FUNDAMENTAL PRINCIPLES OF EDUCATIONAL RESEARCH IN TERTIARY INSTITUTIONS IN NIGERIA

PROF. IDRIS, A.M.

PROF. HASSAN, A.M.

PROF. UMEH, A.

PROF. GIMBA, R.W.

DR. TAFIDA, A.

PROF. ADAMU, Z.E.

DR. BASHIR, A.U.

"Research is seeing what everybody else has seen and thinking what nobody else has thought."

- Albert Szent-Györgyi

PREFACE

Writing of research project is one of the most important aspects of any teacher education programmes including the PGDE, N.C.E., B.Ed, M.Ed and Ph.D. Apart from various diplomas and degrees in Education where research project writing is a sine-qua-non, there are many other fields of human endeavours like medicine, engineering, commerce and industries which require adequate information about the procedures for writing projects. However, it was discovered that the project reports submitted by some of the N.C.E./diploma or even degree students are highly substandard. Thus in some cases results into the cancellation of the projects reports by the co-ordinator(s) or the external supervisors is charge, even after the binding of the projects. The fault is sometimes found not to be that of the student researcher only, but also that of his/her supervisor who has not provided satisfactory guidance to the investigation. The poor writing of research projects becomes more glaring when the degree students started to submit their project report. This prompted the suggestion for the writing of this book; "Research Project Report (A practical Guide)

In most of the sections of this book, a series of examples, which can assist the student/supervisor in the writing of project reports are given. The book treated all aspects of project report techniques from the selection of title, to the last aspect of referencing styles.

FORWARD

This book "**Fundamental Principles of Educational Research in Tertiary Institutions in Nigeria**" has presented a logical analysis of problems encountered by research students in the study of the course, Research Methods in both Social Sciences and Education. It gives insightful reading and practice to an attentive research students in all its aspects. Usually, beginning research students find the area of problem identification and selection, and statement of the problem and formulation of research questions and hypotheses not an easy task to tackle.

This book offers a reason able guide to overcome those problems and more, in other aspects of research execution. The section dealing with experimental designs, with their associated problems was elaborately explained.

The book made an in-depth and comprehensive treatment of most of the concepts/topics in research methods which makes it an invaluable and indispensable resource for both students and teachers of research methods to consult. The simplicity of the treatment of the topics discussed increases its quality and hence demand for adoption for both undergraduate and graduate students in education and social sciences.

I therefore confidently recommend the book to all the target audience/readers for both personal and pedagogical development to find solution to Educational and social science problems.

Prof. T. C. Ogbuanya
Department of Vocational Technical Education
University of Nigeria, Nsukka

TABLE OF CONTENTS

CHAPTER ONE

RESEARCH IN SOCIAL SCIENCES AND EDUCATION

Objectives

The chapter intends to:

1. define scientific research;
2. differentiate between quantitative and qualitative research;
3. explain research process;
4. identify and define research problem;
5. explain the process involved in literature review;
6. state the types of research in education;
7. define research design; and
8. state research questions and hypotheses.

Introduction

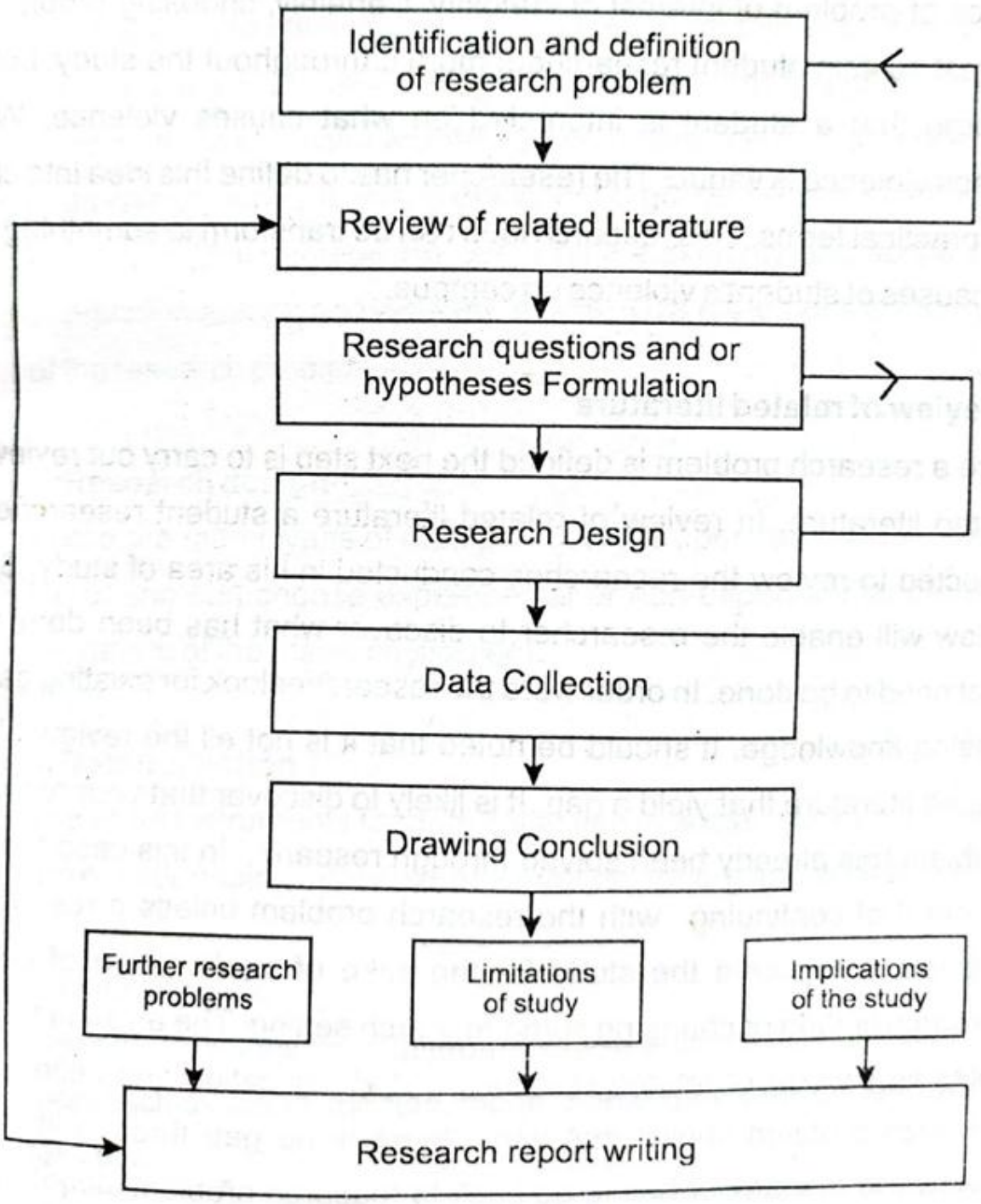
Social research is characterized by two broad traditions; the positivism and interpretivism. The former is synonymous to quantitative research while the later, the qualitative research. Each of these methodological approaches can be adopted in social research depending on the preference of the researcher or type of research question. Sometimes we use both methodologies (triangulation) on the same research problem. In this chapter, we shall discuss issues mainly relating to quantitative research. These include research process and research types. The chapter will also discuss methodological challenges facing social scientists (positivist). Finally, the chapter will introduce the reader to the concept of Educational research.

What is research?

Maduabum (2004) defined research "as the application of scientific method to the study of a problem". To Polit and Hungler (1995) research is a systematic investigation that is rooted in objective reality and that aims to develop general knowledge about natural phenomena. These two definitions show that research can be conducted to solve problem or develop general knowledge about phenomena. The phenomena could be social, psychological, political, economic, educational and so forth.

Research process

Research process ¡s the overall scheme of activities which scientists engage in order to solve a research problem or produce knowledge. Fig 3.31 shows the sequential steps of research process as well as their relationship. This section will give an overview of research process since some elements of the process would be treated as chapters in this text.



1. Identification and definition of research problem

Human beings are surrounded by multitude problems begging for solutions. A student researcher is free to choose any one from his or her area of study. The first

consideration towards problem identification is the choice of problem of interest or curiosity. Certainly, choosing problem of interest sustains student researcher's morale throughout the study. Let us assume that a student is interested in what causes violence. What causes violence is vague. The researcher has to define this idea into clear and practical terms. This research idea can be transformed to Something the causes of student's violence on campus.

Review of related literature

Once a research problem is defined, the next step is to carry Out review of related literature. In review of related literature, a student researcher is expected to review the researchers conducted in his area of study. Such review will enable the researcher to discover what has been done and what needs to be done. In other words, the researcher looks for existing gap in knowledge. It is likely possible to discover that not all the review of the related literature yields a gap it is likely to discover that one's researcher problem has already been solved by another research, in this case there is no need of continuing with the research problem unless the researcher decides to replicate the study for the sake of confirmation of certain research findings or change some research settings. The arrow in Figure between Review of related literature, identification and definition of research problem shows that when there is no gap in literature review, the researcher has to go back to research problem stage. At this stage, he or she either modifies the research problem or choose a new one.

Research questions and hypothesis

Research questions are derived from research problem. Continuing with the earlier research problem stated above, the research can form research questions such as, what are the causes of student violence on campus? There could be many causes of student's violence on campus. At this juncture, a student researcher has to make an intelligence guess, a term that is often referred to as hypothesis. To make intelligence

guess one can say the students' violence on campus increases as the intensity and scope of relative deprivation among them increase. This statement is the hypothesis of the research problem.

Research design

There are many types of research designs open to a student researcher. He or she can choose experimental or non-experimental design depending design on the nature of the research problem.

Data collection

The main instruments for data collection in social, science and education are questionnaire interview, observation record and achievement test.

Data analysis

The data collected from instruments are analysed with different statistical tools such as mean, median, mode, Spearman Rank Order Correlation, t-test, etc.

Drawing conclusion

Drawing conclusion implies generalizations based on the result of statistical analysis of the data. If in a certain study to find the effectiveness of a new drug, it has been discovered that there is significant difference between the mean scores of the experìmen1 group and the control group then, the researcher can go ahead to conclude that such drug does not cause the relief of the subjects in the sample. In other words, the drug is not effective.

Writing research report

This is a stage where the researcher documents all the research activities from research problem to the conclusion for onward transmission to the authorities or the organization concerned. It should be noted that the format of research report varies slightly from one organization to another.

Types of Research

Normally, scientific research is classified based on either purpose or method of investigation. Scientific research can be further classified into funeral purpose and specific purpose. In this section, we shall look at each of the classes.

Classification based on Method

Classification of research based on method yields to two broad classes; the experimental and non-experimental research. Each of these classes is further classified into sub-classes. These types of researches will be dealt with in chapters 12,13 and 14 respectively.

Classification based on general purpose

Classification based on general purpose is applicable to basic and applied research.

- **Basic research**

Basic research (sometimes called pure or fundamental research) is concerned with the formulation or refinement of theory. Faraday's law of electromagnetic induction was as a result basic research conducted by Michael Faraday. Basic research may also be concerned about increasing our understanding of fundamental principles. For example, our understanding of genetics and heredity is as a result of the basic research conducted for the purpose of increasing our understanding natural phenomena. Basic research is curiosity driven and therefore, it h not normally conducted to solve immediate problems. However, its findings may have future applicability.

- **Applied research**

Applied research in contrast, is geared toward solving immediate problems. The findings of the research can be used to solve practical problems. Note that using the

findings of applied research to solve immediate practical problems indirectly contributes to knowledge or theory refinement.

Similarly, it is possible to use the findings of basic research to Solve immediate problems. We therefore, see basic and applied researches as end points on a continuum.

Below are some types of applied research.

- **Action research**

This is a research aimed at solving local problems. In teaching profession for example, an educator can conduct an action research in the area of instructional practices.

- **Evaluation research**

Evaluation research concerned with things like evaluation of programmes System or interventions. The findings of the research are used for the improvement of programmes or Systems. it was the accumulated evaluation research findings of the 65-2-3 system, for example, that led to the introduction of 6.-3-3-4 system of education.

Classification based on specific purpose

Scientific research is sometimes classified based on specific purpose. In this case, the research can be basic or applied. The emphasis is on specific purpose. Under this class we have descriptive, exploratory historical, predictive and control research, but we shall focus on descriptive, exploratory, and explanatory researches.

- **Descriptive research**

Descriptive research concerns about observing and describing a phenomenon. Sometimes it involves specifying a phenomenon in addition to observing and describing it. Descriptive research is not concerned about establishing cause and effect relations, neither does it involve generalization.

- **Exploratory research**

Exploratory research involves the exploration of the dimensions of phenomenon how it manifests, and its relation to other factors. Exploratory researches are mainly carried out in new area or new research topics.

- **Explanatory research**

Explanatory research concerns the provision of the underlying causes of a certain phenomenon. Question like what are the factors responsible for homosexuality is related to explanatory research.

Research and social sciences

One of the aims of research in Natural sciences is to establish casual laws that enable scientists to explain and predict natural phenomena. The laws of nature discovered by natural scientists through scientific researchers are still valid today. These include laws of reflection of light (see section 2.6) and laws of electromagnetic induction to mention but a few. It should be noted that Natural scientists separate themselves (subjects) from the objects (things to be researched) during their research process

A group of social scientists under the label, positivists adopt the assumptions and methods of natural sciences in their study of objects. Their aim is to produce social laws that govern human behaviour. Such idea was rejected by another group of social scientists known as interpretivists who prefer methods such as unstructured interview and observation because they uncover the meaning behind an action and emphasize validity. Such methods (qualitative research) attempt to see the social world through the eyes of the people who inhabit it by studying their everyday life or by letting those being studied speak for themselves (Chapman, 2001).

It is clear that the social world we study is changing rapidly. Do we continue to uphold the assumptions and the methods of natural scientists in the face of this rapid change? Natural scientists separate themselves (subject) from the objects during research. But in the case of social scientists, they are part of the objects being

researched studied. In other words, the subject is not separated from the object. Consequently, our values, assumptions and identities affect the data we collect. Smith (2002) reported.

> *When we study the family, education or culture, we are part of those things, for we live, think and communicate within them. Social science has to wrestle with the problem of human beings creating explanations about themselves and their society when they are part and parcel of that society. Even when social scientists think about and describe their theories and finding they USO words, analogies and metalloids whose meanings are tied to the society of which there are a part".*

These numerous challenges prompted Smith (2003) to raise the following questions.

- Should social scientists look for the assumptions and the methods developed by the natural sciences or developed their own assumptions and methods?
- Do the objects which we study in the social science such as self, society1 the economy, ideology or democracy really exist or are they convenient fictions we have grown to trust?
- Can social life be reduced to simplified relations where it is possible to say that X may be related to or cause Y, or is the everyday social life more complex than this?
- Is it possible for social scientists to bridge the gap between attempts to build general explanations that hold good across a range of similar situations and attempts to understand the complexity of one concrete situation?

Research and Education

The purpose of education is to develop the knowledge, skill, or character of students. The process of developing knowled9, skill and character of students involves

infrastructure, people and issues. The people involved are learners, teachers, parents1 school heads, community and society in general. By infrastructure we mean instructional materials and school buildings. Issues embrace curriculum, instructional methods, teacher's qualification and behaviours, students' learning difficulties, leadership styles of school heads, language of instruction, supervision, and government, among others. Each of the factors mentioned contribute to the failure of our educational system.

It is on record that our educational system ¡s beset with problems ranging from teaching and learning. How do we go about solving the problems? Learn attempt to solve these problems, Educators and Educationists in the past followed different approaches. Some ran to authorities for solution of their educational problems. Some use experience while others use logic reasoning. Some have good teaching personalities, Others have unusually good students, and still others teach under a typically favourable condition. Gephart and Ingle (1969) stated that;

> *A time-honored method employed by many successful teachers is to examine their own practices, to abstract what seems to turn the basis for further success, and to advocate that those practices be universally emulated. The weaknesses of this approach are obvious. The claimed success of those teachers is rarely verified by objective means; the factors to which success is attributed are merely subjective. Impressions that have not been objectively identified or measured and for which no control data is available as a basis for comparison are often successful for entirely different reasons than those of alleged superior methodology.*

None of these approaches produce objective knowledge that will lead to the solution of Educational problems. For avoidance of doubt, let us take an example of using experience as an approach in the improvement of pedagogy.

To remedy these shortcomings, some teachers have conducted various classroom experiments, but since the vast majority of those experiments failed to control relevant variables (ie significant characteristics of the experimental population, of the proposed method of the teacher of the school environment) because they did not utilize reliable measuring instrument and nor subject the results to test of statistical significance, they contribute little to the science of pedagogy.

Education would not progress with only the use of authority, experience and logic reasoning in solving educational problems. Educators have so far adopted scientific method in solving their educational problems. Which led to educational research. Educational research according to Nkpa (1997) "is a systematic inquiry into the educative process'. To Mouly (1978) educational research is a systematic and scholarly early effort designed to provide educators with more effective means of attaining worthwhile educational goals. The types of researches described in section 3,4 also exist in educational forms.

Review Questions

1. (a)What is scientific research? .

(b) With the aid of a flow chart describe the major stages in scientific research.

2 Distinguish between the following pairs of researches

(i) Basic and applied research

(ii) Exploratory and descriptive research

(iii) Descriptive and explanatory research

3 Distinguish between social science and educational research

4 Why it is difficult to establish causal laws in social science?

5. Mention two disadvantages of having a researcher as part of the social objects being studied.

References

Gephart J.W and Ingie, R.B (1969). Educational research. Columbus: Merrill Publishing Company.

Maduabum M. A. (2004). Fundamentals of educational research Owerri; Versatile Printers.

Mouy, G. J. (1978). Educational research; the art and science investigation, Ibadan: University Press Ltd.

Nkpa, N. (1997). Educational research for modern scholars. Enugu: Fourth dimension Publishing co Ltd.

Polit, F and Hungler, P. (1995). Nursing research; principle and methods Pennsylvania: J.B Lippinco

CHAPTER TWO

WRITING A PROPOSAL FOR FUNDING

Objectives

The intend to chapter to:

1. state the objectives of writing a proposal for funding;
2. state the objectives of the writer for the funding;
3. state the objectives of the funding agency;
4. identify the problems of writing proposals for funding;
5. explain the techniques of writing proposals for funding;
6. explain the format for writing proposals for funding; and
7. describe how to develop a proposal.

Introduction

Scholars and students use to experience nightmare in writing proposals to various organisations, parastatals, governments, foundations, and other bodies interested in funding research and non- research projects that contribute to development in various fields of endeavour such as education, science, humanities, medicine, agriculture, business, politics, women affairs, and so on. One hidden information ¡s that proposals for funding are competitive, the number of competitors are not known, and every competitor thinks that his proposal is the best. Fund for funding proposals is limited and the bias of the funding agencies is influencing. While some proposals may stray into luck in form of gambling, some may actually justify being funded. Therefore, there are certain features or characteristics of the latter that will justify such support.

