60 Muslims and 30 Traditional worshippers.

You will subsequently use a simple random sampling technique to select the required number from each group.

(b) Disproportionate Sampling

Stratified samples could be used to enable a researcher to make comparisons among various subgroups in the population when one or more of the subgroups are relatively uncommon. For example, if you want to ascertain the quality of science techniques in a local government area and you want to compare the views of students from the local government area. You may find that students outside the local government area may constitute less than 10% of the students in each school. Which means that, for every 100 students in a school, only 10 will come from outside the local government area. This number would be far too small to make meaningful statistical comparison.

Stratifying, in this case, would allow us to draw a larger sample of the students from outside the local government area to provide enough cases for reliable comparison to be made. This is called disproportionate stratified sampling because the strata are not sampled proportionately to their presence in the population. This type of sample is different from most probability samples where representative is achieved by giving every element in the population an equal chance of appearing in the sample, but the element in some strata have a better chance of appearing in the overall sample than do the elements of other strata. The

characteristics of the entire population together with the purposes of the study must be carefully considered before a stratified sample is decided upon.

SELF-ASSESSMENT EXERCISE 3

In a population of 200,000 people with Ibos, Hausas and Yorubas in the ratio of 4:3:1, how would you select a sample of 320 people?

3.1.4 The Area of Cluster Sampling

This is a different type of population sampling from a large population spread across a large area. Most of the time, it is not feasible to make a list to select a sample for study through normal randomisation procedures. Because of this, the area has to be subdivided into subunits for effective handling. A state, for example, could be subdivided into local governments and further to zones or wards in a series of sampling clusters to smaller ones.

For example, if you want to seek the opinions of retired science teachers about the status of science teaching in Nigeria, you could first use random sampling to select five states. Then in each state, you use random sampling to select ten local governments: from each local government, five wards could be selected, also by simple random sampling. This brings us to the end of the description of the different types of probability sampling.

3.2 Non-Probability Sampling

In Unit 5, we discussed the characteristics of non-probability sampling. You may wish to review it before you study this section. However, some observations as the sampling relates to education are stated below:

Non-probability samples are those that use whatever subjects are available rather than following a specific subject selection process.

Some non-probability selection procedures may produce samples that do not accurately reflect the characteristic of a population of interest. Such samples may lead to unwarranted generalisations and should not be used if random selection is possible.

Educational researchers, because of administration limitations at randomly selecting and assigning individuals to experimental and control groups, often use available classes as samples. The status of groups may be equated by such statistical means as the analysis of covariance. In certain types of descriptive studies, the use of available

samples may restrict generalisations to similar populations. For example, using a physics teacher who uses remedial physics students for a study, the likely thing is that the generalisation will be limited to that group.

A sample made up of those who volunteers to participate in a study may represent a biased sample. Volunteers are not representative of a target population, for volunteering results in a selection of individuals who are different and who really represent a population of volunteers. In a sense, those who respond to a mailed questionnaire are volunteers and may not reflect the characteristics of all who were on the mailing list (Best and Khan, 1995).

SELF-ASSESSMENT EXERCISE 4

What is the major disadvantage of using just any available data?

3.3 The Sample Size

It has become necessary to present two views on sample size here. It appears educators have not agreed on sample size. Best and Khan (1995) explain that there is usually a trade-off between the desirability of a large sample and the feasibility of a small one. The ideal sample is large enough to serve as an adequate representation of the population about which the researcher wishes to generalise, and small enough to be selected economically – in terms of subject availability, expense in both time and money and the complexity of data analysis. There is no fixed number or percentage of subjects that determines the size of an adequate sample.

It may depend upon the nature of the population of interest or the data to be gathered and analysed. It is often stated that samples of 30 or more are to be considered large samples and those fewer than 30 are considered as small samples. It is approximately at this sample size of 30 that the magnitudes of students' critical values for small samples approach the Z critical value of the normal probability table for large samples.

Leedy (1997), on the other hand, provided a statistical formula for determining the size of the sample statistically thus:

$$N = (z/e)^2 (p) (1 - p)$$

Where:

N = size of the sample

Z = the standard score corresponding to a given confidence level
e = the proportion of sampling error in a given situation
p = the estimated proportion or incidence of cases in the population.

As a result of the calculations he carried out, he provided the table and accompanying summary below;

***Table 6.1*: Sample Size(s) required for a given Population Sizes (N)**

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2,800	381
15	14	110	86	290	165	850	263	3,000	341
20	19	120	92	300	169	900	269	3,500	346
25	24	130	97	320	175	950	274	4,000	351
30	28	140	103	340	181	1000	278	4,500	354
35	32	150	108	360	186	1100	285	5,000	357
40	36	160	113	380	191	1200	291	6,000	361
45	40	170	118	400	196	1300	297	7,000	364
50	44	180	123	420	201	1400	302	8,000	367
55	48	190	127	440	205	1500	306	9,000	368
60	52	200	132	460	210	1600	310	10,000	370
65	56	210	136	480	214	1700	313	15,000	375
70	59	220	140	500	217	1800	317	20,000	377
75	63	230	144	550	226	1900	320	30,000	379
80	66	240	148	600	234	2000	322	40,000	380
85	70	250	152	650	242	2200	327	50,000	381
90	73	260	155	700	248	2400	331	75,000	382
95	76	270	159	750	254	2600	335	100,000	384

Source: Krejcie and D.W. Morgan (1970). Determining Sample Size for Research activities Educational and Psychological Measurement, 30608 copyright © by Sage Publications.

However, Best and Khan (1995) argue that more important than size is the care with which the sample size is selected. The ideal method is random selection, letting chance or the laws or probability determine which members of the population are to be selected.

When random sampling is employed, whether the sample is large or small, the errors of sampling may be estimated, giving researchers an idea of the confidence that they may place in their findings.

Since the Leedy's table pegs the maximum size at 400 and Best and Khan argue that painstakingly selected sample is more important than sample size, this table is recommended for use in selection samples.

SELF-ASSESSMENT EXERCISE 5

Explain how researchers can have confidence in their findings.

4.0 CONCLUSION

In this unit, you have learnt that:

- the probability sampling strategies that lend themselves to random sampling are preferred for research than the non-probability sampling techniques;
- Leedy recommends a maximum of 400 as an adequate sample size;
- most authors emphasise the careful and painstaking selection of sample to a large sample size.

5.0 SUMMARY

As mentioned at the beginning of this unit, it was concerned with describing the sampling techniques advanced in Unit 1.

The discussion, so far, shows that careful selection of the sample is a prerequisite for quality research. It is therefore, necessary that you take special interest in Units 15 and 16, and master them properly. Now that you have completed the study on population and sample, you will in the next unit start to study how instruments are designed for data collection from the selected sample.

6.0 TUTOR-MARKED ASSIGNMENT

Write out five research topics and describe how you would select (sample) subject for each research topic.

7.0 REFERENCES/FURTHER READING

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UNIT 2 DESIGNING QUESTIONNAIRE

CONTENTS

1.0 INTRODUCTION

In the last unit, we completed our study on sampling. The samples in most educational studies are pupils, students, teachers, lecturers and parents among others. They are selected as subjects to be investigated or participate in a study in such a way as to provide the necessary information (data) for the study. Often, information is provided by observing, interviewing, questioning and other methods. In the next two units (17 and 18), you will learn about some of the ways already mentioned through which information from a respondent could be obtained through the use of a questionnaire.

Questionnaire need to be well-designed so that they will provide the information a researcher needs, which will be acceptable to the respondents and pose no problem at the analysis and interpretation stage.

In designing questionnaire, the researcher must ensure that care has to be taken to ensure question type, in question writing, in the design, piloting, distribution and return of questionnaires. Thought must be given to how responses will be analysed at the design stage, not after the entire questionnaires have been returned. Questionnaires are a good ways of collecting certain information quickly and cheaply.

In this unit, you will study the design of questionnaire under the following subheadings: what a questionnaire is, steps in constructing questionnaires, choosing a response format, types of questionnaire, evaluating the questions and piloting the questionnaire.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain what a questionnaire is
- list the different types of questionnaire
- state the necessary steps in constructing questionnaires
- choose a response format for questionnaires
- design questionnaires
- evaluate questionnaires
- pilot questionnaires
- administer questionnaires.

3.0 MAIN CONTENT

3.1 What Is a Questionnaire?

In Unit 11, you studied the survey methodology of conducting an investigation. You learnt that a survey is a data collection technique in which information is gathered from individuals called respondents by having them respond to questions. A survey is probably the most widely used research method in educational studies. The many techniques available for conducting a survey make it a versatile tool.

However, all surveys share certain characteristics. First, surveys typically involve collecting data from large samples of people; therefore, they are ideal for obtaining data representative of populations too large to be dealt with by other methods. Indeed, the generalisability of survey findings is another major attraction of its method.

Second and the important one for this unit, all surveys involve presenting respondents with a series of questions to be answered. These questions may touch on matters of fact, attitudes and opinions, or future expectations. The questions may be single item measures or complex multiple item scales. In whatever form, however, survey data are basically, what people say to the investigator in response to a question.

Data can be collected in a survey research in two basic ways: with questionnaire or with interviews. A questionnaire contains written

questions that people respond to directly on the questionnaire form itself without the aid of an interviewer.

Best and Khan (1995) state that a questionnaire is used when factual information is desired. When opinions rather than facts are desired, an opinionaire or attitude scale is used. Also, Okpala, Onuoha and Oyedeji (1993) define a questionnaire as "a self-reporting instrument that has received good use in educational research, psychological research, programme evaluation etc. It is sometimes described as the most common type of research instrument. It is important for teachers, students and research officers to master how to construct a questionnaire. This would enable such people to develop appropriate questionnaires when they cannot get already existing ones that is valid and reliable.

Like tests, questionnaires are constructed for specific purposes. It is therefore, necessary for the researcher to think of a specific study and design before determining whether it is appropriate for him to use a questionnaire. Characteristics of a good questionnaire are:

i. it deals with a significant topic, one which the respondent will recognise as important enough to warrant spending his/her time on. The significance should be clearly and carefully stated on the questionnaire or in the letter that accompanies it;

ii. it seeks only the information which cannot be obtained from other source such as: school reports or census data;

iii. it is as short as possible, and only long enough to get the essential data. Long questionnaires frequently find their ways into the waste basket. Keep the writing required of the respondent to a minimum and make the response system clear and easy to complete;

iv. it is attractive in appearance, neatly arranged and clearly duplicated or printed; and

v. directions for a good questionnaire are clear and complete. Important terms are defined. Each question deals with a single idea and is worked as simply and clearly as possible.

SELF-ASSESSMENT EXERCISE 1

State the importance of mastering how to construct a questionnaire to teachers, students and research officers.

3.2 Steps in Constructing a Questionnaire

Okpala, *et. al.* (1993) state that usually a researcher is faced with respondents who have great amount of information that would go untapped unless the questionnaire items are valid and reliable enough to elicit the information. Process of developing and using a questionnaire could be divided into eight steps as suggested by Henerson *et. al.* (1978). The steps are listed below:

i. Identifying the programme objectives and specific information to be obtained;
ii. Selecting a response format;
iii. Identifying the frame of reference of the respondents;
iv. Writing the item/questions;
v. Preparing a data summary sheet;
vi. Critiquing the questions, trying them out, and revising them;
vii. Assembling the questionnaires; and
viii. Administering the questionnaires.

Some of these steps will be followed in an effort to explain to you how to design a questionnaire.

3.2.1 Programme Objectives and Response Format

The researcher needs good direction which can only be provided by clearly stating the objectives of the programme. Clearly stated objectives help to clear issues concerning the type of information the researcher requires. Objectives of a programme could be:

i. to determine the view of students about teaching of chemistry in their schools; and
ii. to find out the attitude of students toward biology.

Choosing a Respondent Format

Having clearly stated the objectives of the questionnaire, the researcher need to determine the response format. The two major types of questions used in questionnaires are close-ended and open-ended. The researcher could use either a combination of both of them in constructing his/her question.

3.3 Close-Ended and Open-Ended Questionnaires

Two basic questions can be used in questionnaires and interviews. Close-ended questions are those questions that provide respondents with a fixed set of alternatives from which they are to choose. The response formats of multiple items scales, for example, are all close-ended. Open-ended questions are questions to which the respondents write their own response, much as you do for an essay type examination questions.

3.3.1 Close-Ended Questionnaire

Questionnaires that call for short response are known as the restricted or closed form type. In this type of question, you mark a yes or no, write a short response, or check an item from a list of suggested responses. Examples are:

i. Yes or No Type:

Biology is a difficult subject. Yes/No

ii. Writing a Short Response:

The science subject that deals with living things is ……..

iii. Checking an item from a list of suggested responses:

All students should offer Agricultural Science in the secondary school.

Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree.

iv. Multiple Answer Questions:

The ability to do work is …….

(a) Force
(b) Motion
(c) Energy
(d) Motor
(e) Rank

v. Another Multiple Answer Question:

Why did you choose to study at the Open University? Give three reasons in order of importance, starting with the most important.

Rank

(a)	Convenience of transportation	……..
(b)	Advice of a friend	……..
(c)	Reputation of Institution	……..
(d)	Expense factor	……..
(e)	Scholarship Aid	……..
(f)	Others (please specify)	……..

3.3.2 Open-Ended Questionnaire

The open-ended form or unrestricted questionnaire calls for a free response in the respondents own word. The following open form item seeks the same type of information as did the closed item. Why did you choose to do your graduate work at the Open University? Note that no clues are given. The open form probably provides for greater depth of response. The respondents reveal their frame of reference and possibly the reasons for their responses. But because it requires greater effort on the part of the respondents, returns are often meager. Also, the open form item can sometimes be difficult to interpret, tabulate and summarise in the research report. Open-ended questions generally take one of the following forms:

What do you think ……?
In your opinion …….
How do you feel about …….?
List the cause of …….

SELF-ASSESSMENT EXERCISE 2

Write two open-ended and two close-ended questions.

3.3.3 Improving Questionnaire Items

Because the questions that make up a survey are the basic data gathering devices, the researcher should choose word with care, especially with questionnaires that allow no opportunity to clarify questions for the respondents. Ambiguity in questions can be a source of substantial trouble. Therefore, the following steps should be taken to improve questionnaire items:

- Questions should be simple and direct, expressing only one idea. Complex statements containing more than one idea should be avoided e.g. the Universal Basic Education programme is good and all parents should pay levy to support it. This is not a good

question because it is possible respondents would agree with the first part, but not with the second part.

- For the questions designed for research, slang terminology should be avoided.

- Define or qualify terms that could be misinterpreted.

  What is the value of your house? Value may need to be defined. What is the market value of your house? Or How much will you sell your house? Could be more appropriate.

- Beware of **double negative;** underline negative for clarity e.g.

The Federal Government assistance should **not** be granted to those states that **donot** spend the money on the projects they are meant for.

- Be careful of inadequate alternative e.g. Married Yes ….. No …..

Does this refer the present or former marital status? What of widowed, separated or divorced?

- Underline a word if you wish to indicate special emphasis.

  Should all secondary schools offer **computer literacy course**?

- Phrase questions so that they are appropriate for all the respondents.

- Design questions that will give a complete response.

SELF-ASSESSMENT EXERCISE 3

Provide an example for any two of the four instructions above.

3.4 Before Administering the Questionnaire

Before administering the questionnaire, some issues have to be ascertained. They are being discussed under the following sub-topics:

3.4.1 Frame of Reference of Students

It is important for the researcher to consider the frame of reference of the respondents before administering the questions. In fact, it is much

better before phrasing the question. This is necessary in order to ensure that the questions are within the capability of the respondents.

3.4.2 Pilot the Questionnaire

All data gathering instruments should be piloted to test how long it takes to complete them, to check that all questions and instructions are clear, and to enable the researcher to remove any items which do not yield useable data. There is a temptation in a small study to go straight to the distribution stage, but however pressed for time you are, give your best to give the questionnaire a trial run. Note that, it should be tried out on a group similar to the one that will form the population of your study. This will enable you to come out with a good questionnaire which your respondents will respond to, also you can carry out a preliminary analysis of the data collected.

3.5 Administering the Questionnaire

There is a need to make early decision about how to distribute your questionnaire and what to do about no response. There are advantages in being able to give questionnaires to respondents personally. You can explain the purpose of the study and in some cases; the questionnaire can be completed on-the-spot. You are likely to get better cooperation if you can establish personal contact, but if that is impossible, you will need to investigate other ways of distribution. Colleagues and friends may be persuaded to lend a hand. If all fails, you may have to mail your copies, but postal service is expensive and response rate is generally low. Therefore, mailing should be the last resort.