Another major worry in writing proposals for funding bothers on the doubt and lack of confidence by the researcher as the writing begins. That is, many writers have passed judgments of failure on themselves even before making a trial. This may affect the quality of the proposal. Poor training ¡n research may also be a factor while inability to write creatively and organise one's thoughts in such a way that others could understand may also be an obstacle or hindrance. What we are saying here is that, there are many educators or researchers that have good ideas but do not know how to put them down. It is therefore, necessary to painstakingly master the techniques of writing a proposal for funding as described below:

Objectives of Writing a Proposal for Funding:

There are two major categories of intentions or objectives or missions of writing the proposal for funding. The two categories are:

1. objectives of the writer; and
2. objectives of the funding agency.

Objectives of the Writer

The writer may have the following objectives in writing a proposal for funding:

(a) Anxiety in making contributions to the solution of an endemic problem limiting development for which the researchers expertise in his field could make some impact. In many cases, such proposals are never solicited for but the writer has to sell it to a suspected funding agency.

(b) Eagerness to make oneself relevant among intellectual colleagues or to have a permanent record of achievement in a field and be recognized as an authority. In most cases, this is a very difficult task as funding agencies will want to use one's past records of achievement in the field to judge the

proposal. In this case, a well-prepared curriculum vitae is an important attachment to the proposal.

(c) Intention of improving the financial status of the writer. This creates more fear in the writer than the above two objectives because he is not sure whether he will succeed or not, or whether his costing will be too high or too low to win support for funding.

2. Objectives of the Funding Agency

(a) A funding agency may have a mission of contributing to development in specific fields and therefore, invites proposals for funding ¡n specific areas. Such areas are usually listed broadly to give room to researchers to exhibit their competence.

(b) A funding agency may want to assist certain nations or communities to solve their social, economic, educational, health and other problems, and therefore, invites proposals from people in that area or region in the relevant fields for funding. Guidelines are usually given.

(c) Some funding agencies may want to use the result of their activities to attract more fund from some donors and therefore, request for proposals whose results could serve this purpose.

Problems of Writing Proposals for Funding

Educators and researchers encounter some problems in writing proposals for funding. These include:

1. Inability to Identify Appropriate Funding Agency Directly in their Field. In most cases, they tend to respond to requests for proposals for funding by any agency they heard of, such as UNESCO, UNICEF, UNDP, ADB, WRAPA and so on. Most of these funding agencies have their goals, their areas of

interests, target audience, and specific problems they want to solve. For example, Environmental Protection Agency (EPA) may invite proposals for funding in area of environment. Every researcher may feel that he is competent to apply and therefore, tends tilt his proposal from his field of study to environment, not knowing that the assessors for the funding agency will discover the loopholes that would make the proposal irrelevant.

2. Some Researchers Find it very Uncomfortable to Participate in a Group Proposal Though they may have more Expertise in Developing the Proposal: Proposal for funding may involve a network, bringing together many researchers in different fields who make contributions towards solving an identified problem. Proposals that incorporate a network may be more favourable than a proposal written by a single expert.
3. Some researchers may not be able to identify appropriate costs or cost items for their proposals: They may tend towards their personal comfort, that is, allocating high costs to materials like vehicles, accommodation, honorarium, fueling and repairs, with little cost to items that are directly needed in the laboratory or field for achieving research results. Funding agencies are not technically interested in allocating too much money to items of comfort in research work.
4. Problem of time scheduling: A funding agency will not want its research work to be delayed because the agency has a purpose for the result of the research which it holds personal. 1f a researcher's time scheduling is judged inadequate for the plan of the proposal presented, his proposal may not be taken seriously. For example, if a research involves a trial experiment which could last for about three seasons or of four months duration in agriculture but the researcher states that the result will cover a twelve-month period, a specialist in that area will mock the researcher because there may be only One Suitable season for

the trial test ¡n a year. Therefore, the researcher requires three years for the study. But if the researcher is competent in the field, he may do the trial test horizontally instead of vertically.

5. Timing of the Proposal: many researchers use to delay writing their proposals till near the expiration date. They feel complacent at first thinking that they still have a lot of lime ahead to write the proposal. But when it ¡s a few weeks or days to the expiration date of the proposal, they now rush. This may lead to making a lot of errors or mistakes that could make the proposal to fail. At times, the proposal may not reach its destination on time.
6. A proposal for funding may require input from other experts to help the writer build up a good proposal for funding. For the fear of hijacking the work a researcher may hide his write-up from other experts that could modify his work, though his work may be full of mistakes. The proposal may fail because of this deviation.
7. In proposal writing for funding, it is necessary to know the extent to which other researchers have gone in finding solutions to the problem so as to know from where to start addressing the problem. The writer may not be aware that the funding agency has more current information on the problem to which they have invited proposals, and therefore may not be willing to fund a proposal that have been covered by previous work. It is, therefore, necessary for any researcher or educator writing a Proposal for funding to limit herself to competence and recency or join with others for better background of the problem.

Techniques of Writing Proposals for Funding

There are certain things to be considered before writing a proposal for funding.

1. For advertised proposals through newspapers, magazines or handbills, the researcher should note the following:
    (a) the objective of the funding agency that is inviting the proposal;
    (b) the outline given by the funding agency for requesting for information; It will be noted that some funding agencies are not interested in reading volumes. Therefore, they want applicants to be precise, direct to the point and in good research language.
    (c) the closing date for the submission of the proposal;
    (d) the area field of interest of the funding agency; and
    (e) other required information that may be supportive of the application such as letter of recommendation to attest to the character of the researcher or expressing permission of the researcher to undertake the investigation.
2. For non-advertised proposals, ¡t will be useful if the researcher will obtain information on previous funded works of the agency. This will provide the information on the acceptance of the proposal by funding the agency. The document may guide the writing of the new proposal.

Format for Writing Proposals for Funding

If proposals are not solicited for by funding agencies, the researcher could use the conventional format.

Conventional Format for Writing Proposals for Funding Research Projects Include:

- Title of the proposal or project.
- Background
- Problem statement

- Purpose/objectives
- Research questions/hypotheses
- Significance/importance
- Review of literature (brief)
- Methodology of investigation.
    - Design
    - Population sample
    - Instrumentation/experimentation
    - Data collection and analysis.
    - Duration of time (PERT) analysis
    - Detailed cost analysis of the project.

Conventional Format for Writing Proposals for Non-Research Projects Include:

- Title of the proposal or project
- Problem statement
- Effects of the problem
- Analysis of the effects of the problem
- Justification of the project
- Objectives of the project
- Methodology of accomplishing the objectives of the project.
- Cost analysis of the project
- Time schedule

Developing a Proposal-What to Do

In developing a proposal for funding, the following steps should be followed:

1. study carefully the general request of the funding agency, some of which may be in different major areas;
2. search your library or collections or visit nearby libraries to look for information on any of the areas you feel you could handle well'
3. study the format given by the funding agency carefully and familiarize yourself with them. You may wish to do further reading if you have forgotten some of the concepts;
4. view yourself as one of many writers who will apply for the fund and assume that many people may tend to write on certain favourable aspects more than you. This assumption should strengthen you more to work harder in order to get your proposal funded;
5. do not force yourself to write on a particular area in which you doubt your competence simply because you assume that many people will not write in that area and therefore, your own may be one of the few that will compete and so win. It does not usually follow;
6. assemble the materials you obtain either from the library or other collections on the topic;
7. fix the materials into the format. Where materials are limiting, don't feel shy in asking for assistance from others. If no format is provided, you can use the conventional format;
8. write in good technical research language. If you have forgotten, please consult any recent research textbook and write up or consult an expert in research for guidelines;
9. start your writing early, keep the draft for about two weeks and revisit it with the sponsors' outline by your side for purpose of comparison that you are doing what you are requested to do;

10. your budget must be realistic and specific. Don't be selfish by putting high cost on your comfort. You are not the owner of the money and therefore, sponsors are not ready to give you gifts like that without justifiable results;
11. prepare a time schedule which will be realistic. Mere saying that the research will take 6 to 9 months is not enough. Your time schedule should be activity-based and therefore, you can use any of the Operations Research Models such as PERT/Network Analysis which specifies the different activities to be carried on particular days indicating your critical path;
12. if you observe that a research proposal will be better written by more than one specialist, though not mentioned in the advert, please don't hesitate to do so. The team work may help your proposal;
13. type your proposal on the format indicated and be careful not to exceed the required length. If you cannot avoid exceeding the length, let the other information you want to present be in the appendix; and
14. mail your proposal with the most secured mailing system not minding the cost.

Other considerations in developing a proposal include:

educators and researchers should not assume that they are competent in writing proposals for funding. They should always study hard for it, and continue to familiarize themselves with journals, magazines, bulletins in their specialised fields. membership of relevant associations is very useful. Attendance at conferences, seminars, and workshops is very relevant to quality proposal writing.

Conclusion

A good proposal for funding that is acceptable and funded usually brings happiness to the proposal writer. It improves his image and gives the writer the confidence of academic excellence. It is necessary therefore, for any proposal writer to avail him or herself of the critical study of the issues raised in this chapter and practice how to avoid the negative ones while internalizing the positive aspects.

A good proposal is as good as a good research work, if the proposal writer follows judiciously the content of the proposal during implementation.

Review Questions

1. If you or a friend has written a research proposal and succeeded in getting it funded, list some of the issues raised in this chapter that you think helped the writer get it funded. If the writer got it funded, guess some of the issues you think the writer had not complied with. Improve on the proposal that failed using the information in this chapter and then compare.
2. Write an unsolicited research proposal in an area of your competence using the guidelines provided in this chapter.
3. Write a non-solicited project proposal for funding to an organization not interested in research but in a project development or workshop, using the guidelines provided in this chapter. Note that the outlines have been provided for you.

CHAPTER THREE

FINDING A RESEARCH TOPIC

Objectives

The chapter intends to:

1. explain how to begin the search;
2. state how to locate your passion;
3. explain how to find something from your past experience;
4. explain the overview of the research process; and
5. describe how to talk to experts in your area of interest.

Where do you begin the search?

How do you decide on what topic to conduct your research? Outside the confines of academia, the research topic or the issue is chosen for you a client or your boss asks you to provide an answer to a problem the organization is interested in solving. For example, a company specializing in the design, manufacture and distribution of table fashions in a country wanted to diversify its market. They have recently begun marketing bath towels. The question was how to expand the business especially into health clubs and spas. A young intern was given the challenge and was asked find out how big the potential market was and what kinds of towels were used. An oil company planning a new pipeline may wish to know the environmental and social impacts of the project on the communities through which the pipeline would pass. A local government council about to introduce a new tax may want to know the reaction of the people to such a measure. In all these situations, there is an issue or question that the client wants to answer. It is the nature of the question that determines everything else about the research: the wording of the topic, the types of literature that are included in the review, the types of data that are gathered the types

of analyses that are performed and the nature of the report that is written. Everything has to be appropriate to the question and geared towards accomplishing one thing: providing an answer to the question.

How can this situation be applied in the context of a student learning how to carry out research? Who is the client? In this case, the student is expected come up with an issue or topic. The situation of the student is similar to that of a concerned member of the public who has over the years observed a problem and wants to find. An answer to it. For example, he may have noticed that the spring from which the community gets its water is now getting dried up by end of January. He remembered that when he was a child, the spring supplied water all year round; therefore he wonders why it is now drying up by the end of January? Or he wonders why their market is no longer thriving while the market in the next village is thriving and attracting more participants. All these are questions which he is Interested In. He could of course employ a consultant to conduct the research and provide him the answers, but he has no money. He may decide that research is useless and will just make his own conclusion without any research. On the other hand, he may decide to do some investigation and find out the answers. In the case of thriving market in the next village, he may visit the market and observe how it is organized what is being sold; how the security of the market is organized and so on. He may talk to some of the visitors to the market to find out why they like coming to that market. Then he will come back to his own village market and carry out the same activity. At the end, he will compare what he found out from the study of the two markets. Everything else being equal, he can then conclude that the differences he found in the setup of the other market as compared to with his village market account for the success of the other market.

In the example given, the researcher is also the client. This situation is very similar to that of students carrying out their projects. They are both clients and researches. They need to come up with a topic and then set UP the research procedure conduct the research, write up their findings and subit to the department for assessment.

The area should be an area that the student finds interesting. Of course for it to be a valid topic in the Department of Geography your area of Interest has to be geographical orientation. This is also applicable to other disciplines. For the purpose of the projects, the topic must have relevance to the examining discipline.

Fortunately, the field of geography is quite wide. Geography at one time was considered the queen of sciences. It was the fundamental discipline around which all other fields of study revolved. Consider the range of issues that you could be interested in. They would include among other areas; aspects of economics, politics sociology environment, geology, climate, history, and biology. What would make the study specifically geographical? It should be spatial orientation. Geography is a discipline concerned with space and its use. Thus, we are not only interested in mineralogy but its patterns and consequences of those patterns. We are not just interested in sociological phenomena but how these impact the landscape and so on.

Locate your passion

The first question you need to answer is what do you feel passionate about? It could be a phenomenon that is threatening your community. For example in parts of Idomaland, the fragile nature of the soil has resulted in massive erosion that is threatening farmlands and human settlements. What is the true nature of this threat; can it be averted or ameliorated'? In Southern Tiv for example, what used to be a yam growing area is rapidly becoming a cassava growing area. Why is this so? What are the implications of these on the environment and economy, or population? Why

are certain stretches of road in Makurdi seemingly always in a state of disrepair? Where do children in the city play? There seems to be playgrounds in certain parts of the city, are they being patronized? By whom and why are the parks patronized? Who were they originally Intended for? My point is this; there are problems everywhere that need to be Investigated, the main thing Is what are you Interested. It Is Important that you have a personal Interest in the issue, because that interest will spur you on as YOU study the problem. Not only that, you will have the satisfaction of finding an answer to something that you have always wondered about.

But what if nothing researchable comes to your mind? What If it seems there is no area or theme or subject matter that grabs your attention or interest? All is not lost. Perhaps the problem is you have not read enough about the topic or have not been observant of your surroundings or you have not been paying attention to things taking place around you. All or any of those may be true, but that is no reason to panic. Whatever your situation you can move forward to a successful outcome within the time available. There are many ways to "bell" the research cat. Meekyaa (1992)1 lists a number of ideas that have been found useful over the years. These include:

Keeping your antenna up for "chance encounters"

Chance encounters come in various ways: you may discover a potential topic for investigation while reading an article or articles on the subject or a related area. This article could be in a magazine, a newspaper or a journal. Our newspapers are full of researchable ideas. One activity we are good at is finding problems that those in authority are expected to work on. Some of these can be turned into research projects. For example, The Guardian of Tuesday of October 29 had this piece on its editorial page, the short opinions several reasons (hypotheses?) were put forward as explanations to the chaotic traffic in the metropolis. These included; indiscipline of

drivers, the worsening state of roads, and street trading, inadequate number of market stalls, unwillingness of traders to utilize new markets they consider not strategically located, corrupt practices by council officials and so on. The editorial identifies certain streets and locations as being particularly problematic. It also outlines the domino effect of congestion along one arterial route on others. What he calls, "the spifi over effect". It even proffers solutions. None of the statements are backed by data: it is all a matter of conjecture. This presents an opportunity for the researcher; can the assertions made by the author of the opinion piece be supported by facts? Are there other factors that the casual observer has missed? How realistic are the proffered solutions? Do they help solve the problem or make matters worse? These things can be found out by a well-positioned research. But there is another extension. The opinion piece though not supported by data; can be used as a staging post for research into similar problems elsewhere. Does street trading occur in Makurdi? If it does, what are the consequences of such activities on movement in the city or any of a number of other activities? Street trading is a form of hawking. Are there other hawking behaviours in the Makurdi area that could be investigated? All these possibilities arise %from reading the opinion piece in the newspaper.

Find something from your past experience.

Experience is built upon what you have observed or gone through in the past. Perhaps as you were growing up or over the last several years, there was something you noticed In your community. This too can be possibly turned Into a researchable topic. Let me illustrate. My ancestral village is TseGyuse. It is located In Ute district of Vandetkya Local Government Area. However I never grew up there. My father was a school teacher and we were often transferred. There was however a constant in the life of the children, especially during holidays. This W5 the pilgrimage to the village. Over the years from 1955 I have noticed the following changes. In the fifties,

the 1at mile to the homestead, which also included the primary school and church, the road went through dense woodlands.

How do I remember this? I recall my anxiety traversing that portion especially when I was alone. When I could ride a bicycle, I will stand and pedal furiously as If chased by the wind. Today, there are no trees not to talk about the forested area of my childhood. The area around the old homestead is not alone In this change, the forest around the hospital and DRCM/CRC Mission Station at Mbaakon has virtually disappeared; the mighty Tse-Mker forest, which had stories of huge snakes, Is gone. What has caused these forests to disappear? Such an observation could become the stimulus for a research into deforestation or changing patterns of land use.

But that Is not all. In those days, Mbaakon was the main Christian Centre for all of Southern Tiv. Eveiy three months or so, people came from as far away as Aku In Ushongo LOA, Abwa near Obudu and Adlkpo In Kwaflde LOA. Traversing the short cuts, which also meant bush paths, we came across many large streams. Some were so deep that log bridges were built across them. I remember the log bridges because I was too scared to walk across them. More often than not I traversed them on the back of an older person, nearly choking them to death with a panic grip. Most of those streams are now shallow all year round.

Box 1: Street Trading and Lagos Traffic

Apart from the legendary indiscipline of drivers and the worsening state of roads, street trading is a major cause of the chaotic traffic situation in the Lagos area. The phonon of markets bursting beyond their boundaries into the roads is not, of course, a 1906 monopoly. but It Is in this former federal capital that It can be observed at its most destructive. My effort to achieve a successful, long-term solution to the Lagos traffic crisis must take this factor into account.

A first step in this process would be to take an Inventory of the areas in the metropolis where street trading disrupts traffic the most This would mean virtually every part of the metropolis. But some areas are worse than others. Oshodies an especially bad case. Not only are the roads in the bustling local council impassable at all times, the rail lines have been taken over by street traders whose activities have contributed in no small measure to the foul and grim environment on the Lagos Island. Nnamdi AzrJwe and other roads adjoining the Balogun and Idumota market have been conscripted into the market, at the expense of human and vehicular moveme1t. The Oyingbo area is not better off. Everywhere, the situation is the same: street traders, both mobile and sedentary are holding traffic hostage.

The consequences are easy to see. Hundreds of millions of naira in man-hours and productivity are lost every year due to the traffic crisis caused by street trading. For Instance, to avoid the snarls caused by traders who have taken over the Idurnota. Tinubu and Carter Bridge (Areas), motorists divert to Eko Bridge. This results in more snarls. More recently there has been a rise in the activities of robbers and who take advantage of the chaotic condition of the traffic jams caused by the traders to wreak havoc.

Since the problem is constitutionally the responsibility of the local govemm6flt councils, the search for solution must begin at that level of governance. In 1905, most local councils have environmental task forces. Unfortunately, they have not been able to cope with the sheer number of traders on the streets. For a more effective solution, the fundamental causes must be kept in mind. These include Inadequate of market spaces in some areas, lack of control and regulation by council officials who are in the habit of collecting illegal tolls and bribes from the traders and the refusal of traders to move into new markets when they are available, ostensibly because these places are not easily accessible to their “customers”. For instance the traders

have largely ignored new Oko Oba market for this reason. This is not acceptable. The health, safety and convenience of society at large, rather than the selfish interest of a group. Should be the priority of policy at every level. The councils should employ every legitimate means to control the activities of these traders. If they cannot cope, perhaps the state governments can take overall or part of this responsibility and pass the costs to the councils.

Finally, increasing Incidence of street trading and the failure of various measures to stamp it out speak volumes about the hustling culture, which has taken, over the nation. At this point, poverty is a major cause of this but it is by no means the only cause. At heart of this phenomenon is Indiscipline. We are simply not used to obey'fl9 rules. Confronting this fundamental fact must be a part of any successful effort to stamp out the menace of street trading.

Where has all the water gone? Is there a connection between the fact that the forest and woodlands are disappearing and the loss of flow in the streams? I am sure you have noticed similar changes in your communities as well. There are now settlements where only a few years ago, there were none. What started these settlements and what sustains them? Some settlements have started and then died, why? Why there is so much rubbish on the streets of our large settlement How come some locations are seemingly always congested with traffic? Once OU have identified something like that, search in the literature to see if anyone has already studied the problem or a similar one. You do not want to dub other peoples work. There is a word for such activities, stealing. In more refined language it will be called plagiarism. Lawyers will call it theft of intellectual property and can sue you to court. In the department, you may just get a nice round zero for not doing your project.

Talking to experts in the area of your interest

Communicate with experts in the field or your area of Interested. There is hardly an area you would be interested in that there is no one except you. An expert is not someone who knows everything about a subject. For your purpose, an expert is anyone who knows more about the subject matter than you do. It could be a senior student, or a lecturer hi the department or a lecturer in another department, a senior professional in the public service, parastatal or private sector or someone who may be resident in another university or town. Essentially, you open a guided dialogue with them with the intent of finding out areas that have not been studied, which you could begin to investigate. Sometimes such ideas may come in the course of a lecture or class assignment.

Doing a general review of the literature

Use reference work and existing literature. This is one of the most fertile areas of search. Most research reports are include in the conclusion areas for further Investigation. You can look to see if such is an area you may wish to investigate. In some cases, you may find a study you want to replicate in a new area.

Overview of the research process

Perhaps this is as good as placing what to give an overview of the research process. A flowchart can be found in Meekyaa (1992) and a list in probably any text or article dealing with research methods. The general stages in the research process are:

1. Identify a **problem** and define It.
2. Depending on the research design, formulate **hypotheses** and/or simply state the aims and objectives of the study
3. Based on the hypotheses alms and objectives, identify the specific **data needs** and decide on how the data will be collected.

4. **Collect** the data needed. This would include samplings surveying as appropriate
5. **Analyze** the data using appropriate analytical techniques.
6. Prepare and present a **report** of the research in an appropriate format.
7. **Review** and **implement** the report

Notice the constant repetition of the word appropriate. Everything that is done must relate to the stated problem and the aims and objectives of the research. Research is not about writing volumes; it is about solving a problem. George (2002) provides an even more detailed sequence of activities more suitable to survey research. The steps include:

1. define **objectives** as well as data gathering strategies;
2. identify key **questions;**
3. design the **survey instruments** and method of observation;
4. choose **sample type and size;**
5. choose **units** to be sampled;
6. **pre-test** the survey **instrument** as well as anticipated analytical procedures;
7. **redesign** survey **instrument** if necessary;
8. **administer** survey;
9. **code and** edit survey results;
10. **analyze** the results;
11. **interpret** the results; and
12. **write** the report.

Perhaps this is good place as to introduce, in summary form, how scientists study phenomena. This approach is sometimes referred to as the Scientific Method. Scientists in general terms collect data relevant to a problem; analyze the data and

from this analysis they make inferences about the phenomenon they are studying. Science is not about finding the ultimate solutions or answer to a problem. True scientists are more humble than that. Scientific investigations are aimed at reducing uncertainty. Even though it is possible to read in the newspapers or some popular press that science has "proved" something, science never proves anything: it simply tries constantly to find explanations on how things work in the natural world. This Is Important as we approach research. More often than not, all our project can do is to remove a little of the uncertainty concerning the phenomenon under study. Future studies would remove a little or shed more light. When sufficient light has been shed, we may end up with a scientific principle or law.

The method used by scientists may be summarized into five steps.

1. First there is recognition of a question or unsolved problem in the natural world. Once a problem is recognized, you try to find out as much as possible what has already been known about the problem. You find out by reading what has already been researched and reported on the matter. This is what is referred to as reviewing the literature. Thus, you can see that reviewing the literature is an integral part of the problem definition. You cannot say that you have a problem or have defined It until you know all that has been done and reported about the problem. Then, you can know precisely what aspect or aspects of the observed problem are still unknown and therefore need studying.
2. Once the first step has been accomplished, scientists make an educated guess to explain the problem. This educated guess is what is called a hypothesis. A hypothesis must satisfy at least two conditions; first it must be valid and secondly it should be useful. It should tell you something worth knowing that you want to know about. It should make a prediction such that It is possible

to go to the field and test the prediction. Thus, the more verifiable a hypothesis, the more valid It is.

3. Scientists then design and perform an experiment (or study) to test the hypothesis. An experiment is the careful gathering of data. This could be from observation or from taking measurements in the field. The objective of experimenting is to reject or disprove as many alternative guesses as necessary such that what is left is the most reasonable explanation.
4. Scientists then analyze and interpret the data they have collected from the experiment. In the analysis, the key questions asked are: does the data agree with the predictions made by the hypothesis? If not, does the hypothesis need to be modified or should the hypotheses be rejected.
5. The final stage In the method used by scientists is sharing the findings. This is the report, which may take the form of a monograph, a book, a journal article, a newspaper story or a conference paper. The objective of reporting is to allow colleagues read and comment on the work. There should be sufficient Information given such that the experiment can be replicated.

Box 2 why do research?

The obvious answer for a student in an academic environment is that research is required for graduation from the institution. This would however be an inadequate reason to get involved in an enterprise of such complexity and expense. Perhaps, this explains why many students rather than carrying out research, prefer to copy (shall I say steal?) what others have done. Perhaps this also explains in part why those who do not copy other people's work nevertheless lock themselves into a format of research production rather than adopt a spirit of enquiry. Research has many benefits not least of which are the following:

1. Research helps you understand far better the materials you are studying. By involving yourself in the search for new knowledge, you place yourself on the leading edge. You begin to better understand how the information you may be reading comes to be compiled. In that understanding, you gain appreciation for knowledge.
2. You learn how the development of new knowledge depends on the kinds of questions that are being asked. Without asking questions, there are no enquiries. What would have happened if the explorers did not question the flat earth theories? We would have ignorantly continued to believe that if you go sailing off on the seas, you will eventually drop off the edge of the earth. Without getting embroiled in the debate about evolution; think of all that we know today about the earth because Darwin asked some questions concerning the origin of the species? Where questions are not asked, the people soon become slaves of tradition and superstition.
3. Research also prepares you for advanced work ¡n your chosen field. Research never stops. The longer you stay in the field the more your thirst for new knowledge.

There are I am sure many other reasons that can be advanced for research. You are denying yourself a great adventure if your focus Is simply to get an academic grade from your research work. For sure, getting a good grade is important, but it should never be the primary focus. As a matter of fact, experience suggests that you actually get a better grade in your research project by focusing on the research project rather than on the grade. The good grade becomes a wonderful reward for quality focused work on your project.

Box 3: Your Role of a Researcher

Watching students relate to their project supervisors there seems to be a certain amount of stress. I have observed that students keep going back and forth bringing items of their work to the supervisor as if a supervisor being. When one student was asked she said she wanted the supervisor to approve the work before she Will proceed to the next aspect. This is rather poor attitude. It makes the project work into a pointless boring drill, with the teacher as the drill sergeant and the student the recruit Booth. Colomb and Williams (1995) put words to the attitude when they write concerning the students' perspective thus:

Teacher, I know so much less than you who will give me a grade. So my o is to show you how much information I dug up, and yours is to decide if! Have found enough.

This is not the role of a researcher; it is that of a sycophantic acolyte. As a researcher, your role (believe it or not) should be that of someone who is knowledgeable. You should see yourself as the teacher and your supervisor the learner. As a researcher you should have something new and fresh that should interest the reader (your supervisor).

Booth, Colomb and Williams (1995) suggest that this relationship can be established when you as a researcher do more than present the reader (your supervisor in the first instance) a record of well-known facts. They further suggest three possible relationships that could be adopted.

1. You have found something Interesting that you want to share. So the first question you need to deal with how much interest you have in your finding. How much enthusiasm can you muster as you present it? If you yourself are not excited about your findings why should anyone else be?

2. You have found a solution to a practical problem that is important to your readers. This may not be applicable to all types of research. But consider that someone has found a cure for AIDS. That would be big news. Everyone would want to read about it. On a local scale maybe you have found a cheap way to stop building from Makurdi developing cracks.
3. You have found an answer a question that ¡s important to the reader. This is the usual stance of scholarly research. In scholarly research each researcher tiles to answer questions that are at the moment confronting the research community.

As you can see, research is not just compiling known facts; it is finding solutions to problems that are of interest to people in the community. We need therefore to be sure that we have them in mind as we select topics, make them into research problems, Investigate and report them.

Review Questions

1. State the meaning of research methodology.
2. State the importance of research method.
3. Discuss in details why we carry out research.
4. Discuss the roles that a researcher plays in carrying out a research.

CHAPTER FOUR

RESEARCH METHODS

Objectives

The chapter intends to:

1. state clearly the research design suitable for a study;
2. describe the procedure for data collection;
3. explain sample and sampling techniques involved in research;
4. differentiate between population and sample;
5. state the appropriate instrument suitable for a research; and
6. state the types of instruments used in a research.

Meaning

This is the third chapter of a research report and the last chapter in a research proposal. There seems to be no agreement in the captioning of the chapter. While some academic departments adopt ‘Research Methodology’ others adopt ‘Research Methods’ without a convincing justification for any of the choices. This has often generated heated debates most of which ended up not resolving the controversy.

Evidence from literature on the meanings of and the differences between the two concepts, reveal that research methods are the various procedures, schemes, steps, etc. used in research. All the methods used by a researcher during a research study are termed research methods. They are essentially planned, scientific and value neutra1? They include theoretical Procedures, experimental studies, numerical Schemes, statistical approaches, etc. Research methods help in directing samples selection, data collection and analysis all of that lead to arriving at the solution to the problem of a study.

On the other hand, research methodology is a science of studying how research is to be carried out. Essentially, the procedures by which researchers go about their work of describing, explaining and predicting phenomena are called research methodology. It is simply the study of methods by which knowledge is gained. Like

Biology, Geology, Meteorology, etc. research methodology is science, and thus a defined area of study that focused on "describing, explaining and predicting phenomena" i.e. the study of methods that emphasize how research is carried out.

As the aim in the presentations in chapter three of a research report/proposal is to describe the general procedures to be adopted in collecting data through which the problem of the study could be addressed, the appropriate title for chapter three should be Research Methods.

The Importance of the Research Methods

Research methods is about the most crucial aspect of both a research proposal and report because it is here that the feasibility of the plans for actualizing the purpose of the study are clearly spelt out and presented in unambiguous terms. As a method or procedure chapter, the practicability of the various dimensions of theoretical knowledge of research is demonstrated in the chapter. This explains the rationale behind the practice of first subjecting a research project to presentation and defense of the project proposal before a team through which its worthiness or otherwise for a specified programme or funding is determined by research based institutions and funding agencies.

This therefore, calls for the need for carefulness in avoiding possible sources of mistakes capable of masking the feasibility of a proposed study in the course of writing and presenting information in this section.

The various sections of this chapter and errors often encountered therein are:

Design of the study

Design simply means a plan for carrying out a task. Research design is the plan, structure and strategy of investigation conceived so as to obtain answers to research questions through which the problem of the study could be addressed. Research designs specify the methods and procedures for acquiring the information needed to structure and solve the research problem. The overall operational design for a research project stipulates what information is to be collected, from what sources, and by what procedures. A good research design ensures that the information obtained is relevant to the research problem, and that it is collected by objective and economical procedures.

There are different types of conventional research designs and the selection of which design to adopt for a study depends on the nature of the problem of the study. Each of the designs has distinct qualities that enhance valid data collection if appropriately chosen and applied. It is important to be cautious in choosing and Presenting a design for a study as this influences meaningful understanding of all other aspects of the study. What determines the choice of a design include, among others, the following:

- the purpose of the study;
- the nature of the phenomenon - Is it feasible to collect the data, and if so, would it be valid/reliable?
- the reliability of the information of date;
- the ethical nature of the study;
- the cost of the design; and
- the availability of current scientific theory and literature on the topic.

In other words, flaws in presenting designs impair effective communication of subsequent sections of the research report/proposal. Some of such flaws are:

Choice of Inappropriate Designs

Sometimes, inappropriate research designs are chosen, perhaps, as a result of inadequate knowledge of the meanings and conditions for use of different types design. For instance, a study which focus is to ascertain the influence of socio-cultural factors on verbal ability of a group of students(casual comparative design) ought not have a similar design with one examining the status of availability of language laboratory in the schools in a given locality(descriptive survey design). In other words, casual comparative research design cannot be used in place of descriptive survey design. This is a serious error capable of leading to collection of invalid data for the study.

A way out of this error is for the researcher to make adequate consultation of good research methods textbook or relevant journals or report of already completed research with a view to reading and meaningfully understanding of the meaning and the appropriate conditions under which the design is used. In addition, it is recommended that a proposed design be presented and thoroughly discussed in a discussion among a study group of classmates or colleagues or a superior researcher.

Use of broad designs

Some of the conventional research designs are broad in nature. In other words, there are designs under which are subsumed some other specific sub-designs each with some peculiar characterization. Examples of such broad designs are survey design, experimental design, quasi-experimental design etc.

It is a common practice for some researchers to present the design of their studies by just mentioning the broad design of their choice without specifying the sub-design to be adopted.

None justification of choice of design

A research design for a study is not chosen arbitrarily. A research design is presented arbitrarily when a researcher merely names a design as the one to be adopted in the study without explaining or justifying why the design is chosen. This practice is a wrong approach as it could mean that the researcher does not have firm knowledge of the direction of the research and therefore lacks control of the methods of the study.

Choice of research design should be appropriately justified by first defining the design from a good and known literature source, citing the source and using the relevant variables of the study to describe how the study fits into chosen conventional design.

Area of study

An 'area' as a word generally means a geographical location. In research, area of study implies the geographical entity in which the target population of the study is located. It is presented immediately after the design of the study and before the population of the study.

In presenting the area of study, it is recommended that the broad location of the population of the study is first specified then a brief description of the distribution of other subunits of the area of study within the broad one. For instance, in education research study in which the target population is secondary school science teachers that are located in Nsukka local government, the area of study should be presented as follows:

> *The area of Study is Nsukka local government in Enugu state. In Nsukka local government there are x number of secondary schools in which science subjects are taught.*

Area of the study is presented in a precise and unambiguous terms. It does not need to include all the geographical technical terms used in delineation of area in a map such as the longitude and latitude measured in degrees North, South, East and West. Other common lapses encountered in some presentations of the area of study that should be avoided are:

- infusion of area of study in the scope of the study;
- presentation of the location of the researcher by at the time of conducting the study; and
- inclusion of description of the population of the study.

Population of the study

The population of a study is the large collection of individuals or objects known to have similar characteristics that is the main focus of a study. It is the defined group that is studied or generates data through which the problem of the study is addressed. In most cases, population of a study is domiciled within the area of the study. In presenting this subtheme, it is important to be cautious so as to minimize the following identified errors:

Vague delineation

There are cases in which researchers merely state the population of the study without attempting to define and delineate it. For instance, for a study on the "Survey of the availability of Science Equipment in Enugu state secondary schools", stating the population as science teachers in Enugu state secondary schools is improper. This is because, even though Science teachers in Enugu state secondary schools use the science equipment, the presentation of population as shown typifies vague delineation of the population. But because the Source of the data for the study is the

science equipment and the results of the study will have direct implication on it, science equipment is the appropriate population of the study and should be so stated.

Arbitrary choice of population

Populations of some studies are at times so arbitrarily chosen that it serves no purpose in generating the needed data for the study. This situation arises often when the choice and presentation of a population of such studies may have been arbitrarily chosen. In order to ensure the appropriateness of choice of a population, its accessibility and appropriateness, in providing the data for the study should be considered and clearly justified.

Suppressed Information on the Population

A common omission in the presentation of population of studies is failure to specify the relevant characteristics of the population in terms of size, grouping and according to relevant independent variables in the study. The specification of these elements at this stage facilitates the sampling process more meaningfully.

Sample and Sampling Technique

A sample is a smaller group that is drawn from a larger group (i.e. population) and the method of drawing this smaller group out of the larger group is the sampling technique. This section is a combined section in one and therefore the presentations in this section should reflect these two dimensions. The presentation of sample and that of the sampling technique has been identified with flaws some of which are:

Silence on Sample Size

In the presentation of this section, it is recommended that the sample size be stated and followed by the detailed discussion on the methods used in drawing the sample. In several cases, this is not done as some researchers often end up presenting the

methods of sampling without any mention of the number of elements of the population to be used as the sample i.e. the sample size.

Choice of Inappropriate Sampling Technique

There have been cases in which inappropriate sampling techniques are chosen and reported, perhaps due to poor knowledge of the conditions for the use of the various sampling techniques. This underscores the need for researchers to, thoroughly; consult relevant resource materials on research methods with a view to familiarizing themselves with the various sampling methods and the conditions under which each can be appropriately applied. This could also be followed up with discussion of the choice of the proposed sampling methods with other colleagues and/or senior researchers.