Whether the researcher is distributing the questionnaire by direct distribution or by mailing, the instrument must be accompanied with a covering letter. The letter should inform the respondents about the objectives of the questionnaire, what will be done with the information, the deadline for the return of the questionnaire. It might be necessary to assure the respondent about the anonymity and confidentiality of the information supplied.

SELF-ASSESSMENT EXERCISE 4

Which is the best way of administering your cover letter?

4.0 CONCLUSION

In this unit, you have learnt:

- the meaning of questionnaire;
- the characteristic of a questionnaire;
- steps for constructing a questionnaire;
- that there are two major types of questionnaires – the open-ended and the close-ended;
- how to improve the questionnaire items; and
- what to do before administering the items;
- how to administer the items.

5.0 SUMMARY

In this section on how to elicit information for the study, you have concluded the study on questionnaire. In the next unit, you will learn about interview and observation.

6.0 TUTOR-MARKED ASSIGNMENT

Choose a Science Education topic and construct a questionnaire you would use to carryout the study.

7.0 REFERENCES/FURTHER READING

Best, J.W. & Khan, J.V. (1995). *Research in Education* (7th Edition). New Delhi: Prentice Hall. PP 20 – 23.

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UNIT 3 INTERVIEW AND OBSERVATIONS

CONTENTS

1.0 INTRODUCTION

In the last unit, you learnt about construction of questionnaires as one of the methods of eliciting information (data) for most survey research. At the introduction of that unit also, you were informed that apart from questionnaires, interviews constitute another method of collecting data for research. In an interview, there is a face-to-face question and answer session between the researcher and the respondents.

Observation, however, is no 'natural gift', but a highly skilled activity for which an extensive background knowledge and understanding is required, and also a capacity for genuine thinking and the ability to spot significant events. It is certainly not an easy option.

In this unit, interviews and observations will be discussed under the following headings: interview, what interview is, purpose of interview, types of interview, conducting an interview, validity and reliability of interview. Observation: what it is, characteristics, uses, observation plans and tool for recording observation.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- explain what an interview is
- state the purpose of an interview
- list types of interview and their characteristics
- conduct an interview
- determine the validity and reliability of an interview
- explain what observation is
- state the characteristics of observation
- describe the observation plan
- list the different tools for recording observation
- record observation.

3.0 MAIN CONTENT

3.1 Interview – Its Meaning and Purpose

Questionnaires are relatively inexpensive for reaching a substantial number of people, but they have some disadvantages associated with non-response and occasionally with careless response.

The interview is a more effective method of conducting a survey. In interview, the investigator or his/her assistant reads the questions directly to the respondents and records their answers. Interviews offer the investigator a degree of flexibility that is not available in questionnaire. Interview items, like questionnaire items, can be open-ended or close-ended.

The purpose of an interview is to find out what is in someone's mind. The purpose of open-ended *interviewing* is not to put things in someone's mind, but to assess the perspective of the persons being interviewed. Too often, the interviewees provide information based upon what they think the interviewer wants to hear. Therefore, it is critical for the interviewer to make sure the person being interviewed understands that the researcher does not hold any preoccupation notions regarding the outcome of the study.

Interviews are used to gather information regarding an individual's experience and knowledge, his or her opinions, beliefs and feelings and demographics data. Interview questions can be asked so as to determine past or current information as well as predictions for the future. The preferred method for data collection is to tape record the interview if the respondent agrees. Otherwise, the interviewer must keep brief notes

and expand on them as necessary immediately after the interview while the information is still fresh in the interviewer's mind.

SELF-ASSESSMENT EXERCISE 1

State one purpose of the interview.

3.1.1 Types of Interview and their Characteristics

The table below gives a vivid description of types of interview and their characteristics.

***Table 6.1*: Table Showing Types of Interview and their Characteristics**

S/N	Types of Interview	Characteristics	Strengths	Weaknesses
1.	Informal conversational interview	Questions emerge from the immediate context and are asked in the natural course of things: there is no predetermination of question topics or wording.	Increases the salience and relevance of questions. Interviews are built on and emerge from observations: the interviews can be matched to individuals and circumstances.	Different information collected from different questions. Less systematic and comprehensive if certain questions do not arise "naturally". Data organisation and analysis can be quite difficult
2.	Interview Guide Approach	Topics and issues to be covered are specified in advance, in outline fork: interviewer decides sequence and wording of questions in the course of the interview.	The outline increases the comprehensiveness of the data collection. It is somewhat systematic for each respondent. Logical gaps in data can be anticipated and closed. Interviews remain fairly conversational and	Importance and salient topics may be inadvertently omitted. Interviewer flexibility in sequencing and wording questions can result in substantially different responses from

			situational.	different perspective thus reducing the comparability of responses.
3.	Standardised open-ended interview	The exact wording and sequence of questions are determined in advance. All interviewees are asked the same basic questions in the same order: Questions are worded in a completely open-ended format.	Respondents answer the same questions, thus increasing comparability of responses; data are complete for each person on the topics addressed in the interview. Reduces interviewer effects and bias when several interviews are used. Permit users to see and review the instrumentation used in the evaluation of faculties, organisation and analysis of the data.	Little flexibility in relating the interview to particular individuals and circumstances; standardised wording of questions may constrain and limit naturalness of questions and answers.
4.	Closed, fixed response interview	Questions and response categories are determined in advance. Responses are fixed; respondent chooses from among these fixed responses.	Data analysis is simple; responses can be directly compared and readily aggregated. Many questions can be asked in a short time.	Respondents must fit their experiences and feelings into the researcher's categories; may be perceived as impersonal, irrelevant and mechanistic. Can distort what respondents really mean or experienced by

				so completely limiting their response choices.

Source: Paston Qualitative Evaluation and Research Methods © 1990 Table 7.1, 288 – 289.

SELF-ASSESSMENT EXERCISE 2

State one characteristic of the standardised open-ended interview.

3.1.2 How to Arrange an Interview

Below are the steps for successfully handling the interview as a technique for gathering data for one's research study. They are simple but very important.

i. Set up the interview well in advance;
ii. Send the agenda of questions you will ask the interviewee;
iii. Ask for permission to tape the interview;
iv. Confirm the date immediately in writing;
v. Send a reminder together with another agenda for questions, 10 days before you expect to arrive;
vi. Be prompt, follow the agenda, have a copy of your question for your interviewee in case he/she has misplaced his/her copy;
vii. Following the interview, submit a typescript of the interview and get either a written acknowledgement of its accuracy or a correct copy from the interviewee;
viii. After you have incorporated the materials into your research report, send that section of the report to the interviewee for final approval and written permission to use the data in your report.

3.1.3 Strengths of Interview

The interview is often superior to other data-gathering devices. One reason is that people prefer to talk than to write. After the interviewer gains rapport or establish a friendly relationship with the interviewee, certain types of confidential information may be obtained that an individual might be reluctant to put in writing.

The interviewer can explain more explicitly the investigations purpose and what information he/she wants.

- If the subject misinterprets the questions, the interviewer may follow with a clarifying question;

- It is possible to seek the same information in several ways during the interview. It is possible to stimulate the interviewee and possibly explore significant area not anticipated on the original plan of investigation.

Interview is particularly appropriate when dealing with children.

SELF-ASSESSMENT EXERCISE 3

What are the two major steps to be taken when arranging for an interview?

3.2 Conducting an Interview

The interview is a social relationship designed to exchange information between the respondent and the interviewer. The quantity of information exchanged depends on how astute and creative the interviewer is at understanding and managing that relationship.

Note that the goal is to collect data and not to make friends. Appearance must be neat, clean and businesslike but friendly. The first contact of the interviewer with the interviewee must be appealing. At times, characteristics such as: socio-economic status, age, race and ethnicity might influence the interview.

Also, begin with simple non-threatening questions. If an interview schedule is used, the interview will progress according to the schedule. As needed, the interviewer will use probes or follow up questions that are intended to elicit clearer and more complete responses.

Probe could be a pause in conversation that encourages the respondent to elaborate or an explicit request to clarify or elaborate on some issues. An open form question in which the subject is encouraged to answer in his or her own words at some length is likely to provide greater depth of response. Though closed questions are easier to record, they may yield more superficial information. Leading questions that unconsciously imply a specific answer should be avoided.