Failure to Justify the Chosen Sampling Technique

A typical recurrent error in this section is the choice and presentation of a sampling technique, out of a poor of several others, without justifying its appropriateness to the study. For instance, purposive sampling is one technique that is often chosen by many researchers without explaining the justification for its choice. Its choice must always be justified in addition to stating the conditions for the purposiveness i.e. the Coalitions for any element of the population to qualify for inclusion in the sample. In the same manner, the choice of stratified sampling technique must be followed by justification of the reason for the choice in addition to specifying and justifying the stratification frame. Some of the sampling techniques have specific errors that are peculiar with their presentation. These include:

Simple Random Sampling this is constitutes error if chosen Often chosen without stating whether it is any of use of dice, table of random numbers, balloting etc.

Stratified Random Sampling: failure to specify whether it is proportionate or disproportionate random sampling.

Proportionate Random Sampling: omitting to clearly state the (i) sampling frames (ii) proportion of the sample to be drawn from each stratum and the rationale for the choice of proportion

Purposive Sampling: failure to state the criteria of purposiveness i.e. the qualifying characteristics of the elements of the population to be drawn into the sample.

Instrument for Data Collection

Iii this section, information on the instrument i.e. the tool or device for collection and collation of the data/information to be used in addressing the research questions are presented. In doing this vital information regarding the instrument are omitted some of which are:

The Type of the Instrument

Most of the time, information regarding how the entire instrument for a study was sourced is lacking in the presentation. An instrument is sourced for a study through any of the following:

A Researcher Development of Own Original Instrument

When a researcher originates and develops a new instrument based n the specific requirement of the on-going study without direct reference to any other installment earlier developed for another study, Such an instrument is said to be researcher developed and Should be so reported.

Adaptation of Instrument

When an instrument earlier developed for a another study is altered or modified in any form with a view to the it meeting the demands of an on-going research and when used as such, the instrument is said to have been adapted. In reporting an adapted instrument details of all the modifications effected in the original instrument should be clearly specified and justified.

Adoption

Adoption is a process in which an instrument earlier developed for another study is used in the on-going one without alteration in any form. Details on the process of development for researcher-developed, adapted and adopted instruments, are often either entirely omitted or partially reported. For some instruments such as achievement test that have conventional procedures for their development, every stage in the development process has to be reported. For other types of instrument such details concerning its physical features such as the number of section, subsections (if any) and the number of items in each section/sub-sections and the response format for each of the different types of items have to be stated.

Validation of Instrument

In this section, some researchers only state that validation was carried out without a comprehensive account of the type of validity established. The justification for the choice and the detailed process of validation are also expected to be presented.

Useful information regarding which of the validity among face, content, construct, predictive etc must be established and the justification for the choice based on the peculiar nature of the study have to be presented. Also, the comprehensive account of the process of establishing the chosen type of validity has to be shown. Examples

of types of instrument and conditions requiring the establishment of some of these types of validity are as shown below:

S/no	Type of validity	Condition	Example of Instrument
1	Face	Applicable in all conditions	AU types instrument
2	Content	When developed from a specified and known task area tests e.g. Syllabus	Achievement tests
3	Construct	When measuring an abstract concept such as personality traits e.g. attitude, anxiety etc.	Interest Inventory
4	Predictive	When an instrument is to be used in estimating future behavior or task	JAMB or common entrance examination instruments

Trial or Pilot Testing of the Instrument

The process of administering an instrument to a small number of respondents deemed parallel to the intended subjects of the study with a view to ascertaining the suitability of the items in the instrument to the target respondents is referred to as trial or pilot testing. In addition, scores generated from the trial testing of the instrument are also used in estimating the reliability of the instrument. Some of the lapses often observed in the reporting of this sub-section are:

Omission of the Section

There are some researchers who, either completely omit reporting this sub-section or submerge it under the presentation of validation of the instrument.

Inappropriate Titling

Pilot study that is known as the process of carrying out a preliminary study before going through the entire research procedure with a small sample and reporting its findings is at times used as a caption for trial testing or pilot testing of the instrument. This is misleading.

Omission of Vital Information

Some important information in the presentation of this section such as the number of subjects used, the source of the subjects, average time taken to complete the testing and the reaction of the subjects to the instrument are often omitted.

Review Questions

1. Discuss in detail the research design, types of design and the errors that one can encounter in the choice of a research design.
2. Explain the type of sampling techniques and the implications of choosing an inappropriate technique in a research.
3. Distinguish between population and sample.
4. Explain area of study.

CHAPTER FIVE

THE MAIL QUESTIONNAIRE

Objectives

The chapter intends to:

1. define questionnaire;
2. state the type of questionnaire in research;
3. explain how a questionnaire can be constructed;
4. state the characteristics of a good questionnaire;
5. identify the advantages and disadvantages of a questionnaire; and
6. explain the validity and reliability of a questionnaire.

Introduction

Survey testing represents the most systematic research programme conducted in most West African colleges and universities. The proper interpretation of the results of survey testing requires considerable background in the field of tests and measurements, especially from the standpoint of the validity of the instruments used in the particular situation.

The questionnaire is, perhaps, the most used and the most abused survey instrument. Too often, it is used to provide a pooling of ignorance in situations where only an experimental method can provide a meaningful answer.

The Nature of Questionnaires

Questionnaire really constitutes the first attempts at true scaling. They are particularly advantageous whenever the sample size is large enough to make it uneconomical for reasons of time or funds to observe or interview every subject. Questionnaires do not, however, cause the test condition to become standardized,

particularly ¡n mailing. Perhaps the greatest difficulty with questionnaires that are distributed ° the subjects is the probable bias which exists when less than the total number In the sample actually responds.

THE FORM OF QUESTIONNAIRE

The questionnaire is often divided into two part. The first part normally is a classification section. The section requires such details of the respondent as sex, age marital status, occupation. The second part possesses the questions relating to the subject- matter of the inquiry. Usually, the answers given in the second first part can be analyzed according to the information in the first part.

DESIGNING THE QUESTIONNAIRE

The first step in designing a questionnaire is to define the problem to be tackled by the Survey and hence to decide on which questions to ask. The tendency is always to cover too much, to ask everything that might turn out to be interesting. This inclination must be resisted. Lengthy, rambling questionnaires are demoralizing for the respondent and generally should be no longer than is absolutely necessary.

The following list gives some principal points in designing questionnaires:

1. *The number of questions should be kept at a minimum:* A researcher must first carefully review the main prob1en of the study to make certain that he knows precisely what questions should be asked in the survey in order to solve the problems. Do not include any question if it has no significant value to the study. Too many questions will reduce the respondent’s enthusiasm to answer them.

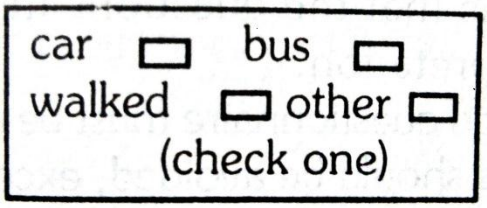
2. *Questions should be short and clear:* The human mind is capable of holding at one time only a limited amount of facts. The longer a question is the harder it is to understand A respondent will have less chance to misinterpret the question and a greater chance to give a correct answer if a question is short and clear.
3. Offensive questions should be avoided. Offensive questions should be carefully avoided. A respondent not be cooperative if offensive questions are asked. For example, questions concerning an individual s private life and those of a confidential nature should not be included. If this type of question must be asked, it should be asked in such a way that the respondent knows that it will be kept confidential and that no personal offence is purposely involved.
4. *Influential or leading questions should not be used.* This type of question will influence the thoughts of a respondent and thus a true answer may not be obtained. For example, one may ask: Do you like our cement more than others? This question is leading the respondent to give an answer, because a respondent will not have adequate opportunity to express his own preference. A more objective type of question may obtain more meaningful answers. The above question may be asked in a different way: "Which brand of cement do you like best?" A respondent may now give one of the names of the competitive brands, which will give more valuable information to the survey.
5. *Questions should be easy to answer.* Questions should be designed to find facts that respondents are expected to be able to give. Questions requiring reasoning or special knowledge in order to be answered correctly should be avoided. For example, questions designed to ascertain why a certain product is better or poorer than the product of another brand are difficult to answer. Some persons may not have knowledge of both products. A respondent may

guess a reason because he has to give a quick answer. This type of answer is obviously meaningless.

6. Questions should require simple answers When the answers are in simplified form, they can be easily recorded and organised. The best type of question is the one that can be answered by either "yes or no". For example, in a shopping survey for a retail store in a city, one may ask: Did you buy anything in this store today? Yes \No (please check).

If a yes-or-no type of question is not satisfactory in a given Study, the multiple choice type, including all possible answers and checking space for each answers may be used. For example, in the shopping survey, the second question may red 'Did you come to the city by car or bus?' If the question is answered with yes or 'no", the answer is meaningless. Furthermore, there are other transportation means which should be considered. It would be better if the question is framed in this way:

How did you come to the city?



Note the question, "How often during the last month have you shopped in this city?" It would be better to provide multiple choice answers to accompany the question. Consider the fol1ong form for providing the answers:

Never	
1 to 3 times	
4 to 6 times	
7 to 9 times	
10 and above	

Otherwise, the answer from the respondents may vary greatly such as "one or two ", "about a dozen times", every Saturday", "once a week", "last time, two months ago", "every often", "not too Often, etc,

Before a large-scale survey is begun, a good practice is to test the drafted questions with a small group of persons who are representative of the population being surveyed. The pretest will give opportunities to discover any oversight in the draft, to improve the final form of the questionnaires, and to gain some valuable experience in interview technique so that a better result can be obtained.

CHARACTERISTICS OF A GOOD QUESTIONNAIRE

Desirable qualities of a good questionnaire appear to be a matter of common sense. Designing questionnaires is one of the most difficult tasks of an investigator. A pilot survey carried out prior to actual survey almost invariably leads to modifications and improvements in questionnaire. The following are the common characteristics of a good questionnaire. A good questionnaire :

1. should not be ambiguous, this means that the questions must be capable of only one interpretation;
2. must be easily understood, technical terms should be avoided, except where the questionnaire is meant for specialists;
3. must not contain words with vague meaning;
4. should not require calculations;
5. should not require the respondents to decide upon classification;
6. should not be in such a form that the answers will be biased;
7. should cover the exact object of the inquiry; and
8. should not be too long.

ADVANTAGES AND DISADVANTAGES OF THE QUESTIONNAIRE

The choice of the questionnaire in preference to other survey techniques is generally a matter of weighing its advantage and disadvantages against those of the interview, with which it is most nearly interchangeable. Some writers insist that the term "mailed questionnaires" should be used to distinguish the questionnaires that are mailed and used as guide in interviewing. The discussion that follows will be oriented on the basis of the usual criteria of validity, reliability and usability.

Among the major advantages of the mail questionnaire are:

1. it permits wide coverage for a minimum expense both in money and effort. It affords not only wider geographical coverage than any other technique but it reaches individuals who are normally difficult to contact.
2. Particularly when it does not call for a signature or other means of identification the questionnaires may, because of its greater impersonal what? elicit more candid and more objective replies.
3. The questionnaire also permits more considered answers. In an interview, if the respondent does not have information, he may still give an answer rather than admit his ignorance.
4. The questionnaire is more adequate in situations in which the respondent has to check his information.

   The questionnaire possesses the following disadvantages:

   1. The main questionnaire does not permit the investigator to note apparent reluctance or evasiveness of his respondent. For instance, matter which is better handled through the interview. Similarly, the questionnaire does not permit the investigator to follow through or misunderstood questions or evasive answers.

2. The advantages of the questionnaire are more obvious than its disadvantages, and, consequently, it frequently appeals to the amateur who uses it for all purposes regard of its suitability and without sufficient awareness of its semi hidden weaknesses and limitations The major weakness of the questionnaire is undoubtedly that of non-returns.
3. Another major disadvantage of the questionnaire is the possibility of misinterpretation of the questions. This danger is increased when the questions are ambiguous because of improper formulation or because of the differential meaning of words associated with differences in socio-economic .and cultural status.
4. Furthermore, the validity of questionnaire data depends in a crucial way, on the ability and the willingness of the respondent to provide the information requested.
5. Finally, the questionnaire frequently does not provide the researcher with sufficient opportunity for developing interest on the part of the respondent, nor does it allow him to develop the rapport necessary to permit him to ask questions of a personal or embarrassing nature.

OPEN AND CLOSED QUESTIONS

The relative merits of open and dosed questions have been the subject of a good deal of research and debate. In an open question, the respondent is given freedom to decide the aspect, detail and length of his answer. Closed question, on the other hand, helps to keep the questionnaire to a reasonable length and thus, encourage response and validity in terms of the representativeness of the returns. Open questions enable the respondent to give a more adequate presentation of a particular case. The open questionnaire possesses greater flexibility which may or may not be desirable. it

allows the respondent more leeway in stating his position1 which may be the, equivalent to saying that it allows for greater validity On the other hand, it increases the risk of misinterpretation. For example, the answer? in response to the question about a person's present occupation introduces greater confusion in interpretation than would listing clearly defined occupational levels for the respondent to chose. The closed questionnaire with its alternatives structures the concept under study and minimizes the risk of misinterpretation. It permits easier tabulation and interpretation by the instigator On the negative side, the alternative may well provide the respondent who does not have an answer with an alternative that he can check whether it applies significantly in his case or not.

In a closed questionnaire, it is essential to allow for possible answers, that is, the categories provided must be both exhaustive and mutually exclusive. This frequently requires adding an extra category asking for "other - please specify" for the respondent who does not find any of the alternatives provided particularly suitable.

The question of whether to the open or the closed questionnaire can be resolved only on the basis of the usual criteria of validity, reliability, and usability, and in as much as most of the problems to be covered in the social sciences are varied and complex, a combination of the two is generally better than the exclusive use of one. Each has its merits and demerits, it is a matter of using the proper one for the proper purpose. The questionnaire generally makes for greater coverage and more systematic tabulation. On the contrary, there may be the need for the respondent to clarify his position with regard to some of the items, and it is generally advisable to include an open question or two for any general reaction or comment at the end of each major section of the closed questionnaire. Neither the open nor the closed questionnaire is particularly effective for probing into a problem. When such a purpose is

contemplated, the possibility of relying on the interview particularly of the depth variety, should be considered

The exact manner in which the respondent is to indicate his answers to a closed questionnaire depends largely on the individual questions. Certain questions can be answered by yes and no, but most answers dealing with complex aspects of a problem are not that clear-cut. The use of a five-point scale, such as "Strongly Agree", "Agree", "Undecided". "Disagree", "Strongly Disagree". frequently elicits more valid responses and is less frustrating to the respondent who wants to be truthful.

Whenever the respondent is asked to rate certain items he should be given specific directions as to the number of items he should check, for example, the three most important reasons. This will facilitate compatibility in the tabulation of the responses. If the directions simply call for "check your favourite games", the research would not be able to equate the responses of the individual who checks only one game with those of the person who has checked a large number in which he has varying degrees of interest. To some extent, greater uniformity and, possibly, validity might be obtained by instructing the respondent to rate his favourite games in a 1-2-3 order.

A number of guiding principles and suggestions have been given for the designing of questionnaires. These principles should be considered in terms of scientific data-gathering rather than considered as factors peculiar to the questionnaire. The fundamental task is to provide a vehicle which will permit the respondent to indicate his answer truthfully and which encourages him to do so. More specifically, the problem is one of devising an instrument of maximum validity and reliability, capable of obtaining the information relevant to the given topic.

THE VALIDATION OF QUESTIONNAIRE

The actual validation of a questionnaire utilises the same principles and procedures as the validation of any instrument of tests and measurements. At the most elementary level, it is necessary for the questionnaire to have face validity. This means that each question must be related to the topic under investigation; there must be an adequate coverage of the overall topic; the questions must be clear and unambiguous; and on. A more adequate validation, however, requires checking the responses which the questionnaire elicits against an external criterion For example, factual questions about age and educational background can be checked against the records. On the other hand, it is somewhat more difficult to locate an adequate criterion for questions of opinion and attitudes A possible solution is to follow the questionnaire with an interview of a sample of the respondents to see whether their responses to the questionnaire actually represent their views on the subjects discussed.

In certain cases, it is possible to validate questionnaire responses against actual behaviour. However, a respondent may be willing to divulge his feelings in response to a questionnaire item and yet suppress such feelings in his behaviour in a face-to-face contact. Establishing validity is even more complicated in open questionnaires where the interpretation of the responses constitutes an added source of unreliability and invalidity. In some instances, the greater flexibility of the open questionnaire may promote greater validity in the responses, but it also increases the possibility of invalidity of tabulation.

It has been found that-requiring signatures in answering questions ¡n surveys tends to inhibit honesty and frankness. However, for certain questions, requiring signatures will not make any difference. For certain general questions as “Have you had a course in Latin?” and “Did you belong to the dancing club of your high

school?" may not introduce any bias, but it should be borne in mind that there should be no all-inclusive generalization 'that the identification of the respondent is irrelevant from the standpoint of the validity of his responses. Requiring signatures when sensitive questions are involved does inhibits honesty and frankness in filling out the questionnaire.

The validity of a questionnaire must be established before its use. Validation is an aspect of a questionnaire (deve1op) and not of its use in the solution of the problem. Invalidity must be emphasized, not restricted to the instrument itself. It can also result from systematic errors in coding or interpretation or from biased orientation of the directions. '

RELIABILITY OF QUESTIONNAIRE DATA

The re-test technique is the only practical approach to the establishment of the reliability of the questionnaire' a respondent who has completed a questionnaire as part of its standardization, can be asked to complete it again, and his choices can be compared for consistency. This method is not foolproof, since on the retest, the respondent will probably attempt to remember and duplicate his earlier responses rather than answer the questions as he sees them. For this reason, such evidence of consistency can hardly testify the validity of the instrument and is a questionable measure of its reliability.

NON-RETURNS IN MAIL QUESTIONNAIRES

Mail questionnaires are usually plagued by a relatively high percentage of non-returns: many investigations in the literature report returned as low as 20 to 40 percent. On the other hand, some studies have had as high as loo percent return. A follow-up study of the graduands of the Business Education students of the University of Nigeria conducted in 1979, for example, had a 100 percent return. Of

the many factors that promote a high percentage of return, none is of greater importance than the selection of a worthwhile topic and the addressing of the questionnaire to a group for whom the topic has interest and psychological meaning. Most people are not interested in busy work or studies that are not likely to lead anywhere. The investigator should prove the significance of his problem to the satisfaction of the potential respondents. Conversely, while the percentage of retur1is is bound to vary from topic to topic, a low percentage of returns frequently implies a poor choice of topic or of population. It also implies inadequacy in the construction of the questionnaires. These deficiencies can be minimized through a pilot study.

The next most important factor in Promoting a high percentage of return is the follow-up. Usually, there will be quite a few persons who will fail to return the questionnaire on first contact and it is necessary to initiate the means for follow-up of the missing returns. In certain cases, failure to return stems from a direct rejection of the questionnaire. More frequently, it implies nothing more than human preoccupations it is important, therefore, to send out follow-up letters whenever the flow of returns starts to dwindle. A series of following and finally, perhaps a double postcard calling for a brief answer to a shortened version of the questionnaire, or an interview may be necessary to bring the returns to an acceptable level. In sending out follow-up letters, it is wise to include a second copy of the questionnaire in case the respondent has misplaced the first.