3.2.1 Recording Responses

A central task of interviews, of course, is to record responses of respondents. The four most common ways of recording responses are: classifying responses into predetermined categories, summarising the "high point" of what is said, taking verbatim notes or recording the interview with a tape recorder or video machine. Recording is easiest when an interview schedule is used.

Controlling Interview:

Once the interviewers go into the field, the quality of the resulting data is dependent on the proper supervision during interviewer training. Interviewers should be informed that their work will be thoroughly checked and failure to follow procedure will not be tolerated.

SELF-ASSESSMENT EXERCISE 4

State any two ways of recording interview responses.

3.3 Observation: Definition and Characteristics

From the earliest history of scientific activity, observation has been the prevailing method of inquiring. Observation of natural phenomena aided by systematic classification and measurement led to the development of theories of nature's forces. Observation continues to characterise all research: experimental, descriptive and qualitative.

Observation is the act of looking out for and recording the presence or absence of verbal and non-verbal behavior of a person or group of persons. The use of specially designed evaluation instruments to collect observational data is referred to as observational techniques. All methods of data collection involve some forms of observation.

Observational techniques, according to Monette *et. al.* (1994), is the collection of data through direct visual or auditing experience of behaviour. With observational techniques which include video or audio recording of behaviour, the researcher actually sees or hears the behaviour or words that are the data of the research.

Observational method varies in terms of the extent to which the researcher participates in the activities of the people being observed. The two general possibilities are: that of participant observer, and that of a non-participant observer.

Participant observer is a method in which the researcher is a part, and participates in the activities of the people, group or situation that is being studied. Participant observation is highly qualitative research.

3.3.1 Characteristics of a Good Observation

Best and Khan (1995) noted that: observation, as a research data-gathering process, demands rigorous adherence to the spirit of scientific inquiry.

The following standards characterise observers and their observations:

i. Observation is carefully planned. Systematic and perceptive observers know what they are looking for and what is relevant in a situation. They are not distracted either by the dramatic or the spectacular.

ii. Observers are aware of the wholeness of what is observed. Although they are alert to significant details, they know that the whole is often greater than sum of its parts.

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

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

v. Observation are checked and verified, whenever possible by repetition or by comparison with those of other competent observers.

vi. Observations are carefully and expertly recorded. Observers use appropriate instruments to quantify and preserve the results of their observations.

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

SELF-ASSESSMENT EXERCISE 5

Mention two characteristics of observation.

3.3.2 Uses of Observation

Yoloye (1977) in Okpala *et. al.* (1993) summarised situations in which observational data could be useful thus:

- measuring classroom process variables;
- measuring attainment of programme objectives;
- measuring programme implementation;
- identifying difficulties in programme use;
- identifying changes introduced by teachers;
- identifying typical instructional pathways; and
- supplementing data from other sources.

3.3.3 What Should be Observed?

Monette *et. al.* (1994) stated that it is possible to organise one's thought around some general categories of things to be observed and recorded:

i. **The setting:** field notes should contain some description of the general physical and social setting being observed.

ii. **The people:** field notes should include a physical and social description of the main characters who are the focus of your observations.

iii. **Individual behaviour –** the central observation in most studies are the behaviour of the people in the settings.

iv. **Group behaviour:** In some cases, the behaviour of group may be an important bit of information.

SELF-ASSESSMENT EXERCISE 6

Outline two uses of observation.

3.4 Measurement of Evaluation

If it does not create a barrier between the observer and those observed, simultaneous recording of observations is recommended. This practice minimise the errors that result from faulty memory. There are other occasions when recording would more appropriately be done after observation. The recording of observation should be done as soon as possible, while the details are still fresh in the mind of the observer. However, many authorities agree that objectivity is more likely when the interpretation of the meaning of the behaviour described is deferred until a later time, for simultaneous recording and interpretation often interfere with objectivity.

3.4.1 Systematising Data Collection

To aid the recording of information gained through observation, a number of devices have been extensively used. Checklists, rating scales, scorecards and scaled specimens provide systematic means of summarising or quantifying data collected by observation or examination. For example, the teaching practice assessment sheet is an observation scale except the part that deals with quality of the written lesson note.

SELF-ASSESSMENT EXERCISE 7

Name two devices that are used in recording information on observation.

3.4.2 Rating Scale

For example, the rating scale involves qualitative description of a limited number of aspects of a thing or of tracts of a person. The classification could be set out in some definite categories as shown below:

a. Superior, above average, fair, inferior.
b. Excellent, good, average, below average, poor.
c. Always, frequently, occasionally, rarely, never.

One of the problems of constructing rating scale is conveying to the rater which quality you wish to be evaluated. It is better to have a brief behavioural statement because it is more objective than an adjective that may have no universal meaning in the abstract. For any of the above categories to be considered, an effective method in observational research, the traits and categories must be very carefully defined in observable (behavioural) terms.

Some limitations of rating scale are:

- Conveying to the rater exactly which quality one wishes to be evaluated;
- How effect cause raters to carry qualitative judgement from one aspect to another;
- The tendency of the rater to be generous;
- Behaviours might mean different things to different observers;
- Systematic observation of human behaviours in natural setting is, to some degree, an intrusion into dynamics of the situation. The intrusion may be reactive, i.e. affect the behaviour of the persons being observed.

4.0 CONCLUSION

In this unit, you have learnt what interview is, how to prepare for an interview and that the major purpose of interview is to find what is in someone else's mind and also information about individual's experiences and knowledge.

We also discussed the meaning of observation as the act of looking and recording the presence and absence of verbal and non-verbal behaviour

of a person or group of persons. Two methods of observation are the participant observer and the non-participant observer.

5.0 SUMMARY

In the last two units (17 and 18), you dealt with how to elicit information (data) for research. In Unit 17, we discussed how to design questionnaire and in this Unit 18, we dealt with interview and observation.

In the next unit, you will learn how to determine the validity of these measures.

6.0 TUTOR-MARKED ASSIGNMENT

You are conducting a study on the topic "Persistent poor performance of secondary school students in chemistry".

Prepare an interview schedule you would use to collect information from principals.

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MODULE 7 WRITING THE RESEARCH REPORT

UNIT 1 LEVEL OF MEASUREMENT VALIDITY AND RELIABILITY

CONTENTS

1.0 INTRODUCTION

In the last two units (17 and 18), you learnt about the different ways of collecting information (data) for your research. In this unit, we shall look into different forms of measurement as well as how they are considered defendable by considering their validity and reliability.

The discussion in Units 17 and 18 shows that there are numerous ways of measuring phenomena such as: by asking questions or noting observations. Measures also differ from one another in terms of what is called the level of measurement: nominal, ordinal, interval and ratio.

If you keep in mind that variables are things that can take on different values, measurement basically involves assessing the value, or category into which a particular entity falls. For example, measuring age is the process of placing each person into a particular age category.

Whatever procedure for collecting data is selected, it should always be examined critically to assess to what extent it is likely to be reliable and valid. Therefore, as it has been mentioned earlier, levels of measurement, types of validity and reliability will be discussed in this unit.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- identify and describe the different levels of measurement
- state the different types of validity
- list the appropriate reliability methods to be used on a set of data
- apply the levels of measurement, validity and reliability appropriately on a set of data
- evaluate a research report on the appropriateness of the use of these terms.

3.0 MAIN CONTENT

3.1 Levels of Measurement

As mentioned in the introduction, not only do all data have certain clearly recognised characteristics, but every statistical approach also has its own specific requirement in terms of the type of data appropriate to the demands of that statistical procedure.

A straightforward and widely accepted definition of measurement is given by Kerlinger (1986). "The assignment of numerals to objects or evens according to rules". Data may be characterised and classified in four ways: nominal data, ordinal data, interval (continuous) data and ratio data. The four scales comprise a hierarchy of measurement levels based on the amount of information contained.

3.1.1 Nominal Level of Measurement

Measurement, in this case, could be seen as some form of restriction or limitation. Assign a specific name to anything and you have restricted that thing to the meaning of its name. For example, you can measure a group of children by dividing it into two groups: boys and girls, each group is thereby measured – "restricted" by virtue of gender to a

particular category. By assigning a name, you create a measurement. Things can be measured nominally in an infinite number of ways. For example, you can measure the groups above, according to their religion, where they live, etc.

Nominal measurement is elemental and unrefined, but it does divide data into discrete categories that can be compared with each other. If you have six people; Chike, Ayo, Adamu, Nosa, Tolu and Habiba, they can be measured into six units of one each. They can form two groups or more. The data can be statistically treated by finding mode, percentage, chi-square etc.