It must be borne in mind that numerous follow-ups can be an annoyance to the respondents leading him to refuse to cooperate in future questionnaire studies. It may also cause the respondent to send back results that are completely invalid. Therefore, it is advisable in a follow-up for the researcher to attempt a new approach at 0nvincing the prospective respondent that his response is significant to the

successful completion of the study. It is also advisable for the researcher to offer to mail the results of the study to those respondents who are interested.

OTHER FACTORS

The following are other factors that determine the percentage of returns of mail questionnaires:

1. The Length of the Questionnaires: Generally, the shorter the questionnaire the less demand it makes on the respondents' time, the higher the percentage of returns. The questionnaire should not take more than half an hour of the respondents' time.
2. The Choice of Population: The choice of the population is a vital consideration in determining the extent of response. If the topic is of interest to the respondent, he will take time to fill out the questionnaire. The population needs to be defined in such a way that participation is restricted to those who are interested in the success of the study.
3. The Instrument: Most people tend to assess the adequacy of the study in terms of the quality of the questionnaire. The attractiveness of the format is also conducive to higher returns. It generally pays, from the standpoint of returns, to have the questionnaire printed rather than mimeographed.
4. The Cover Letter: The cover letter or any other means of contacting prospective respondents is also of critical importance to the success of the study, since the researcher cannot rely on his personality to elicit cooperation, but must rely upon printed words to "sell" his study. The cover letter must be brief, courteous, and forceful and also must appeal to the individual so that he will want to cooperate. The letter should be separate from the questionnaire itself, and should be addressed to the respondent by name and title. It should also bear the investigator's name and title and his relation to the study. It

should make particularly clear the purpose and important to the study, if any, and so on. When a student is writing to an authority in the field, the faculty adviser, as a courtesy should also write a letter of sponsorship. The investigator should enclose a self-addressed envelope. Ideally, he should include two copies of his questionnaire so that the respondent will have one for his files.

5. Timing: The timing appears to have an effect on returns. It is perhaps best not to have the questionnaire arrive on a Monday or at the beginning of the year, when most officials are busy. It is also important to avoid sending question during the vacation periods, when most people will be away or during examination periods if the questionnaire is directed to students. The researcher should bear in mind the importance of timing his dispatching of the questionnaire and use discretion in terms of his population.

DEALING WITH NON-RESPONSE

As was discussed earlier, reasons for non-response range all the way from complete refusal or inability to respond to mislaying the questionnaire, forgetfulness and reluctance to take the trouble. Ordinary follow-up methods will recruit their successes for the latter end of this range. As an alternative, interviewers can be sent to all or some of the non-respondents. They can be sent either to the initial non-response group or only to those who did not respond to the follow-up. This procedure will often be ruled out on grounds of expense but it is an excellent way of combining the economy of mail questionnaires with the higher response from interviews.

Follow-up attempts need not necessarily use the entire original questionnaire. Non-respondents can be sent a shorter version of the questionnaire or even a postcard asking for only key items. The replies mas: indicate how different the non-respondents are from the rest. A more sophisticated method is to send one short

questionnaire to one set of non-respondents a different one to a second set and so on. In this way, data covering the entire range of the original might be collected; each part or set of questions being based on a small sample of the non-respondents. One remaining possibility is to use interviewers for that Part of the sample which is expected to have a low response rate, like the less educated or the rural population, and mail questionnaires for the rest. As with any of the methods combining mail questionnaire and interview data, there is the overriding problem of reconciling oral answers with those put down on paper.

It is clear that the mail questionnaire as a data-collecting technique has its advantages and its limitations. Among the former, relative cheapness and speed are the most important. Among the latter the problem of non-response stands out. If the seriousness of this could be satisfactorily overcome, the economics of the method would undoubtedly bring it much more into favour.

EVALUATIVE CRITERIA OF MAIL QUESTIONNAIRE

A number of studies have been reported on the relative adequacy of the questionnaire as a research instrument. Unfortunately, most of the studies have failed to point out that adequacy as used in the contact of mail questionnaire must be spelled out according to the usual criteria of validity, reliability and usability, and further, that validity is a specific concept. A questionnaire may be adequate for obtaining information on family size and yet not adequate for determining student's reactions toward their lectures.

The present consensus is that, as an instrument of science, the questionnaire has potentialities when properly used. However, there is urgent need for the improvement of its quality and for the restriction of its use in situations for which it

is suited. The following criteria may be used as a checklist for evaluating a questionnaire:

1. does it deal with a significant topic, make an important contribution, and is it worthy of professional participation?
2. is the importance of the problem clearly stated in the statement of the problem and in the cover letter?
3. does it seek only the information not available elsewhere?
4. is it as brief as the study of the problem will permit?
5. are the questions objective and relatively free from ambiguity and other invalidating features?
6. Are they questions that may embarrass the respondent or place him on the defensive avoided?
7. are the questions in good psychological order?
8. are the questions arranged so that they can be tabulated and interpreted readily?

Question for Review

1. Outline and discuss the steps which will guide a researcher in designing a questionnaire.
2. What are the characteristics of a good questionnaire?
3. Briefly discuss the merit and demerits of the questionnaire as a research tool.
4. Open questions enable the respondent to give a more adequate presentation of his particular case. Discuss.
5. How does an investigator validate the questionnaire?
6. How would you treat the case of non-returns?
7. What factors contribute to non-response in mail surveys?

8. How would you evaluate the quality of a questionnaire?

References

Ppenheim A. N., Questionnaire Design and Attitude Measurement, New York: Basic Books, 1966.

Madge J., The Tools of Social Science, New York: Doubleday and Co., 1965. 283

Fox D. J.. The Research Process in Education, New York: Holt Rinehart and Winston. 1969

Richardson, S. et al., Interviewing, New York: Basic Books. 1970.

Kornhauser A.. and Rey. P. Sheats, Question Construction and Interview Procedure, New York: Holt. Rinehart and Winston. 1969.

CHAPTER SIX

VARIABLES

Objectives

The chapter intends to :

1. define variable;
2. state types of variable;
3. discuss different types of variable; and
4. discuss the relationship and the importance between two variable; and
5. differentiate between dependent and independent variable.

Introduction

In this chapter, we shall begin with the concept of variable. We will then discuss different types of variables. The chapter ends with discussion of the relationship between the two variables and the importance of such relationship.

Concept of Variable

Imagine that the temperature all over the world is the same and constant. Do we need to measure the temperature of a body or system? Even if we do so, for what reason? Certainly, if temperature is constant, there is no need for its measurement. But in reality temperature changes. As it changes it affects other properties. Since temperature changes affect other properties we can think of investigating the effect of for example, variation of temperature on the volume of a given mass of a gas for example. Imagine also that all people over the world hate "committing suicide". Will there be any theory on suicide. But ¡n reality some people commit suicide while others don't. Hence, there ¡s variation in the issue of suicide among people. If all the parents of students ¡n secondary school have equal socio-economic status, do we

have to conduct research on the effect of socio-economic status of parent on student's academic achievements? But in reality, the social-economic status of parent differs; some parents have higher socio-economic status than others. A researcher wants to find out whether such variation if economic status of parent has an effect on the academic achievement of students.

From the forgoing examples, we see that temperature, attitude and socio-economic status change or vary. For that reason, they are called variables. In fact, it is the changing of variables that give rise to many researches in Natural science, Social science and Education Let us pause and have a simple and comprehensive definition of variable. Labovitz arid hagedorn (1976) defined variable as "a measurable dimension of a Concept or a measurable concept that takes on two or more values, either from one unit to the next or for any unit at different periods of time. Concept of height can be considered as a variable since it can take two or more values. In a class we can have students with the following heights; 1 .4m, 1 .5m, 1 6m and soon.

Categorical and Numerical Variables

Variables can be classified as categorical or numerical. Categorical vanables are those variables that make up a set of attributes that form a category but do not necessarily represent a numerical scale or measure. Variables like religion, ethnic group, sex, and martial status are some of the examples of categorical variables categorical variable can be dichotomous and non-dichotomous. A dichotomous variable has two values. Income is an example of dichotomous variable because can have high and low income. In numerical variables numbers are used to represent each unit of the variable and the numbers carry mathematical meaning (Bloch in seale, 2006). Concepts like time, temperature, and mass are typical examples of numerical variables. Time as a numerical variable can take values like 1 second, 2 seconds) 3 seconds, etc.

Independent and Dependent Variables

Scientific experiment is characterized by measurement of variables. A scientist may decide to study the relationship between two variables. In doing so, he manipulates (changes) one variable and observe whether such manipulation has an effect on the other variable. For example, it is a popular notion among natural scientists (physical scientists) that the more you pulled the two ends of a spring the lower its length. Here, the variable "pull" is called causal variable or Independent Variable and the affected variable "length" is termed as dependent variable (also known as criterion variable). The idea to refer to length as dependent variable stems from the fact that it depends on pull and pull is independent of length.

Extraneous Variable

In natural settings, one, two or more independent variable (s) can affect the value of one dependent variable. If a researcher is interested in the study of the effect of one independent variable on a particular dependent variable, he or she most control (eliminate or not allow to vary) the other variables The other variables to be controlled are called extraneous Variables (or control variables) Suppose that a teacher wants to find the effect of a particular teaching method on the academic performance of his Students. Here, teaching method is the independent variable while the academic performance is the dependent variable. But in teaching situation, there are other independent variables that can affect the academic performance of the students other than teaching methods and should not be allow to vary. These include personality of the teacher, gender of the students, time of the day to the class meet, class size, among a host of others. The above mentioned variables are extraneous variables, as far as the study of effect of teaching method on the academic achievement of students is concerned. Therefore, in order to establish that it is the

teaching method that is responsible for the high performance students, the researcher should control them.

Nnabugwu (2006) refers to extraneous variables as all the other independent variables that comprise the multicausaf nature of human activity and their effects have to be anticipated as far as possible. Extraneous variables are threats to interval validity of research study. Hence, any research design must contain some measures of control of extraneous variable if the researcher is to establish a non-spunous relationship with confidence.

Relationship between Variables

Scientists use the idea of dependent \ independent concepts to establish causal laws. Such laws enable them to predict the behaviour of a system. For example, the length (dependent) and pull (independent) can be use establish a causal law. Such law is known as Hook's law.

Dependent-independent relation also has its roots in social science as well as in management sciences. It is widely accepted among social scientists and alike. The more salary is paid to the workers, the more satisfied they are. In this example, salary is an independent variable while job satisfaction is the dependent variable. The independent variables here predict or explain how the job satisfaction will look like. Hence, independent variables are sometimes called predicators or explanatory variables.

Education as an academic discipline is not left out in the utilization of the concept of dependent – independent variables in explaining phenomena. An Educator for example, may be interested in finding the effects of two teaching methods on the academic achievement of his students, in this case the variable, which is teaching method can be manipulated in order to observe the dependent variable which is the

academic achievement of students. By so doing we can establish causal relation relationship.

- **Moderator and intervening variables** are another types of variables that are basically independent variables. A moderator is a variable that modifies the relationship between independent and dependent variables. How moderator modifies the relationship between two variables can be understood by the following example. Suppose a business outfit decided to introduce the concept of diversity in to the business in order to make more profit. Such training is expected to eliminate conflict and miscommunication among managers. Here "diversity training serves as moderator variable because it modifies the relationship between the diversity (independent variable) and profitability (dependent variable)
- **Intervening variable** (sometimes called intermediary variable on the other hand is the one that is affected by the independent variable which in turn affects the dependent variable. For example, Education makes someone to eat nutritious food that in turn makes him healthier. In this example, the intervening variable, nutritious food is affected by independent variable, the Education which in turn affects the dependent variable, the health status. The relationship between the three Variables is depicted in fig 4.61. Note that if the intervening variable is held constant there will be no relationship between the independent and dependent variables For example, without eating nutritious food one can not say that the more Educated someone is the

healthier he is, after all some uneducated people are healthier than the educated ones.

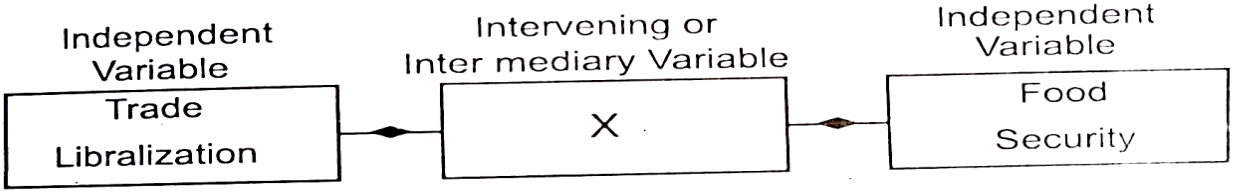


Fig 4.61: show the relationship between Education and Health status.

4.7 Review Questions

1. (a) Define a variable

   (b) Distinguished between independent and dependent variables by giving examples.

2. (a) What is moderator variable?

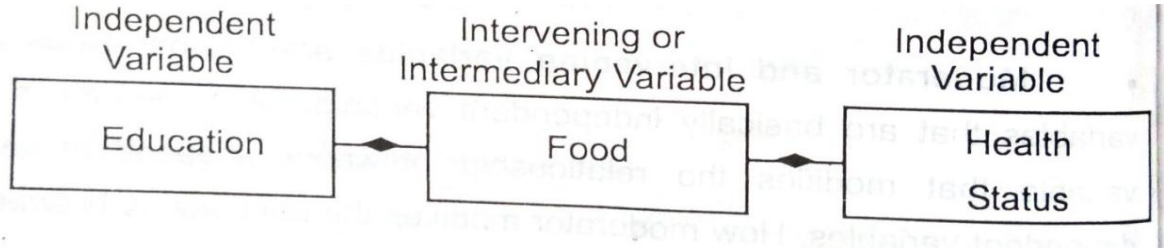
   (b) Write down three examples of moderator variable.

3. Consider the following statement; the more the student teacher relationship the more the academic achievement. The more the guidance and counseling lecture given to final year students in senior secondary schools, the more the academic achievement of students.

   Find out the independent and dependent variables in each of the sentences above.

4. Fig 4.71 shows a simple analytical framework for linking trade reforms and food security. Replace x with any suitable intervening (intermediate) variable.

Fig 4.71 a simple analytical framework for linking trade reforms and food (Adapted from (http://www:fao.Org/DOCREP/°°51'Y467l E/y467 1 E/y467/ef)fl.htm.



5. What is the importance of the control of extraneous variable in a research study?

References

Labouitz, S and Hegedorn, (1976) Introduction to social research. New York: Mcgraw-Hill book company

Seale, C (2006) Doing social surveys. 5earching society and culture. London: sage Publications .

CHAPTER SEVEN

RESEARCH PROBLEM AND QUESTION

Objectives

The chapter intends to:

1. define a research problem;
2. state the sources of research problem;
3. state clearly the statement of the research problem;
4. define research question;
5. state the characteristics of a research problem; and
6. explain how to formulate a research problem.

Introduction

Nothing ¡s more prostrating to a beginning researcher than to discover that his or her chosen research problem or topic is not researchable after going in to some extent in the research work. A choice that does not only was the beginning researcher's time and resources but also his supervisor. Research topic or problem is akin to the foundation of a house where research questions, hypotheses, research design, data collection, analysis, and interpretation of research findings are built on it. Therefore, a wrongly worded or ill-conceived research problem or topic cannot stand a taste of time. Thus, this chapter serves as a guild towards selection of research problem, stating of problem statement and research questions among others.

What is a Research Problem?

Researchers conduct research mainly to provide solutions to problems. So, problem gives rise to research. Hence, it is imperative to know what search problem means before going into research proper. According to Fraenkel and Wallen (2003) "Problem can be anything that a person finds unsatisfactory or unsetting, a difficulty

of some sort, a state of affairs that needs to be changed, anything that is not working as well as it might, involves areas of concern to researcher. Research problems involve condition they want to improve, difficulties they want to eliminate questions for which they seek answers". An increase ¡n suicide rate, increase in rate of kidnapping of people and poor performance of senior secondary school students ¡n external examination to mention but a few are some of the examples of research problems.

Sources of Research Problems

There are many sources of research problems. This section will look at four sources; namely, experience, literature, theory and other sources.

- **Experience**

A researcher can derive a research problem or topic from work experience. For example, a worker may observe a decrease in the production capacity ¡n a company he is working with. If some managers were replaced during the period of the decrease in production, the worker can conduct a research in order to find out whether the reduction in production capacity ¡s as a result of change of some managers. A teacher may observe poor performance of his students in achievement test. He can conduct a research to find out the reasons for such poor performance. These are some of the working experiences that contribute to research problems.

- **Literature**

The bulk of research problems or topics come from literature (journal article, text books, conference reports, workshop reports and theses.) Through the reading of literature, a researcher can come across a number of research problems. A research problem from literature can be from the need for further study, inconsistency of research findings or the need for replication of a certain study for generalizability,

among Others. For example, Allen and her colleagues in Gill and Johnson (2002) conducted a study on changes of marketing manager's attitude air organization down signing Allen and her colleagues suggest further research on the attitude of non-management personnel within different organizational settings. This suggestion can form a research problem or topic Therefore, beginning researchers are encouraged to read text books, article journals, conference reports and other Published materials in their fields widely in order to locate research problems

- **Theory**

Theory arranges set of concepts to define and explain some phenomenon (Silver man in seale, 2006). We have many theories in Education and Sciences. This includes Durkhejm theory of Suicide, Maslow's theory of human motivation, theories of learning, theories of child development theories of counseling theories of demand and supply among a host of others. Each of these theories tries to explain a phenomenon for example, Maslow's (I 954) theory of human motivation states that humans are primarily motivated by the desire to satisfy five Psychological needs. These needs, in order of prepotency are as follow; Physiologi, safety and security, love and belongingness, esteem and self-actualization Maslow (1954) further suggested that the satisfaction of these needs is related to psychological wellbeing. A researcher, after reading these theories can decide to validate any one of the needed categories (eg Esteem) through research. By this way, a theory has become a source of researchers research problem.

- **Other Sources**

A part from experience, literature, and theory there are other sources of research problem. These include research topics obtained through:

- students project supervisor
- research founding bodies

- peers
- Professional conferences

Selection of Research problem

After Brainstorming with peers, reading of literature, recalling of past experiences in place of work and examination of a number of theories of interest, a researcher is likely to come up with an array of competing research problem for topics. How can he or she select only one among these competing ones. Below are some criteria or factors to be considered in final selection of a research problem.

- **Signification of the Problem**

A research study should contribute to the area of policy formulation, improvement of practice and refinement of theory among others. For example, there are many research studies indicating low enrolment of females in Technical Education (Zakarl, 1999). Therefore, a research with research question may aim at finding the percentage of enrolment of female students in technical colleges. Certainly, the finding of the study will help policy makers in addressing such low percentage in enrolment similarly, a research on finding the efficacy of a Particular teaching method will go along way in improving the practice of teaching. A study aimed at confirming the relationship between variables in existing theory is of contribution to the existing body of knowledge. Therefore, such Study is of no significance to humanity. But a study designed with the aim of refining a theory is of immense benefit.

- **Research ability of the Problem**

A researchable problem ¡s the one ¡n which its variables can be defined precisely and measured. It is also the one that has no moral or ethical attachment. A research problem involving finding the effect of prayer on the success of a Business-man is not researchable. It is not researchable in the sense that even if a researcher can define prayer the fact that he cannot measure it renders, the problem not researchable. Another problem that is not amenable to scientific investigation (n. researchable) is the problem that concerns making value judgment. For example, a problem with research question on whether medical doctors should join unions or not ¡s not researchable because there‘s no right or wrong answer. But such question can be modified to become researchable. We can ask: Do younger medical doctors hold more favourable opinions of unionism than older doctors?

- **Feasibility of the Problem**

A problem that is significant and researchable can be considered inappropriate if it is not feasible. Below are some of the factors to be considered whenever a researcher is evaluating the feasibility of research problem.

- **Time:** many of our research studies have deadlines for their completion. Therefore1 a researcher should choose a research problem that will enable him or her to complete the research within a stipulated time.
- **Availability of the subjects:** availability of subjects with the desired characteristics for a research problem is one of the most important considerations to be made before choosing research problem. In a situation where a researcher found desired subjects but unwilling to participate in his research, he can use monetary incentives to attract them.
- **Facilities and Equipment:** it is imperative for a researcher to consider the facilities and Equipment required to execute a certain study before embarking

on it. Any research study that requires certain facilities and Equipment beyond the reach of the researcher should be avoided.

- **Money:** any research problem whose monetary requirement Is beyond the financial capability of the researcher should be discarded.
- **Accessibility:** It is important for a researcher to consider the possibility of getting some information or data before embarking on a research problem. This is necessary in view of the fact that there are certain sensitive documents (g expenditure of a government establishment) that are ot likely to be released to a researcher.
- **Experience of the Researcher:** a begiflfllfl9 researcher should choose a problem that is within his or her knowledge or experience. A problem that will for example, involve development of sophisticated measuring instrument or require Complex statistical analysis should be avoided.
- **Ethical Consideration:** in research context, there are cert guidelines that must not be violated (see chapter 10). A researcher with research questions that are likely to violate these guide lines should be dropped.
- **Interest of the Researcher:** a research problem within the researcher's interest and curiosity sustains the researcher's morale from the beginning to the end of the research. Therefore, a researcher should choose a problem of interest that informed the procedure in which supervisee is allowed to bring some research topics of interest to a supervisor, from which one will be approved for him.

Table 5.41 provides a quick way of evaluating a research problem before selection.

Table 5.41 checklist for testing the feasibility of the research problem (httP://www.petechacza/robe,.+resprobIht)

S/N		YES	NO
1.	Is the problem of current interest? will the research results have social, educational or scientific value?		
2.	Will it be possible to apply the results in practice?		
3.	Does the research contribute to the science of education?		
4.	Will the research lead to new problems and further research?		
5.	Is the research problem important? will you be proud of the result?		
6.	Is there enough scope left within the area of research (field research)?		
7.	Can you find an answer to the problem through, research? Will you be able to handle the research problem?		
8.	Will it be practically possible to undertake the research?		
9.	Will it be possible for another researcher to repeat the research?		
10.	Is the research free of any ethical problems and limitations?		
11.	Will it have any value?		
12.	Do you have the necessary knowledge and skills to do the research? Are you qualified to undertake the research?		
13.	Is the problem important to you and are you motivated to undertake the research?		
14.	Is the research viable in your situation? Do you have enough time and energy to complete the project?		

15.	Do you have the necessary funds for the research?		
16.	Will you be able to complete the research within the time available?		
17.	Do you have access to the administrative, statistics and computer facilities the research necessitates?		
	TOTAL		

Statement of the Research Problem

One of the aims of scientific research is to solve problem. Starting research problem in a written form offers a guide to a researcher designing his study. For statement of research problem to achieve this purpose, it must be stated or written ¡n clear and concise form. Nkpa (1997) suggested the inclusion of the following elements inorder to ensure an adequate problem statement.

(a) Firstly, a problem statement should establish the existing factors whose interaction yields a problematic outcome.

(b) Secondly, it should relate the problem to its educational, scientific, economic, or social antecedents. In doing this, the origin of the problem is traced to its present context so that the reader can appreciate the problem.

(c) Thirdly, the problem statement qualifies the problem in terms of any special circumstances prevailing when the investigation is conducted.

(d) Finally, the significance of the problem should be Justified by the problem statement.

Research problem can be stated in declarative or interrogative form. problem statement in declarative form suggests the manner in which the researcher is seeking to solve the problem while problem statement in interrogative form (question form) invites an answer and helps psychologically to focus the researcher's attention on

the kinds of data that would have to be collected to provide that answer (polit and Hungler, 1995). Below is an extract of problem statement taken from a study conducted by Akiflbobolola and lkitde (2007) on strategies for achieving quality assurance in science education in Akwa Ibom State in Nigeria.

> *The quality of science education is affected by policy and contextual factors within the environment, the availability of inputs, the process and the consumers of the products of science education. The future of any Nation in the modem World depends to a great extent, on the educational system. Low quality teachers and low quality facilities necessarily imply low quality products and low quality performance in the society by such products. Ah (2000) reviews period 1993-2000 and found that it has been falling. He also noted lack of adequate practical experience in schools due to lack of adequate workshops/ laboratories, equipment and instructional materials What are the things or issues that can lead to quality assurance Ifl science*
> *education in Nigeria?*

This is an example of problem statement stated in interrogative form. We can convert this problem statement into declarative form. The conversion is left as an exercise to the reader.

Research Question

For every research problem or topic there must be research question(s) Answer to these research questions lead to the solution of the research problem. For example, a worker in a certain government establishment may observe ineffectiveness in the establishment. Therefore, he can decide to conduct a research to Uncover the causes of the problem of ineffectiveness One of his research questions could be “is the amount of money budgeted for the establishment the same as the amount money

released?" Certainly, the answer of this question and other will lead to the solution to the problem of ineffectiveness of the establishment.

Essential Characteristics of Research Question

Research question must possess certain characteristics if it is to contribute to the solution of research problem. Fraenkel and Wallen (2003) itemized such characteristics.

1. The question is feasible (it can be investigated without an undue amount of time, energy, or money).
2. The question is clear (most people would agree as to what the key words in the question mean).
3. The question is significant (it is worth investigating because it will contribute important knowledge to the human condition.
4. The question is ethical (it will not involve physical or psychological harm or to the natural or social environment of which they are a part).

Formulation of Research Question

One of the key strategies toward formulation of good research questions is to state the objectives or purposes of the study and convert such purposes into research questions. In a study to identity the competence needed by crop farmers in soil Erosion management in Enugu State, Uroko (2009) states the following specific purposes of the study as to find;

1. Competencies needed by crop farmers in tillage and making cross bars.
2. Competencies needed by crop farmers in mulching and cover cropping.
3. Competencies needed by crop farmers in channeling and terracing
4. Competencies needed by strip cropping and contour bonding

The researcher then converted the above specific purposes into research questions as follows;

1. What are the competence improvement needs of crop famers in tillage and cross-bars?
2. What are the competence improvement needs of crop famers in mulching and cover cropping?
3. What are the competence improvement needs of crop famers in channeling and terracing?
4. What are the competence improvement needs of crop famers in contour bund and strip cropping?

It should be that the number of research questions Should not be more or less than that the number of the specific purposes stated. In other words, the number of specific purpose should equal to the number of research questions.

Review Questions

1. (a) What is research problem?
   (b) Mention three examples of research problem.
2. Discuss the various sources of research problems.
3. What criteria should guide a researcher in selecting a good research problem?
4. (a) Select one research problem of your choice
   (b) State three specific purposes for the problem.
   (c) Convert the specific purposes in to research questions.

References

Fraenlek, J. R. and Wallen, N.E (2003). How to deign and Evalu' research Education. New York: Mcgraw-Hill.

Gill, J and Johnson, P (2002). Research methods for managers. Londc Sage Publications.

Maslaw, A.K (1954).motivation and Personality. New York; Row.

Polit, F and Hungler,P (1995) Nursing research: principles and methods. Pennsylvania J. B Lippincott.

Seale, C (2006) Doing social survey. Researching society and cultural. London; Sage Publications.

Uroko, O. R (2008) competency improvement needs of crop farmers in soil erosion management in Enugu State. Unpublished thesis, University of Nigeria Nsukka.

Zakari A(1999). Strategies for improving female enrolment in technical education in department of technical education. Kaduna Polytechnic. Unpublished undergraduate project.

CHAPTER EIGHT

CHARACTERISTICS OF MEASURING INRUMENTS

Objectives

The chapter intends to:

1. define the reliability of research instrument;
2. state the procedures involved in carrying out the reliability of an instrument;
3. explain the different ways of calculating the reliability of research instruments;
4. define the validity of research instrument;
5. explain the procedures involved in carrying out validity of research instrument;
6. state the types of validity in research; and
7. explain the different types of validity in research.

Introduction

In quantitative research, the quantitative data obtained from the instruments are to be analyzed. The result of the analysis determines the research findings. Therefore, inaccurate data may lead to wrong research findings or conclusion about the phenomenon under consideration. Unless certain measures are taken in the construction, administration, and scoring of a measuring Instrument, the conclusion to be drawn about phenomenon is of little value. Hence, this chapter discusses reliability and validity as some of the measures used by researchers to improve the quality of research data.

Reliability of Measuring Research Instrument

Before going directly into Reliability of measuring instruments, we shall first look at the concept of Reliability.

Concept of Reliability

The Reliability of a measuring instrument is the degree of consistency with which it measures the attribute it supposed to be measure. A good measuring scale or instrument is expected to give the same result for repeated measurements of an attribute. An instrument with such quality is said to be reliable. However, it is possible for a scale to give different results for repeated measures of the same attribute. Such a scale is unreliable. Let us take a hypothetical example to illustrate more about the concept of reliability. Suppose that the mass of a student is 70kg. Suppose further that when a spring balance is used to measure the mass of the student for five consecutive times after an interval of one minute each, it was found that the scale read 70,68, 70, 72 and 74kg respectively. We can therefore conclude that such spring balance (scale) is not reliable since it does not give the same measure (70kg) for repeated measure of the same attribute (mass) of the student. But if on the other hand, we obtain 70 kg for each repeated measurements of the mass of the student after each one minute interval, we can say that Such scale is reliable.

Reliability is concerned with consistency of a measuring instrument to give the same result of repeated measurement of the Variable It does not bother about whether the result (same result for repeated measurement) we Obtain is correct or wrong. It is possible for a measuring instrument to be reliable and at the same time faulty. Take an example of a wrong graduated metre rule. Each time such metre rule is used to measure say the length of a table, it gives the same result. The Concern of a researcher is to find out the causes of variation in the same measurement and

minimize them.

Assessment of Reliability of Measuring Instrument

We shall now turn our attention to the assessment of the reliability of measuring instruments. There are several approaches to such assessment. In this subsection, we shall discuss the assessment of reliability of a measuring instrument through the concepts of stability, internal consistency and equivalence.

Stability

The stability of a measuring instrument refers to the extent to which the same results are obtained on repeated administration of the instrument. The assessment of the stability of a measuring instrument can be achieved through test-retest reliability method. In this method, the same test is administered to the same subjects on two different occasions. The two test scores are then correlated to obtain the correlation co-efficient (stability or reliability co-efficient). The numerical value of the correlation co-efficient varies from -1.00 through 0.00 to +1.00. Correlation co efficient running from 0.00 to -1.00 expresses inverse or negative relationship. For the values from O to +1.00 indicate positive relationship. A value of +1.00 indicates perfect relationship. The value of correlation co-efficient in nutshell indicates the magnitude of test stability. The following example will illustrate how correlation coefficient of two tests can be calculated.

Worked example 23.21

Table 23.2.1 shows the test scores of 10 students obtained through test-retest method. Calculate the correlation co-efficient and interpret the value.

Table 23.2.1 Test Retest scores

S/N	**TIME 1(test)**	**TIME 2(Retest)**
1	62	60
2	72	70
3	58	56
4	46	48
5	63	62
6	52	55
7	65	61
8	70	68
9	68	65
10	49	51

Solution

S/N	Time1(X)	lime2(Y)	X2	Y^2	XY
1.	62	60	3844	3600	3720
2.	72	70	5184	4900	5040
3.	58	56	3364	3136	3248
4.	46	48	2116	2304	2208
5.	63	62	3969	3844	3906
6.	52	55	2704	3025	2860
7.	65	61	4255	3721	3965
8.	70	68	4900	4624	4760
9.	68	65	4624	4225	4420.
10.	49	51	2401	2601	2499

The correlation co-efficient (r) is given by

$$r = \frac{N\Sigma VY - \Sigma X\Sigma Y}{\sqrt{(N\Sigma X^2 - (\Sigma X)^2)(N\Sigma Y^2 - (\Sigma Y)^2)}}$$

$$= \frac{10 \times 36626 - 605 \times 596}{\sqrt{(10 \times 37331 - (605)^2)\,(10 \times 35980 - (596)^2)}}$$

$$= \frac{5680}{5778.79} = \quad +0.98$$

The computed value of the coreIatjon co-efficient (or stability co-efficient) was found to be +0.98. This high value indicated that the students that did well in the first test also did well in the second test. Similarly, those students that performed moderately in the first tested performed moderately in the second test. Therefore, the test is highly stable and therefore reliable.

A researcher who obtained a reliability co-efficient of + 0.98 or little below (say + 0.70) after test-retest can go ahead and use his or her test for data collection. But what of a situation where a researcher obtained a co-efficient of reliability of say 0.40? such a value indicates that the instrument is not stable or reliable. At this point, the reader may ask what makes a measuring instrument unreliable? The unreliability of a measuring instrument can be from poor construction or the carelessness of the measurer or the nature of the variable to be measured. Sometimes from the nature of the physical condition surrounding the variable, poorly constructed measuring instrument may Contain wrongly worded questions or ambiguous questions. An ambiguous question for example, can make a respondent to respond to the same question at two different occasions differently (through questioning), thereby making the instrument unreliable. A solution to this problem is to correct the questions that seem to be either wrongly worded or ambiguous. Certainly, such

correction will lead to a higher value of reliability co-efficient. Variation in scoring method can also be a source of unreliability of a measuring instrument. A measurer that uses two different scoring methods in test Retest is likely to have a low value of reliability co-efficient.

Poor Constriction of measuring instrument and variation in scoring method are not the only reasons for unreliability of measuring instruments. Variation of respondent's attitude, behaviour, mood, and physical condition between two tests can also make an instrument unreliable. It is possible for a respondent to develop a headache, anxiety or to be mentally disorganized before the administration of the test and become okay before the administration of Retest. This situation will definitely render the instrument unreliable. What of the additional knowledge gained after the first test?

Another factor responsible for making an instrument unreliable is the memory interference. If the time between the test and retest is made short because of the fear of intervening factors, there is the possibility of the students to remember the question asked in the first test. A situation that makes the instrument unreliable. This will give higher value of reliability co-efficient.

From the foregoing discussions, we see that the co-efficient of reliability using test-retest technique is time-dependent. Time-dependent in the sense that short term retest tends to give higher reliability co-efficient while long- term retest gives low reliability co-efficient. This implies that test Retest technique is only suitable in the measurement of attributes that do not change within short time. These include; personality, abilities and height among others.

Internal Consistency

The scales for the measurement of concepts or variables usually consist of multiple items. Each of these items is expected to measure the same concept. If the answers or responses to these items are highly associated with one another, the scale or instrument is said to be internally consistent or homogeneous. Three of the most widely used techniques in estimating the internal consistency of instrument will be discussed here.

Split half technique

In this technique, the items in a scale are splited into two groups by flipping of a coin, using odd and even numbers or other random assignment methods. A scale with 20 items can be splited into two groups. If we use odd and even numbers, the two group will be 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, and 2, 4 , 6 8, 10, 12, 14, 16, 18, 20 Each group forms 10 test items. The two tests are administered and the scores are then correlated. A high value of correlation co-efficient indicates that the instrument is internally consistent and therefore reliable.

It is clear that the correlation co-efficient to be 0mputed using split half technique will not represent the entire scale. It represents only 10-item instrument, a situation that underestimates the entire correlation coefficient of the 20 item test. To estimate the correlation coefficient of the entire 20-item test, we use Spearman Brown prophecy formula.

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

Where r = the correlation coefficient computed on the split half

r^1 = the estimated reliability of the entire test.

If the computed correlation coefficient of split half testis 0.7, then the estimated reliability for the entire 20 item will be

$$\mathrm{r}^1 = \frac{2r}{1+r}\,\mathrm{r}^1 = \frac{2 \times 0.7}{1+0.7} = 0.82$$

We can now see that split half technique has two initiations over the test-retest technique. These advantages are;

1. The co-efficient of reliability is not affected by time.
2. It is less expensive than test-retest (ie use only One test)

However, split half technique is not without problem. The method of splitting test items into two group can give rise to different reliability co-efficient (correlation co-efficient) for the same test. For example, using odd and even method or flipping of a coin on the same test can give different values of reliability co-efficient. Kuder Richardson formula 20 and 21 and Alpha (cronbach alpha) can solve the problem suffered by half split formula

Kuder - Richardson formula 20

The Kuder - Richardson formula 20 is given by

$$r_{k-R20} = \frac{K}{K-1}\left(1 - \frac{\Sigma \mathrm{pq}}{S^2}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 23.21$$

Where $r_{k\text{-}R20}$ = Estimated Reliability co-efficient

K = number of items in the test

Z = summation of

P = the proportion of the test takers who scored items correctly

q = the proportion of test takes who score items wrongly

S^2 = variance of the test

Worked example 23.21

Suppose in an attempt to establish the reliability of a measuring instrument (achievement test), a researcher randomly selected 10 subjects and administered the following test to them.

1. A triangle has
   A. Two angles B. Five angles C. Three angles D. Four angles
2. A square has
   A. Two angles B. Three angles C. Four angles D. Five angles
3. A Box has
   A. Two sides B. Three sides C. Four sides D. Six sides
4. The total angles of any triangle add upto
   A. 30° B. 90° C. 1000 D. 1800
5. The total angles of a square add upto
   A. 360° B. 900 C. 180° D. 50°

Suppose further that after scoring the subjects, the researcher came up with the following results.