3.1.2 Ordinal Level of Measurement

In ordinal level of measurement, think in terms of symbols > (greater than) or < (less than). This scale orders the scores on some basis, such as: low to high or least to most. Although the scores are ordered, equal intervals between scores are not established. In measuring on the ordinal scale, the relationship is always asymmetrical. Something is always greater than, less than, older than, younger than etc. Using ordinal scale, you can find the mode and the median, determine percentage or the percentile rank and test by the chi-square.

SELF-ASSESSMENT EXERCISE 1

Briefly explain the term nominal measurement?

3.1.3 Interval Level of Measurement

The interval level of measurement is characterised by two features, namely:

i. It has equal units of measurement;
ii. Its zero point has been established arbitrarily.

For example, the thermometric scale is equal to the others and the zero point has been established arbitrarily. A common use of the interval measurement is in the rating scale employed by many businesses, survey groups, and professional organisations. Unlike the nominal and ordinal data, any data generated by using the interval scale can be subjected to all statistical operations starting with the basic ones of counting, ranking, adding, subtracting to the use of analysis of variance etc.

3.1.4 Ratio Level of Measurement

The highest level of measurement is ratio measures. Ratio measures have all the characteristics of interval measure, but the zero points is absolute and meaningful rather than arbitrary. As the name implies, you can make statements to the effect that some score is a given ratio of another score. For example, with income, you have the Naira as the unit of measurement. Also, you all recognise that there is such a thing as no income at all; therefore, the zero point is absolute. Because it is absolute, it is legitimate to say that an income of N100,000 is twice the income of N50,000. Given that ratio scales have all the characteristics of interval scale, you can perform all arithmetic functions on them.

In summary, you should note that although researchers have no control over the nature of variable, they do have some control over how they will define variables, at both the nominal and operational levels, and this affects the level of measurement. It is sometimes possible to change the level of measurement of a variable by redefining it at the nominal or operational level. This is important because researcher generally strive for the level of measurement to enable them measure variables more precisely and use more powerful statistical procedures.

It is also desirable to measure at the highest possible level of measurement because it gives the researchers the most options. The level of measurement can be reduced during the data analysis, but it cannot be increased. Thus, choosing a level of measurement that is too low introduces a permanent limitation into data analysis. Other things being equal, a researcher having two measures available; the ordinal and the other interval would generally prefer the interval measures.

SELF-ASSESSMENT EXERCISE 2

What affects the level of measurement most?

3.2 Validity and Reliability

Validity and reliability are two words that are used repeatedly in research methodology. They are used primarily in connection with measurement instruments. The integrity of your research may well stand or fall on the basis of how well you understand their meaning and carefully obey their demands. They govern the acquisition of data and the skillfulness with which you design the research structure and create the instruments of measurement as an integral part of it.

3.2.1 Validity

Validity is the extent to which a test result measures what it has been designed to measure. In a standardised test, for example, validity would raise such questions as: What does the test measure? Does it in fact measure what it is supposed to measure? How well? How comparatively? How accurately does it measure it?

In general, a test is valid, if it measures what it claims to measure. Validity can also be thought of as utility. There are several types of test, and uses of test need different types of validity. The seven most common types with a brief discussion of each are listed below;

i. ***Face Validity*****:** This type of validity relies basically on the subjective judgement of the researcher. It asks two questions that the researcher must finally answer in accordance with his or her best judgement:

a. is the instrument measuring what it is supposed to measure? and
b. is the sample being measured representative of the behaviour or trait being measured?

ii. ***Criterion Validity*****:** This type of validity is determined by relating performance on one measure (e.g. a test) to performance on another measure called a criterion. The essential component in criterion validity is a reliable criterion – a standard against which to measure the results of the instrument doing the measuring. The data of the instrument should correlate highly with equivalence data or the criterion.

iii. ***Content Validity*****:** This type of validity is sometimes equated with face validity. Content validity is the accuracy with which an instrument measures the factors or situations under study – the accuracy with which an instrument measure the factors or situations under study, that is, the content being studied. If, for example, you are interested in the content validity of questions being asked to elicit familiarity with a certain area of knowledge, content validity would be concerned with how accurately the question asked tend to elicit information sought.

iv. ***Construct Validity*****:** A construct is any concept that cannot be directly observed or isolated, e.g. attitude. Construct validity is concerned with the degree to which the construct itself is actually measured. Different methods of measuring the same construct should 'converge' or 'focus' in their result. Discriminability means that the measuring instrument should be able to

discriminate or differentiate the construct being studied from other similar constructs.

v. ***Internal Validity*:** Interval is the freedom from bias in forming conclusions on various data. It seeks to ascertain that the changes in the dependent variable are the results of the influence of the independent variable rather than of the way the research was designed.

vi. ***External Validity*:** This type of validity is concerned with the generalisability of the conclusions reached through observation of a sample to the universe, or more simply stated, can the conclusions drawn from a sample be generalised to other cases.

vii. ***Predictive Validity*:** This refers to the usefulness of a test in predicting some future performance such as: the college performance. If a test is designed to pick out good candidates for appointment on a job, and test score show a high positive correlation with later actual success on the job, the test has a high degree of predictive validity, whatever factor is actually measured. It predicts well. It serves a useful purpose. But before determining a test's predictive validity, success on the job must be accurately described and measured. Predictive validity is not easy to assess. It is often difficult to discover whether the faults of prediction lie in the test, in the criteria of success or failure or both. Validity looks to the end result of measurement. The principal question that validity asks is: "is the measure measuring what it is supposed to measure?" Unfortunately, many students limit their assessment to content validity with all its heavy reliance on the subjective judgment, but content validity should be used with caution.

SELF-ASSESSMENT EXERCISE 3

Mention the essential component of criterion validity.

3.2.2 Reliability

Reliability is the consistency with which a test result measures what it has been designed to measure (Oloyede, 2007). To ensure the integrity of any research, the researcher should consider it mandatory to state clearly and definitively the specifications of the measuring instrument. Here, you are dealing with the foundation factors of the entire research structure. Just as a building with a questionable foundation is very likely to be unsafe for habitation, so also is a research effort employing faulty tools of measurement will likely end as a defective research

endeavour. There are many specific techniques for estimating the reliability of a measure, but they are all based on one or two principles – stability or equivalence. Stability is the idea that a reliable measure should not change from one application to the next, assuming the concept being measured has not changed. Equivalence is the idea that all items that make up a measuring instrument should be measuring the same thing and thus be consistent with one another. The first techniques for estimating reliability, test-retest reliability, are based on the stability approach. The other discussed use is the equivalence principle.

SELF-ASSESSMENT EXERCISE 4

Name the validity type that is concerned with the generalisability of the conclusion reached.

3.3 Assessment of Reliability

The assessment of reliability will be discussed under the following sub-topics: Test-Retest; Split-Half Approach Formulae.

3.3.1 Test-Retest

The first and most generally applicable assessment of reliability is called test – retest. This technique involves applying a measure to a sample of subjects and then somewhat later, applying the same measure to the same subjects again. After the retest, you have two sets of score on the same measure. These two sets of scores are correlated by using appropriate statistical measure of association, because with scores obtained from the two identical questionnaires, a high degree of association is expected. According to Monettee *et. al*. (1994), a correlation coefficient of 0.8 or more is normally necessary for a measure to be considered reliable.

3.3.2 Split-Half Approach

In the split-half approach to reliability, the test group responses to the instrument are then divided into two halves. Each half is then treated as though it was a separate scale, and the two halves are correlated by using an appropriate measure of association. Because the split half approach divides the scale, each half is shorter than the whole scale. To correct for this, the correlation coefficient is adjusted by applying Spearman-Brown formula thus:

$$r = \frac{2\,r_x}{1 + r_x}$$

where r_x = Uncorrected Correlation Coefficient

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

where r_c = Corrected Correlation Coefficient

3.3.3 Kuder-Richardson Formulae

Kuder and Richardson developed a number of formulae for determining reliability using scores from only one test administration. The correlation coefficient calculated is a measure of internal consistency. A basic assumption is that the score are homogenous and therefore possess inter-item consistency as below:

K_{R20} : $$r = \frac{n}{n-1}\left(\frac{(1 - \sum Pq)}{PS^2}\right)$$

K_{R21} : $$r = \frac{n}{n-1}\left(1 - \frac{\bar{X}(n - \bar{x})}{ns^2}\right)$$

where r = reliability coefficient
n = number of items
p = proportion of people who got the item right
q = proportion of people who got the item wrong
pq = variance of a single item scored dichotomously
$\sum$ = summation sign
S = variance of total test
x = mean of total test.

There are also other methods of estimating reliability such as: Equivalent forms methods, the Cronbach Coefficient Alpha, among others. Any standard text in measurement and evaluation is likely to address most of them.

4.0 CONCLUSION

In this unit, you have studied:

- levels of measurement: nominal; ordinal; interval and ratio levels of measurement.
- validity and different methods of determining validity and reliability. Types of validity – face, criterion, construct, content, internal, external and predictive validity; and
- reliability – test-retest, split-half and Kuder-Richardson formulae.

5.0 SUMMARY

In this unit, you have studied the issues on which measurement instruments are assessed. The integrity of any research depends wholly on its validity and reliability.

In the next unit, will learn how to write a research proposal.

6.0 TUTOR-MARKED ASSIGNMENT

1. Name five types of validity approaches and state how you would use them in various studies.
2. State the two principles on which reliability is based. Is any reliability approach considered superior to the other? Explain.

7.0 REFERENCES/FURTHER READING

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UNIT 2 RESEARCH PROPOSAL

CONTENTS

1.0 INTRODUCTION

From Unit 1 to Unit 19, you have studied the major components of research method. Having gone so far, in your study, it is now appropriate to learn how to write a research proposal. We shall be concentrating on writing a research proposal in this unit.

The preparation of a research proposal is an important step in the research process. Many institutions require that a proposal be submitted before any project is approved. This provides a basis for the evaluation of the project and gives the supervisor (advisor) a basis for assistance during the period of his or her direction. It provides a systematic plan of procedure for the research to follow.

The proposal is comparable to the blueprint an architect prepares before the bids are let and the building commences. The initial draft proposal is subject to modification in the light of the analysis by the student and his/her supervisor. This is because a good research must be carefully carried out; procedures that are improvised from steps will not be very helpful. A worthwhile research project is likely to achieve only from a well designed proposal.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- write a research proposal
- recognise the different aspects of a research
- identify the importance of a well defined problem in a research
- evaluate research proposals to improve their quality.

3.0 MAIN CONTENT

3.1 Characteristics of Proposal

Research demands that those who undertake it should be able to think clearly, without confusion. The proposal will show beyond all reasonable doubt whether the author possesses that capability or not. When an advisor reads a proposal, the presentation helps him/her to form an impression about the researcher that produced such a document.

Qualification, as a researcher, more often than not, rests squarely upon the quality of the proposal submitted. Therefore, as you embark on writing a research proposal, you should understand and appreciate exactly what characteristics a proposal should have.

A proposal should not be filled with extraneous matter. An introduction should be specific and concise. Whatever does not contribute directly to the delineation of the problem and its solution should be removed.

Your opening sentence must be information laden and appealing to the reader. If your sentence at that stage irritates the reader, you are immediately put at a disadvantage and perhaps, have sacrificed your reader's interest.

More seriously, it may indicate that you cannot plan meaningfully and may cast doubts upon your ability, as a researcher, to think clearly and critically.

In fact, poor beginning could suggest that the writer does not actually know the meaning of a proposal which is a serious indictment. There should be a beginning that shows all senses of seriousness.

SELF-ASSESSMENT EXERCISE 1

What does a well-though out proposal show?

3.1.1 Proposal and Language

An architect's drawing is not a "literary" production. The mission is not artistic; the purpose of both is to communicate clearly. As an architect's drawing presents an idea of construction with economy of line and precision of measurement, so a proposal indicates how a research work is to be executed to completion; with an economy of words and a precision of expression. It provides no opportunity for literary composition.

The language must be clear, concise and sharp. The proposal affords the researcher to present with ultimate clarity and precision that the researcher can state a problem, delineate the treatment of data and establish the logical validity of a conclusion.

3.2 Writing different Components of the Proposal

This will be discussed under the following subtopics.

3.2.1 The Statement of the Problem

This is often a declarative statement and could be in question form. This attempts to focus on a stated direction in respect of the research process. It must be limited enough in scope to make a definite conclusion possible.

The major statement may be followed by the minor statement. A problem usually implies that a controversy or difference of opinion exists. As stated earlier understatement of the problem in Unit 3, problems can be derived from theory prior research results, or personal observation and experience. Often, problems are based upon a significant concern, problem of poor performance in science subject, success of the Universal Basic Education, the menace of cult activities in our educational institutions, poor scientific literacy in the nation, stability of democratic practices in Nigeria etc.

A problem could be that knowledge of participation in an experiment may have a stimulating effect upon the reading achievement of participants. To develop it, there will be a major problem and sub-problems. This has been discussed earlier. The problem statement suggests the research questions and hypotheses and provides a focus for the entire research.

3.2.2 The Significance of the Problem

The researcher should be able to point out how the successful execution of the problem or the answer to the questions raised can influence educational theory and practice. The research must show why it is worth the time, effort and expenses required to carry out the proposed research. Careful formulation and presentation of the implications or possible applications of knowledge help to give or justify the worth of the research. Failure to include this step in the proposal may well leave the researcher with a problem without significance i.e. a search for data of little ultimate value. With so many gaps in education theory and practice in need of investigation, there is little justification for the expenditure of research effort on trivial or superficial investigation.

3.2.3 Definitions, Assumptions, Limitations and Delimitations

It is important that all terms and expressions that could be misinterpreted be defined. These definitions help to determine the frame of reference with which the researcher approaches the problem. The major variables – dependent and independent should be defined in operational terms. Such expression as performance and personality are useful concepts, but they cannot be used as criteria unless they are defined as observables. Academic grade assigned by teachers or scores on standardised achievement tests are operational definitions of performance. Tolerance, anxiety level, comportment etc. are components of individual's personality.

Assumptions are statements of which the researcher believes to be facts, but cannot verify.

Limitations are those conditions beyond the control of the researcher that may place restrictions on the conclusion of the study and their applications to other situations. Lack of female student for a study that sex was proposed as a variable; poor teaching due to unqualified staff; administrative policies that preclude using more than one class in an experiment, using non-randomised groups because of lack of subject are examples of limitation to a study.

Delimitations are the boundaries of the study. A study of attitudes toward science may be concerned with elementary science pupils. Conclusions cannot be extended beyond this group.

3.3 Review of Related Literature

A summary of the writing of recognised authorities or researchers generally provides evidence that the researcher is familiar with what is already known and what is still unknown and untested. Since effective research is based upon past knowledge, this step helps to eliminate the duplication of what had been done and provides useful hypotheses and helpful suggestions for significant investigation.

Citing studies that show substantial agreement and those that even seem to present conflicting conclusions helps to sharpen and define understanding of existing knowledge in the problem area. Providing a long list of annotated studies relating to the problem is ineffective and inappropriate. Only those studies that are plainly relevant, competently executed and clearly reported should be included.

Below are certain important elements that the researcher should note as suggested by Best Khan (1995):

- Report of studies closely related to problems that have been investigated;
- Design of the study, including procedures employed and data gathering instruments used;
- Populations that were sampled and sampling methods employed;
- Variables that were defined;
- Extraneous variables that could have affected the findings;
- Faults that could have been avoided; and
- Recommendations for further research.

The search for related literature is very vital in any research because it is guide to defining the problem, recognising its significance, suggesting promising gathering devices, and appropriate study design and source of data. A meaningful search for related literature provides clues to all other important aspects of the problems.

3.4 Hypotheses

It is appropriate here to formulate a major hypothesis and possibly several minor hypotheses. The hypotheses give direction to the data gathering process. A good hypothesis has several basic characteristics it should:

- be reasonable;
- be consistent with known facts and theories;
- be stated in the simplest possible terms; and
- have at least two variables.

Research hypothesis is a tentative answer to a question. The formulation of an hypothesis in advance of the data gathering process is necessary for an unbiased investigation. It is appropriate to formulate additional hypotheses after data have been collected, but they should be tested on the basis of new data and not on the old data that was initially suggested.

SELF-ASSESSMENT EXERCISE 3

State two basic characteristics of a good hypothesis.