Question number	**Number of subjects answered the questions correctly**	**Number of subjects answered the question wrongly**
1	8	2
2	9	1
3	8	2
4	7	3
5	6	4

Subjects	1	2	3	4	5	6	7	8	9	10
Score/ Marks	4	8	7	6	8	6	9	7	10	8

Find out whether the researcher's test is reliable

Solution

Calculation of pq .

From the first table, the proportion of subjects that answered question 1 corre

$$(P_1) = \frac{8}{10} = 0.8$$

The Proportion of subjects that answered the same question wrongly

$$(q_1) = \frac{2}{10} = 0.2$$

Note that we can also get 0.2 by subtracting 0.8 from I (je 1-0.8=0.2) Using the same procedure,

$P_2 = 0.9$ $q_2 = 0.1$

$P_3 = 0.8$ $q_3 = 0.2$

$P_4 = 0.7$ $q_4 = 0.3$

$P_5 = 0.6$ $q_5 = 0.4$

$P_1 q_1$, = 0.8x0.2=0.16

$P_2 q_2$ = 0.9x0.1 =0.09

$P_3 q_3$ = 0.8x 0.2 = 0.16

$P_4 q_4$ = 0.7 x 0.3 =0.21

$P_5\, q_5$ = 0.6x0.4=O.24

= 0.8600

Calculation of S^2

Score (X)	**X2**
4	16
8	64
7	49
6	36
8	64
6	36

$$S^2 = \frac{\Sigma X^2 - (\Sigma X)^2}{(n-1)}$$

$$= \frac{555 - \frac{(73)^2}{10}}{(10-1)}$$

$$= 2.9$$

Using equation 23.21

r_{b}-$_{R20}$ – k/k-1(1- Σpq/S^2)

=5/5-1(1-0.866012.9) 0.88

We shall postpone the interpretation of this value until we reach a place for interpretation

The kuder-Richardson formula 21.

The kuder-Richardson formula 21 is given by:

r_{k-R21} =k/k-1{1-x̄ (k-x̄)fkS^2}--------23.22

Where $\bar{x} =$ mean

K = number of test items

S^2 = vanance

A closer look at this formula will show you that is it simpler than Kuder Richardson, Formula 20 in that computation of pq is eliminated

Cronbach Alpha

Cronbach alpha (a) is a statistic commonly used by researchers as a measure of internal consistency of tests or scales. The statistic was developed by Lee Cronbach in 1951, who named it alpha. Hence, the name Cronbach Alpha. Cronbach's (a) is given by

$$a = \frac{K}{K-1}\left(1 - \frac{\Sigma S_1^2}{S_2^2}\right) - - - - - - - - 23.23$$

Where K The total number of Items in a test or scale

S^2_1 = The variance of each individual item

S^2_2 = The variance of total test or scale scores

The Cronbach's estimate reliability can also be based on item correlation. The formula for Cronbach reliability estimate based on item correlation according to

Hayes (2008) is given by

$$r_{xx} = \frac{K}{K-1}\left(1 - \frac{\Sigma Xji}{Xji + \Sigma Xji}\right) - - - - - - - - 23.24$$

Where ΣXji and ΣXij are elements in covariance or correlation matrix. K is the number of items in a given dimension of a construct. The numerator ΣXji indicates that the elements in the diagonal of the covariance or correlation matrix are added together. The denominator ΣXji + ΣXij indicates that all the elements in the covariance or correlation matrix are added together.

It is important for a reader without sound knowledge on matrix to visit section 32.6 of chapter 32 before proceeding to the application of equation 23.24

We have already seen in chapter 16 that the calculation of reliability of a questionnaire or scale is one of the phases of questionnaire or scale development. Suppose a researcher wants to develop a questionnaire to measure customer service satisfaction, Customer service satisfaction has three dimensions: satisfaction with availability of service, satisfaction with responsiveness of service and satisfaction with the professionalism of service. Suppose further that the researcher is to measure customer's satisfaction with the availability of service and consequently generate three items shown in table 23.21. To find the reliability of the questionnaire, the researcher has to administer the questionnaire to randomly selected subjects with the same characteristics with the subjects to be used in his study.

Table 23.21: Questionnaire to measure satisfaction with the availability of Service

S/N	Item Statement.	SA	A	UD	DA	SD
1.	The Merchant was available to schedule me at a good time					

2	I could get an appointment with the merchant at the time I desired					
3.	My appointment was at a convenient time.					

Adopted from Hayes (2008)

Suppose Fig. 23.22 represents the correlation matrix computed from the data obtained from the administration of the questionnaire in Table 23.22 to subjects

$$\begin{pmatrix} 1.00 & 0.83 & 0.76 \\ 0.83 & 1.00 & 0.90 \\ 0.76 & 0.90 & 1.00 \end{pmatrix}$$

Fig. 23.22: Co relation matrix

We can find the estimate of the reliability of the questiOflflj Using equation 23.24

ΣXji 1.00+1.00+1.00 =3.00

ΣXji + ΣXij =1.00 + 0.83 + 0.76 + 0.83 + 1.00 + 0.90 + 0.76 + 0.90 + 1.00=7.98

K = 3

$$r_{xx} = \frac{K}{K-1}\left(1 - \frac{\Sigma Xji}{\Sigma Xji + \Sigma Xji}\right)$$

$$= \frac{3}{3-1}\left(1 - \frac{3.00}{7.98}\right) = 0.94$$

With this value, we can conclude that the questionnaire is reliable.

Remark

We have been able to calculate the Cronbach alpha manually simply because we dealt with only three variables. However, in real questionnaire construction we

normally use many variables (Items). In such a case computation of Cronbach alpha can not be efficiently done manually. We use computer packages.

Internal Consistency, Dimensionality and Factor Analysis

In the last worked example we computed the cronbach alpha and found it to be 0.94 and concluded that the questionnaire is highly internally consistent and thus reliable. It is reliable in the sense that the value of cronbach alpha is very high. What of a situation where the cronbach alpha is small say 0.42? An alpha value of 0.42 renders the questionnaire unreliable. There are several factors that make a scale or questionnaire unreliable. These include the use of items that are ambiguous or not specific. To achieve higher reliability, one has to modify such items so that they become unambiguous and specific. Another reason that can lower the value of cronbach alpha is the presence of items in a scale that measure different dimensions of a concept. To achieve higher value of cronbach alpha, one has to conduct factor analysis. The result of the analysis will put all the items that measure each particular dimension of a construct together. By this way, the scale will have high internal consistency or high value of cronbach alpha, which in turn makes it highly reliable.

Equivalence

In collecting data using observation technique, researchers often use two or more observers to rate some people, events, or places. In this case, two or more observers using the same instrument to rate the same phenomenon are expected to have similar ratings. If the ratings are similar, the researcher concludes that such instrument is reliable. This kind of reliability is known as Inter observer (Interpreter) reliability. Interpreter reliability can be estimated by the use of equivalence co-efficient.

To find the equivalence co-efficient, two or more trained observers watch some peoples characteristics simultaneously and independently and record such

characteristics. The characteristics recorded are then correlated to find the correlation co-efficient which is the equivalence co-efficient. A high correlation co efficient signifies that such observational instrument is reliable.

Another way of using the co-efficient of equivalence is in finding the reliability of a multiple choice test. In this case, the researcher constructs a multiple-choice test and then reversed the order of the respondents choice or modify the question wording in minor ways to produce another multiple-choice test. The researcher then administers the two tests to same sample in a quick succession. Finally, the researcher correlates the two scores and find the equivalence co-efficient. A high value of correlation co-efficient shows that the test is reliable.

The concept of equivalent is also used in finding the reliability of scales or questionnaires. To find the reliability of a questionnaire for example, a researcher has to generate large set of items that address the same concept or construct and then divide the items (either using random numbers or using even and odd numbers) into two sets. The researcher finally administers the two sets (parallel forms or equivalent forms) to the same sample. The correlation between the two parallel forms ¡s the estimate of the reliability of the scale or questionnaire. The cronbach alpha based on parallel form test according to Brown (2001) is given by

$$a = 2\left(1 - \frac{S_{odd}^2 + S_{even}^2}{S_{total}^2}\right) - - - - - - - - - - -23.25$$

Where Q = Cronbach alpha

S_{odd}^2=the variance of scores for odd numbered items

S_{even}^2=the variance of scores for even numbered items

S_{total}^2=the total variance of scores for odd numbered and even numbered items

Suppose the scale below was constructed to measure self-esteem.

S/N	Item	Strongly disagree (1)	Somewhat Disagree (2)	Somewhat Undecided (3)	Somewhat agree (4)	Strongly agree (5)
1.	I feel good about my work on the job					
2.	On the whole, I get along well with others at work					
3.	I am proud of my ability to cope with difficulties at work					
4.	When I feel uncomfortable I know how to					
5.	I can tell that other people at work are glad to have me there					
6.	I know I will be able to cope with work for as long as I want					
7.	I am proud of my relationship with my supervisor at work					
8.	I am confident that I can handle my job without constant assistance					
9.	I feel like I make a useful contribution					
10.	I can tell that my co-workers respect me					

Adopted from William (2006) and modified

(Note that the actual scale did not contain undecided category. I only included it for the sake of clarity). Suppose further that the table below represents the responses of twenty (20) respondents to the above scale.

Subject	Item (1)	Item (2)	Item (3)	Item (4)	Item (5)	Item (6)	Item (7)	Item (8)	Item (9)	Item (10)
Subject1	5	5	4	4	4	4	4	4	4	5
Subject2	5	5	3	4	4	3	3	4	4	4
Subject3	2	2	3	3	2	4	4	3	3	2
Subject4	2	1	2	2	2	1	2	2	1	2
Subject5	1	1	1	1	1	1	2	1	1	1
Subject6	1	2	1	2	1	1	1	2	1	1
Subject7	5	5	4	5	5	4	5	4	5	5
Subject8	5	4	3	4	4	4	4	4	4	4
Subject9	5	5	3	4	4	3	3	4	4	4
Subjectl0	3	2	3	3	3	4	4	3	3	1
Subject11	2	1	2	2	1	1	2	2	1	2
Subjectl2	L	1	1	2	1	1	1	1	1	1
Subjectl3	L	2	1	1	1	1	1	2	1	1
Subjectl4	5	4	5	5	5	5	5	5	5	5
Subjectl5	5	4	3	4	3	3	4	4	4	5
Subjectl6	5	5	4	4	4	3	3	4	4	4
Subjectl7	3	2	3	4	3	4	4	3	3	1
Subjectl8	2	1	2	2	2	1	1	2	1	2
Subject19	1	1	1	2	1	1	2	1	1	1
Subject20	1	2	1	1	3	1	1	2	1	1

We can Calculate the reliability of the scale by using equation 2325. To do so, you find:

1. The total score for odd numbered items of each respondent and put it in column o of the table below,
2. The total score for even numbered items of each respondent and put it in column E of the table below.
3. The total score for even numbered items and odd numbered items of each respondent and put it in column T in the table below.

Subject	Item (1)	Item (2)	Item (3)	Item (4)	Item (5)	Item (6)	Item (7)	Item (8)	Item (9)	Item (10)	O	E	T
Subject1	5	5	4	4	4	4	4	4	4	5	21	22	43
Subject2	5	5	3	4	4	3	3	4	4	4	19	20	39
Subject3	2	2	3	3	2	4	4	3	3	2	14	14	28
Subject4	2	1	2	2	2	1	2	2	1	2	9	8	17
Subject5	1	1	1	1	1	1	2	1	1	1	6	5	11
Subject6	1	2	1	2	1	1	1	2	1	1	5	8	13
Subject7	5	5	4	5	5	4	5	4	5	5	24	23	47
Subject8	5	4	3	4	4	4	4	4	4	4	5	5	41
Subject9	5	5	3	4	4	3	3	4	4	4	19	20	39
Subjectl0	3	2	3	3	3	4	4	3	3	1	16	13	29
Subject11	2	1	2	2	1	1	2	2	1	2	8	8	16
Subjectl2	L	1	1	2	1	1	1	1	1	1	5	6	11
Subjectl3	L	2	1	1	1	1	1	2	1	1	5	7	12
Subjectl4	5	4	5	5	5	5	5	5	5	5	24	25	49
Subjectl5	5	4	3	4	3	3	4	4	4	5	19	20	39

Subjectl6	5	5	4	4	4	3	3	4	4	4	20	20	40
Subjectl7	3	2	3	4	3	4	4	3	3	1	16	14	30
Subjectl8	2	1	2	2	2	1	1	2	1	2	8	8	16
Subject19	1	1	1	2	1	1	2	1	1	1	6	6	12
Subject20	1	2	1	1	3	1	1	2	1	7	7	7	14
Variance S^2											S^2_{odd} 45.85	S^2_{odd} 45.49	S^2_{odd} 180.91

Applying equation 23.57 on the data in O, E and T columns of the table above yielded

$$a = 2\left(1 - \frac{S^2_{odd} + S^2_{even}}{S^2_{total}}\right)$$

$$= 2\left(1 - \frac{45.85 + 45.49}{180.91}\right)$$

$$= 0.99\ or\ 99\%$$

From the values we can say that the scale is 99% reliable and by extension 1% of unreliable.

Interpretation of Co-efficient of Reliability

In our previous discussions, we have been talking about the values of correlation co-efficient. We often say that a high value of correlation co-efficient indicates that the measure or test is reliable. There is no standard for what an acceptable reliability co-efficient should be. If a researcher is only interested in making group level comparison, then co efficient in the vicinity of 0.70 or even 0.60 would probably be sufficient. By group level comparison, we mean that the investigator is interested in comparing the scores of such group as male versus female, smokers versus nonsmokers, experimental versus control and so forth. However, if measures were

to be use as a basis for making decisions about individuals, then the reliability co-efficient should be 0.9 or better (Polit and Hungler,1995)

Validity of Measuring Instruments

Quantitative research involves measurement of concepts or indicators of concepts. Once the selected concept or indicator is chosen, the next step is to design a measuring instrument to measure it. The designed instrument is supposed to measures what it supposes to measure. The degree or extent to which a measuring instrument measure what it supposed to measure is what is referred to as its validity. According to natural scientists, the issue of validity is not of much concern. Once they decide on the concept or variable to measure, the next thing is to use a standard measuring instrument and measure the variable. For example, when a natural scientist wants to measure time he uses stop clock (or stop watch). To measure weight he uses spring balance. These two measurements are valid with the two instruments. However, achievement of valid measurement in social sciences may not be as easy as that of natural sciences (physical sciences). A social scientist may set out to measure one concept and ended of measuring another one. For example, he may set out to measure anxiety and ended of measuring depression. Therefore, social scientists and educators pay more in finding out whether the concept they want to measure is really measured. They do so through four different approaches, These approaches are face validity, content validity, and criterion validity and construct validity. .

Face Validity

A measure is said to have a face validity if the items in that measure are related to the phenomenon to be measured. In order words, face validity Concerns with the extent to which the measurer believes that the instrument is appropriate for measuring the phenomenon. For example, a questionnaire with a question item the

that asks the number of houses acquired by a public political office holder within a year in office has a validity if such questionnaire is designed to measure corruption, a report of high number of houses by the respondent indicates how corrupt he is. On the other hand, a questionnaire with a question about the number of civil servant friends made by a public political office holder within one year in office is not likely to have a face validity if it is to measure corruption. The face validity of a measure established after specialists agree that the items in a measuring instrument are related to the variable to be measured.

Content Validity

Content validity ¡s concerned with sampling adequacy of the content that is being measured. The items in a measure should be representative in type an proportion of the content area. For example, when a teacher taught 10 topics in mathematics, his test questions should represent all the 10 topics. Furthermore, large topics should have more questions than smaller topics. A test with this kind of properties ¡s said to have content validity. When items in a test are representative both in types and proportion of the content area, such a test is said to have high content validity. A test with some test items that cover topics not taught in the course, ignore or overemphasize certain topics has low validity. One of the practical ways of evaluating the content validity of a test is to systematically compare the test items with a given course content or syllabus or any other reference material.

Criterion Validity.

Face validity concerns strictly whether the measure is related to the phenomenon under investigation or not. It does not concern whether the result obtained through an instrument is accurate or not. It is possible for an instrument to have face validity but measure variable inaccurately. For example, a question about the number of bottles of beer one drinks in a week has face validity on the measure ones alcoholic

consumption, but may not measure the actual number of the bottles of beer drank by the respondent. This is because many heavy drinkers tend to under report the number of bottles of beer drunken on self report (e.g. questionnaire). To minimize such bias, scientist's device a means of estimating the validity of self report and other measuring instrument through the concept of criterion validity.

Criterion validity is established when the scores obtained on one measure can be accurately compared to those obtained with a more direct or already validated measure of the same phenomenon (Shutt, 2004). For example, a measure of alcoholic consumption on self report can he validated by comparing such measure with that of urine test (criterion).

The criterion validity of a measure can be established in two ways. The first way is to measure the criterion at the same time with the variable to be validated. If the scores of both variables are the same or very closed, the measure is said to have a concurrent validity. The second way of establishing criterion validity is to measure the criterion after the measurement of the variable to be validated. Again, if the two scores are the same or very close, we say thatthe measure has predictive validity.

Educational measures are also subjected to criterion validity test. For example, a class room teacher may want to find out whether the test given to his students can predict the success or in a future test. If such test predicts either success or failure in future test, such a test is said to have predictive validity. To determine the predictive validity of a test, the teacher has to correlate the scores of the first test with that of the future one (criterion). If there exists a high correlation co-efficient, we conclude that the first test has predictive validity. Sometimes, a teacher may be interested in establishing the concurrent validity of his test. In this case he has administered two

tests in quick succession to his students and then correlated the scores of the two tests. A high value of correlation co-efficient shows that his test has concurrent validity

Construct Validity

Before now we have been talking about validating measuring instruments that measure variables directly. There are certain situations in which we have to measure a variable indirectly (through an indicator). If we do so, how are we sure that our designed instrument measures the construct under consideration accurately. One way of verifying this is to examine whether a proposition or theory that is assumed to exist is confirmed with the measure from the instrument. Suppose that a researcher developed a new indicator to measure self-esteem; suppose further that there is a positive relationship between self-esteem and health status. His instrument for measuring self-esteem is said to have construct validity if the measure obtained confirmed the positive relationship between self-esteem and health status.

Review Questions

1(a) What is meant by the term Reliability of a measuring instrument?

(b) Under what condition is a measuring instrument is said to be

(i) Reliable

(ii) Unreliable

2. Describe how you can use test-retest method to determine the co-efficient of reliability of a test.

3. (a) Mention three factors that can cause unreliability of a measuring instrument.

(b) Explain any two of them.