3.5 Methodology

This part of any proposal usually consists of three parts – population and sample, procedure and data analysis. The subjects section describes the target population from which the sample is to be selected. The number of subjects (sample) and how they can be selected are discussed in this section. The procedure section outlines the research plan. It describes, in detail, what will be done, how it will be done, what data will be needed and what data gathering devices would be used, and the method of analyzing the data (this will be discussed in the statistics course material). The information given in the data analysis section should be specific and detailed enough to demonstrate to the reader exactly what is planned. No details should be left open to question.

A research proposal is a clear statement of a problem and sub-problem, the data and how these will be processed and more important of all, how the data will be interpreted. Although the interpretation of data is what gives the research the necessary information for leasing out the findings and subsequent recommendations, many students treat it in a very casual manner. Data should be handled properly. Some suggestions towards proper handing of data are as follows:

- Systematically describe the treatment of the data;
- State precisely where the data are to come from;
- State clearly how the data will be secured;
- State fully how you intend to interpret the data;
- Spell out every step in the interpretation of data – you may treat each question or hypothesis separately; and
- Be sure the data will support your conclusions.

3.6 Time Schedule

Although this step may not be required by your supervisor, a time schedule should be provided so that the researcher may budget his or her time and other resources required for the study effectively. Dividing the

time into manageable parts and assigning dates for their completion to organise the study and minimise the natural leniency to procrastinate.

SELF-ASSESSMENT EXERCISE 4

List the areas to be discussed under methodology in a research proposal.

You will discover that most of the major sections stated here have been discussed in the different units of this course; you should refer to any relevant section for clarification where you are in doubt. Though most institutions provide their own format for presenting a proposal, a general approach is given below:

i. Introduction

- General background of the study
- Purpose of the study
- Research questions and hypotheses
- Delimitations and limitations
- Significance of the study
- Definition of terms.

ii. The Review of Related Literature

iii. Methodology

- Theoretical framework
- Type of design
- Population and sample
- Demographic
- Data collection strategies
- Data analysis strategies
- Presentation of results.

iv. Findings

- Relationship to literature
- Relationship to theory
- Relationship to practice.

v. Management plan, timeline, feasibility
vi. References / Bibliography
vii. Appendices.

The writing of the proposal – The arrangement: the material should be
so presented that it forms, for the reader, a clear, progressive presentation by keeping together items that belong together.

4.0 CONCLUSION

In this unit, you have learnt the major steps of writing a proposal. Language in research writing, the different components of the proposal and a possible format for presenting proposal.

5.0 SUMMARY

This unit shows that a proposal helps learner in organising the projected research work and a proposal provides the learner's supervisor with a global view of the project and affords an opportunity to counsel and guide the learner with respect to areas that may pose exceptional difficult.

It is awesome to contemplate, but to no small degree, your proposal is you. It defines your ability to think critically and to express your thoughts capably. It is the practical application of your educational competencies laid bare upon a sheet of paper.

6.0 TUTOR-MARKED ASSIGNMENT

Choose a topic in your area of specialisation and write a research proposal of not more than four foolscap pages.

7.0 REFERENCES/FURTHER READING

Best, J.W. & Khan, J.V. (1995). *Research in Education.* (7th Edition). New Delhi: Prentice Hall. PP 20 – 23.

Cresswell, J.W. (1994). *Research Design: Quantitative and Qualitative Approaches* Thousand Oaks C.A.: Sagem in P.D. Leedy (1997) *Practical Planning and Design.* (6th Edition) New Jersey: Merril, PP103 – 110.

Leedy, P.D. (1997). *Practical Research: Planning and Design* (6th Edition). New Jersey: Morill, PP103 – 110.

Monette, D.R.; Sullivan, T.S. & Dejong, R.D. (1994). *Applied Social Research: Tool for the Applied Social Research: Tool for the Human Services* (3rd Edition) Chicago: Harcourt Brace.

Okpala, P.N.; Onocha, C.O. and Oyedeji, O.A. (1993). *Measurement and Evaluation in Education.* Jattu-Uzairue: Stirling-Horden Publsihers Limited, PP86 – 103 Observation Techniques.

Yoloye, E.A. (1977). Cited in Okpala, P.N., Onocha, C.O. and Oyedeji, O.A. (1993). *Measurement and Evaluation in Education*. Jattu-Uzarue: Stirling-Horden Publishers Limited, pp. 105.

William, W. and Stephen, G.J. (2005). *Research Methods in Education* (8th Edition). Pearson Educational Inc.

UNIT 3 WRITING A RESEARCH REPORT

CONTENTS

1.0 INTRODUCTION

A research work will be a worthless effort if after an excellent problem has been identified, a clearly stated and comprehensive literature has been searched and reported with an appropriate methodology, the final analysis and interpretation are now poorly presented. This can only be likened to roofing a new building with perforated roofing sheets.

To write a report of one's research that shows fidelity to the data and the ability to organise them logically and present them clearly is to bring one's research effort to its destined conclusion: to share with others your findings and whatever nuggets of meaning they may contain.

A research report is a straightforward document that sets forth clearly and precisely what a researcher has done to resolve a research problem. In structure, it is factual and logical. Like the research proposal, it makes no pretence at being a literary production. It must, however, be readable which is another way of saying that the writer of the research report must know how to communicate clearly.

The basics of the sentence and paragraph structure must evidence mastery. Punctuation use and spelling must display proficiency. The research document you write is a clear reflection of your knowledge as a researcher; this is why it is also often used as a culminating measure of a

student's educational success. Writing a report or a dissertation requires discipline, and even the most experienced of researcher needs to improve some sort of self-control to ensure that the task is completed on time. Different people have different ways of working and what suits one person may not suit another. The important thing is that you must impose some sanctions on yourself, set time frame and work towards it.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- plan a research report
- structure a research report
- write a research report
- appraise a research report.

3.0 MAIN CONTENT

3.1 Planning a Research Report

A research report has a relatively simple format. In general, it should achieve three objectives thus:

i. It should acquaint readers with the problem that has been researched and explain its implications adequately enough so that they have a clear orientation to the problem;

ii. It should present the data fully and adequately. The data within the report should substantiate all the interpretation and conclusion that the report contains; and

iii. It should interpret the data for the reader and demonstrate exactly how the data resolved the problem that has been researched. A report that merely represents raw data and uninterpreted fact is of little help to the readers in deriving meaning from these data.

For a thesis or dissertation report, it is advisable to visit the graduate school to find out whether the university has a prescribed set of guidelines for writing theses. Such issues as paper size, width of margins, size and style of typeface should be checked from the graduate school. Often, what is acceptable in one institution may not be accepted in another. You should ask whether your University has a style manual for writing research documents or whether it recommends you follow a particular style manual and if so, which one.

No matter how well you write, your writing will benefit from regular usage of style manual.

SELF-ASSESSMENT EXERCISE 1

State one objective which a research report must bear in mind.

It has been mentioned earlier that in almost all cases, institutions have their manuals for writing research reports, particularly thesis and dissertation. You are advised to consult your graduate school so as to obtain a copy of the manual and follow it thoroughly. For the purpose of discussion, the following format will be used as follow:

3.2 Format for the Research Report

i. Title Page

This includes the title of your study, your name and the date, the title should accurately reflect the nature of your study and should be brief and to the point.

ii. Acknowledgement

You may wish to acknowledge the help given to you in the preparation of your report. If so, acknowledge generally.

iii. Abstract

In most cases, institutions demand an abstract. It is quite difficult to produce in few words what your research set out to do, the methods employed and the conclusions reached. Also, most institutions specify the length; an abstract should be at most two A4 pages. Generally, most scientific journals, theses and dissertations contain abstracts. An abstract is a summary of the study that allows the reader to learn enough to decide whether to read the whole thing. In an abstract, the first sentence should be clear statement of the problem that was investigated in the study. The research methodology and sampling techniques are then indicated. A brief summary of findings and conclusion completes the abstract.

iv. Introduction and Problem Statement

The first part of the body of the report states the research problem and its importance. This should include a brief literature review or the history of the problem in previous research and theory. The objectives

of the study, research questions and hypotheses all constitute part of this aspect of the study.

A guide should: explain the research problem in few sentences, state the aims/objectives/hypotheses, provide any background to the study which is necessary to place the study in its context. Draw attention to any limitation the study might have at this stage. This chapter also accommodates the significance of the study and definition of terms.

SELF-ASSESSMENT EXERCISE 2

What should the introduction of a research report contain?

3.2.1 Review of Literature

A thesis or dissertation should have a chapter which deals exclusively with the review of literature. This should include the history of the problem (if any). It also indicates how the current study flows from previous studies. Simply put, the review of literature provides the context and background of the study. Selection has to be made and only books and journals articles which relate directly to the topic should be used. You should be able to select material which is related to your study, group the information into categories, comment on features which are of particular importance and also compare the results of different investigations. A good review of literature sets the scene, places the work in context and prepares the reader on what is to follow.

SELF-ASSESSMENT EXERCISE 3

What is the major aim of a literature review?

3.2.2 Methodology and Statement of Results

The methodology section describes the sample that was studied and the research techniques employed. It also shows how concepts are operationalised and what measurement devices such as scales were used, choice of variables and controls. This section is very important because it provides the basis for any future replication efforts, so such section must be written with sufficient detail so that it can perform these two functions. Readers of this section of your thesis or dissertation must be able to tell precisely what was done in the study and who participated.

3.2.3 The Statement of Results

This is the heart of the report and will consist of tables, figures and text, depending on the nature of the thesis and dissertation. The way results are presented is important. Tables, charts, graphs and other figures should illustrate and illuminate the text. The text should be written after the results are prepared and should not duplicate information in the tables, but should highlight significant aspects of the findings. You should ensure that all relevant facts are presented in a way that draws the readers' attention to what is most important. This requires some practice and in most cases, you need to repeat the draft severally before you produce something acceptable to your supervisor. You should recognise that other students have produced research reports before you, so you will do well to look through their work.

SELF-ASSESSMENT EXERCISE 4

Discuss methodology and statement of results in thesis and dissertation.

3.2.4 Analysis and Discussion

It is often advisable to start this section with a restatement of the problem before discussing how the result affects existing knowledge of the subject. If your research aimed at certain hypotheses then, this section demonstrate whether they were or were not supported by the evidence. Any deficiencies in the research design should be mentioned, with suggestion about different approaches which might have been more appropriate. Implications for improvement of practice, if any, should be stated under this section. Often, research results raise new questions as they answer others. Any suggestions for future research should be stated in this section.

3.2.5 Summary and Conclusion

The main issues arising from the analysis and discussion should be summarised clearly in this section. Only conclusion that can be justifiably drawn from findings should be made. It is advisable to read the entire report before writing this section of the research report.

3.2.6 References

All the materials referred to in the text and only those listed alphabetically in the reference section of the manuscript should be written. Some examples are shown below.

Books:

Jegede, O.J. (1998). *Primary Science for Nigerian Primary Schools*. Ibadan: Heinemann Educational Books; PP80 – 150.

Oloyede, O.I. (2007). *Measurement and Evaluation for Tertiary Institutions*, Kaduna: Euneeks and Associates, PP37 – 53.

Associations:

Science Teachers Association of Nigeria, STAN (1998). *The History of STAN.* Ibadan: University Press Plc. PP90 – 110.

Journals:

Otuka, J.O.E. (2000). Think and Do Activity-Based Science for Nigerian Primary Schools. *Journal of the Science Teachers Association of Nigeria,* 80, PP1 – 10.

Thesis:

Ezenwa, V. (1998). Children's Ideas about Chemical Bonds. Unpublished doctoral thesis, Ahmadu Bello University, Zaria.

Chapters in Edited Books:

Otuka, J.O.E. and Atadoga, M. (2000). How Children Learn Scientific Concepts, in M.J. Shuaibu and M.F. Bandele (eds.) *History of Science in Nigeria,* Kaduna: Bode Press, PP211 – 219.

Appendices:

Should include copies of questionnaire, interview schedules, raw data etc.

3.3 Principles of Writing

Remember that your report is you; your report is a powerful psychological weapon. Without your meaning to do so, a report can say more about you to your supervisor than you possibly can imagine. Below are some tips to note:

Neatness and Clarity: Your report should be clean and clear. Each sub-problem should be a clear stepping stone in the resolution of the main problem. Little things leave lasting impressions. Your page

should be easy to read, double-spaced lines and clear crisp letters, placed attractively on the page.

Precision: In addition to neatness and clarity, a research report should be crisp with precision. There should be no room for guessing or for ambiguous or foggy terms. Your document should be clear-cut and present its information plainly.

Writing research reports effectively is not an easy task. Good reports are not written in a hurry. Even experienced and skillful writers revise their report severally before they submit their final report.

3.4 Evaluating the Research Report

Below are some questions that could enable you to evaluate your research report.

Step 1: The Problem

- Is the problem clearly and concisely stated?
- Is the problem adequately narrowed down into a research effort?
- Is the problem significant enough to warrant a formal research effort?
- Is the relationship of the identified problem to previous research clear?

Step 2: Literature Review

- Is the literature review logically organised?
- Does the review provide a critique of the relevant studies?
- Are gaps in knowledge about the research problem identified?
- Are important relevant references omitted?

Step 3: Theoretical or Conceptual Framework

- Is the theoretical framework easily linked with the problem, or does it seem forced?
- If a conceptual framework is used, are the concepts adequately defined, are the relationships among these concepts clearly identified?
- Are the independent and dependent variables identified?
- Is a predicted relationship between two or more variables included in each hypothesis?
- Are the hypotheses clear, testable and specific?
- Do the hypotheses logically flow from the theoretical or conceptual framework?

Step 4: Research Variables

- Are the dependent and independent variables operationally defined?
- Are any extraneous or intervening variables identified?

Step 5: Hypotheses

- Is a predicted relationship between two or more variables included in each hypothesis?
- Are the hypotheses clear, testable and specific?
- Do the hypotheses logically flow from the theoretical or conceptual framework?

Step 6: Sampling

- Is the sample size adequate?
- Is the sample representative of the defined population?
- Is the method of selection of the sample appropriate?
- Are the sample criteria for inclusion into the study identified?
- Is there any sampling bias in the chosen method?

Step 7: Research Design

- Is the research design adequately described?
- Does the research design control for threats to internal and external validity of the study?
- Are the data collection instruments described adequately?
- Are the reliability and validity of the measurement tools adequate?

Step 8: Data Collection Methods

- Are the data collection methods appropriate for the study?
- Are the data collection instruments described adequately?
- Are the reliability and validity of the measurement tools adequate?

Step 9: Data Analysis

- Is the result section clearly and logically organised?
- Is the type of analysis appropriate for the level of measurement for each variable?
- Are the tables and figures clear and understandable?
- Is the statistical test the correct one for answering the research question?

Step 10: Interpretation and Discussion of the Findings

- Are the interpretations based on the data obtained?
- Does the investigator clearly distinguish between actual findings and interpretations?
- Are the findings discussed in relation to previous research and to the conceptual / theoretical framework?
- Are unwarranted generalisation made beyond the study sample?
- Are the limitations of the results identified?
- Are recommendations for future research identified?
- Are the conclusions justified?

4.0 CONCLUSION

In this unit, you have learnt:

- how to plan a research report;
- the format for a standard research report but institutions have variations of this standard format;
- how to write a comprehensive research report and takes care of all aspects of such a report, of the need to revise your research report draft severally before you arrive at the final report;
- that your research report provides a mirror of your person to the society, you must therefore do it very meticulously.

5.0 SUMMARY

We have come to the end of this course. I hope you enjoyed it. I do hope you can now initiate and carryout research. Also, you can assess and criticise research work. Try publishing your research findings in journal. If you are a classroom teacher, action research can improve the quality of your teaching and make you popular. You may try it.

6.0 TUTOR-MARKED ASSIGNMENT

Select any three research studies from a journal and use the scale for evaluating research reports to evaluate them.

7.0 REFERENCES/FURTHER READING

Best, J.W. & Khan, J.V. (1995). *Research in Education* (7th Edition). New Delhi: Prentice Hall. PP 20 – 23.

Cresswell, J.W. (1994). *Research Design: Quantitative and Qualitative Approaches* Thousand Oaks C.A.: Sagem in P.D. Leedy (1997) Practical Planning and Design (6th Edition) New Jersey: Merril, PP105 – 107.

Leedy, P.D. (1997). *Practical Research: Planning and Design* (6th Edition). New Jersey: Morill, PP103 – 110.

Monette, D.R.; Sullivan, T.S. & Dejong, R.D. (1994). *Applied Social Research: Tool for the Human Services* (3rd Edition) Chicago: Harcourt Brace College Publishers, PP3 – 8.