4(a) Describe how you can use split-half method to measure the reliability co efficient of a measure.

(b) State two advantages of split-half method over test-retest method.

5 Under what condition a test is said to have internal consistency?

6(a) Write down the Cronbach's alpha formula and define all the terms in the formula.

(b) Give one advantage of Cronbach's alpha formula over split half method.

7. Write short notes on the following types of validity

(i) Face validity

(ii) Content validity

(iii) Criterion validity

(iv) Construct validity

8(a) What do you understand by the term validity of a measuring instrument?

(b) Distinguish between predictive and concurrent validity.

REFERENCES

Brown, J.D (2001). Using survey ¡n language progress. London; Cambridge University Press

Hayes, B.E. (2008). Measuring customer satisfaction and loyalty: survey design, use, and statistical analysis method. Milwaukee: ASQ press publications.

Pilot, F and Hungler, K. (I995). Nursing research principle and methods. Pennsylvaflia J. B. Lippifl cott.

Shutt, R.K. (2004). Investigating the social world, California: sage publications.

CHAPTER NINE

CONDUCTING YOUR FIELD WORK

Objectives

The chapter intends to:

1. state how field work can be carried out in research;
2. explain the common problems that one can encounter in carrying out research fieldwork; and
3. explain how such problem can be dealt with in the carrying out fieldwork

Introduction

In the section on research design, we listed some of the issues you need to consider before going to the field. Now that you are in the field, what can you do to ensure a successful outcome? What is a successful field experience? What are the common problems encountered in fieldwork?

What is a successful fieldwork experience?

Successful fieldwork is when you have gathered all the information (data) needed to answer the research questions, within the time and budget planned and with minimum problems and obstacles.

Common problems encountered in fieldwork

It is impossible in a general discussion to describe what you need to ensure minimum problems during your data gathering process However, there are problems that need to be taken into account in studies involving people. They are:

1. the subjects may not be available or willing to supply the information you require;

2. the subjects may supply false Information;
3. they may be suspicious of your intent. For example, during elections or in an environment of social stress and upheaval, people are bombarded by questions such that a stranger seeking information is treated with suspicion if not outright hostility;
4. sometimes, the subjects may not understand the questions;
5. there may be taboos and or restrictions that would make research difficult if not impossible. For example, male researchers would have difficulty having access to female respondents in an Islamic society because of purdah" or "Ba Shiga" restrictions;
6. questionnaires may be too long in the opinion of the respondents leading to partially completed returns;
7. subjects may be Inaccessible due to Inadequacy of infrastructure: such as roads becoming Impassable at certain times of the year; and
8. where field assistants are used, they may be unreliable and make inaccurate returns. A case was reported of research assistants employed to conduct a traffic survey in a certain town. They spent some of the time doing their own things but submitted data, which on closer examination and cross checking turned out to be falsified.

Common problems associated with fieldwork that do not Involve getting responses from people are different in types. They include the following:

1. Equipment failure: even with the best plans, the equipment you need to take measurements in the field may malfunction.
2. Inaccessibility of project site due to hostility and or natural hazards
3. Limitations concerning when the phenomenon may be observed. For example if your study involved measuring crop growth, it has to be done during the

growing season. This however may not be the most suitable time 1f you are a student and have a deadline to keep. Fluvial processes and climatic data also need to be observed as they occur.

Dealing with problems

How does a researcher on a limited budget deal with these and other problems? The answer is found in advance planning and careful preparation. Many beginning researchers go to the field without anticipating difficulties and are both surprised and frustrated when problems crop up. In research, it is good to keep in mind what is popularly known as ‘Murphy’s Law’, which states that, ‘If It can go wrong, it will.”

Another way to prepare is to allocate adequate time for fieldwork. Expect no shows, expect delays and add a buffer time in your requirements so that when they do occur, you are not thrown completely off schedule.

Plan a research project that is manageable. A common problem about beginning researchers is to try to do too much. There is a difference between your lifetime research Interest and a project you need to execute within certain time and resource limitation. For students, it is unlikely that you will have more than three to four weeks to carry out your questionnaire survey. Given your resources and the expectations of your department, decide on what you can realistically accomplish in such a time frame. Certain geographical researches especially, but not exclusively in Climatology require data to be collected over time. For such research, take into consideration the time that would be needed to gather valid data and incorporate such time into your study design. It might mean that you would need to start gathering your data much earlier than others; it could also mean that you may have to depend on secondary sources of data, where such are available.

Review Questions

1. Explain in details the procedure involved in carrying out a research fieldwork
2. Outline the challenges that a researcher can encounter in the process of his fieldwork.

CHAPTER TEN

DEFINING RESEARCH TERMS

Objectives

The chapter intends to:

1. define terms used in research work; and
2. explain how the terms used in research can be defined

Introduction

Every subject has its own unique syntactic or its own language, that is, the language that may be peculiar to it. An economist uses certain terms that may not be intelligible to a physicist in the ordinary sense and vice-versa. When an accountant uses his professional terms, they may not be easily understood by a layman, unless these terms are defined. In the same way, the educator and social scientist need to. define their professional jargons which they often use to describe and summarize their observations. In other words, terms that are technical and if unexplained may hamper one's understanding of the social science or educational research report needed to be introduced and briefly explained. The following section will, therefore, be devoted to definitions of such terms, which are commonly used in educational and social science research. The best approach to addressing the issues of research terms is to define them where and when they first occurred in the report. Creating a sub-section for defining research terms is now old-fashioned, anachronistic, and, so unacceptable. Ideally, terms in one's topics should be defined in the background, context and perspective of the study. Now, let us define some of the terms that are commonly used in research ¡n education and the social sciences:

Concept: a concept is an abstraction from observed events (Ary, 1972). It is an idea that is usually quite technical but usually close to the event it represents. For

example, tree, chair, dog, book, liquid, table, colour are close to the objects they represent. A concept, therefore, is an abstract idea but it represents phenomena that are directly observable. The primary purpose of a concept is to simplify thinking, a belief or event by a number of events under a common general heading or meaning. For example, the concept, "achievement" includes observation of certain quantitative values on a test or the observation of certain behaviours that are associated with learning tasks like reading, doing arithmetic drawing and so on. Once the word "achievement" is mentioned these learning behaviours readily come to one's mind. One's concepts should be defined, as used in any work. Such a definition must be clear, precise and informative.

Concepts like aggressiveness, impact, anger, marital maladjustment, performance, job-related stress, achievement, weight inflation, to mention but a few, are nebulous to items or ideas they represent and therefore need to be defined using quantifiable explanations. For instance, does aggressiveness mean someone who fights 5 times out of 6 provocations or one who fights without even being provoked' In the same way, researchers should be able to quantifiably define as applicable to his research/study, any new idea, concept, etc used in the research. A section, definition of terms may be needed or terms can be defined where they occur, for the first time. It is preferable to define research concepts where they occur, for the first time, in the research report. All the major concepts in the research topic should be clearly defined, in perspective and in the background of the study section. One may present two definitions given by experts in the particularfie1d and then summarize with his own definition, as applicable in the present study.

Constructs: a construct ¡s a higher-level abstraction (than concept) which is not directly observable like a concept, but can be inferred on the basis of its observable effects on behaviour. For example, words like motivation, intelligence, justice

problem-solving, and ability cannot be easily observed or illustrated by directly pointing at objects or ideas they represent. The effects of motivation nigh or low, intelligence, visual acuity, among others, can only be inferred from observed behaviour. Thus, constructs are more abstract than concepts. Very often, the distinction between the two is not important and the reader should not be unduly concerned with the similarities between concepts and constructs.

Variables: A variable is a concept or a factor that can take on different values and varies from time to time, within an individual or from one individual to another. Height, weight, achievement, financial well-being, location are among variables that can vary within an individual from time to time or from one person to another.

A variable can be defined as a symbol to which numerals or values can be assigned. For example, 'X' can be labelled as a variable. Scores can be assigned to 'X' to represent intelligence. In the same way, scores can be assigned to 'Y', another variable, to represent achievement. The two variables, intelligence and achievement, can, thus, be represented by the symbols 'X' and 'Y', respectively. No matter the variable in question, it is very important in research studies that they are very clearly well defined as to be understood by the reader. Again, all the variables planned for investigation in a study must be fully discussed in the background of the study.

Such variables as gender, school location, type of school, type of social structure, economic resource base, learning styles (field independence versus field dependence), different types of economic regimes, among others, once they are the issues for investigation, must be properly presented and discussed in the background of the study before they are considered under the statement of problem, purpose of study, research questions and hypotheses.

Broadly speaking, there are three major types of variables— independent, dependent and intervening variables. Independent variable is the presumed cause of an event, under controlled and manipulated conditions, while dependent variable is the presumed outcome of an event. In other words, an independent variable is the antecedence causing, expected to cause, (or may not cause) something to happen, upon manipulation or observation. Intervening variable is any event or factor which interferes with or influences the direct interaction between the independent and dependent variables by such intervention, the impact of independent variable on the dependent variable is altered. In order to help the reader to further distinguish between independent and dependent variables, more clues need be given. Usually, an independent variable is a factor that can be manipulated in an experimental research study so that the effect it has on the dependent variable, if it does, can be observed. For example, in children's academic achievement, parent's so economic status, is the independent variable, while the dependent variable is children's achievement. A change in the socio-economic status of parents is supposed to result in a change in children's academic achievement. Again, two methods of teaching a particular subject are compared with regard to how they affect the students' achievements in that subject; the method of teaching is the independent variable while achievement is the dependent variable.

While it is true that some independent variables cannot be manipulated, (e.g. gender) variations of them exist such that they can be comparatively studied; such as fat males and thin females. An independent variable, with a few exceptions, is qualitative while a dependent variable is quantitative. By looking at examples of independent variables like social class, attitude of people towards education, gender of subjects and so forth, one can see that these are all qualitative. But on the other hand, dependent variables like achievement, correct choice of career; retention of

facts, performance of a project on poverty reduction and so on, are quantitative. For example, a programme is said to be successful in reducing poverty if some quantitative criteria are met, as a result of the programme. When two independent variables combine to produce an outcome, this phenomenon is referred to as interaction effect e.g. the impact of education and type of job on one's poverty level.

Hypothesis: A hypothesis can be defined as a conjectural statement of the predicted order of cause-effect relation between two or more variable More simply, one can define a hypothesis as a research's guess, hunch or speculation as to the probable outcome of his experiment involving the tent one variable (independent) causes another variable (dependent. It provides a basis for mean comparison for determining significant differences, if indeed they exist, between mean of two or more' research groups that have received treatment and control conditions of the experiment, respectively. Hypotheses relate variables together. A good hypothesis should state a relationship between variables that are comparative and measurable or have a potential for masurbi1ity. Three different types of hypotheses are stated below as illustration; the first two are directional or one-tailed hypotheses also called research hypotheses while the last one is null or non-directional two-tailed hypothesis:

1. Benue State senior secondary school students who are taught geography map work by discussion teaching method will obtain significantly higher mean scores on à geography map work achievement test ($p<.05$) than their counterparts taught the same geography map work by the lecture method.
2. Counseled young migrant male and female nomads will exhibit significantly better mean score, on a measure of attitude scale towards formal education ($p<.05$) than their uncounseled counterparts.

3. There is no significant difference in the observed mean score on deviancy incidences ($p<.05$) among teenage senior secondary one students of polygynous and monogamous families.

In all the three examples, the relationship between independent and related dependent variables is clearly stated, and the outcomes are measurable or potentially measurable. Iii the first example, the method of teaching (independent variable) is postulated to be related to achievement (dependent variable), which is measurable and can be expressed in scores earned by students. In the second example, the relationship between counseling and attitude is measurable. Attitude of nomadic people can be measured and expressed either quantitatively or as positive or negative. In the third example, the type of family a child belongs to, is related, in some ways to juvenile delinquency behaviours, which can be measured. Hypotheses are very useful guides for research activity because they anchor the major problem investigated as well as provide a basis for the researcher to collect, collate, analyse and report valuable research data; hence the need for postulating clear, precise and measurable hypotheses. Whatever hypothesis is stated, it must have a discriminant (significant difference, better than, greater than etc), which serves as a basis for two or more group comparison (mean rating, mean achievement) and an index on which the comparison is made (male versus female, etc), as the case may be.

Scope: The scope of the study refers to the boundaries or limited issues or content of the study. It refers to the specific geographical location (geographic scope) of a study, drawing attention to who was involved, and in what area. For example, a study may be confined to the senior secondary two in Edo State and not all the classes in the secondary schools in Edo State. A study may be designed to focus on principals and not on all the staff in the school. Another term for scope is "Delimitation". Students should not confuse delimitation with the term "limitations". Another aspect

of scope is that which concerns the content scope. What topics, units, aspects of a programme will be investigated, constitute the content scope. Both geographical and content types of scope ought to be fully and clearly well defined in any study.

Limitations: This term, which is often confused with delimitation (scope or what was covered in a study) means the research weaknesses or shortcomings encountered during a study, of which the researcher was aware of but could not control probably because of the structural deficiencies inherent in the type of design adopted.

Thus, the type of design a researcher used could be Considered a limitation to a study. For example, descriptive studies hardly test hypotheses because data generated from such studies are usually unstable. Ex-post facto design is structurally weak in the sense that the variables investigated were pre-existing before the researcher got there and so could not be manipulated and observed to determine the effects of independent variable on the dependent variable, if any.

Thus, realistically, the researcher can only test the relationships already existing, as it were, between or among variables, but could or needed not manipulate them. The amount of control, in this case is zero or hardly possible. Thus, the events were there already and could not be controlled even though they may have affected the outcome of the study. Other types of limitations which almost all the research students list, include lack of resources such as time, enough money and transportation facilities to cover a wider area for a broader generalisation of results. It is essential to note that these may not be accepted as limitations, if how they may have affected the outcome of the research are not properly well articulated. Some common acceptable limitations are difficulty of access to sample, instability of the sample (death etc) and in society, occasion of wars, disruption to academic activities, etc.

References: This is an alphabetical list of all the sources or works referenced or used in the study which appears at the end of the research report. A serious problem which many research students have with this list is that they forget to list some of the authors cited in the body of the report. This offence is capital and can severely lower a student's score on a research project. It is thus advisable for students to list tentatively in an exercise book, all through the initial and final drafts of their project, all the authors they cited so as to forestall the tendency to miss some of the cited authors and embark on a frantic journey again to relocate referenced materials when it is time to defend the project before the external examiner or a panel of internal examiners.

In preparing the reference, it is essential to consult and use the latest referencing format since the format keeps changing. The most popular format is the APA, (American Psychological Association) usually produced or revised at the yearly/annual conference of the year in question. Consult your faculty research handbook for the referencing format to use for your preparation of your references. Most importantly ensure that each of your referenced article or source is complete and correct.

Appendix (plural-Appendices):

An appendix contains pertinent materials used in the research, which are not particularly necessary for inclusion in the main body of the report but serve as useful reference point for the reader. An appendix is an integral part of the research but is listed at the end of the entire study (after bibliography) for reference purposes. Examples of items for appendix include the questionnaires used to collect data; detailed statistical analyses of research data; instruments and their scoring keys, as well as lesson notes used in a study. Statistical tables and some vital correspondences, arising from carrying out a research may be included in the

appendices. Appendices need to be well titled and listed serially. This section should not be unduly bulky or poorly and haphazardly arranged.

Statistical Concepts:

The term "Statistics" 'involves the collection, classification and analysis of numerical facts. Statistics therefore refers to the methods of dealing with data or numerical facts on such topics or issues being investigated. The very mention of the word statistics tends to drive fear into some students who feel that they have no brain-power for manipulating figures. Probably, such students who give up so easily on statistics do not know how useful "statistics" is or that statistics does not involve long and tedious arithmetic operation only.

The use of statistics helps the researcher to summarize and quantify statements more precisely. To say, for example, that "13 out of every 21 students prefer to use pencil instead of pen in writing class-note at Auchi Boys Secondary School is to make a statistical statement. The use of statistics saves time and words. It makes a research report more scientific and objective. In order to understand statistics, the student needs to come to grips with certain basic mathematical notations. These will be presented in the next section. But you need to know that most African Countries have very low culture of statistics. This is because we thrive on secrecy of information; a very large number of African population is illiterate and infrastructure for data collection/observation and handling, literally do not exist. Furthermore, research is in its infancy in Africa so that the sustained use of statistics is only just beginning.

Nonetheless, the increasing high level of computer awareness, computer education and literacy, access to computers and acquisition of computer skills among young people, is a very welcome development that will hasten the development of research

(information search, location, updating, storage, accessing, retrieval etc) capacity in the third world countries. This will also help in initiating and sustaining a robust research culture in the future.

Review Questions

1. What do you understand by variable?
2. Explain types of variables

CHAPTER ELEVEN

PREPARING THE THESIS RESEARCH REPORT

Objectives

At the end of this chapter, learner should be able to:

1. clearly write a research thesis proposal;
2. state clearly essential components of research; and
3. explain the challenges to the development of thesis research report.

INTRODUCTION

Thus far we have presented examples of how to prepare your Curriculum Vitae (CV) journal-type of research reports, theoretical and empirical conference papers, research proposals and citation on an important personality. The expectation is that by your reading through these, you will learn the techniques of writing them, based on the examples given. With regard to your thesis, we shall present to you, the different sections of the thesis and how to present them in your booklet. The preliminary sections will be dealt with in the latter part of this chapter, but bear in mind that the final form which your thesis takes (content, referencing style, synopsis, structure, writing style, substance, binding, etc.) depends on the format approved by your department and or faculty; so always consult your supervisor/department for such an approved format and fully comply with it Also, note that the expectation is that your topic has been approved by the faculty/department/supervisor and that you have carried out the study which now has to be reported as an M.Ed or Ph.D thesis. Ensure that your topic is good enough for the degree in question otherwise you may be told that the completed work is not good enough as an M.Ed or Ph.D research study, as the case may be.

CHAPTER ONE of the research report is the introduction. It is made up of the following sections; the Background; the Statement of Problem; Purpose of Study; Research Questions; Hypotheses; Scope of Study; Significance of the Study, and, if needed, the Definition of Terms. The background of the study should be in three to five pages written, clearly and precisely to acquaint the reader with the nature and scope of the problem to be investigated by providing and explaining relevant theoretical, empirical and practical considerations as well as presenting the affairs related to the problem in context. This can be achieved by referring to the views research conclusion and suggestions of authorities in the particular problem area of your ivstigat1on as well as drawing attention to the experiences gained from the field by the researcher. All in all, the background should show the present status of issues of the problem to be investigated; especially with regard to the gaps which your present study will investigate and fill; a clear and argument on the need for your study; what your Study will investigate or produce. Let us consider a beginning paragraph of background to a research study on the effects of good study habits on students' achievement in mathematics:

> over the past decade or so, secondary school students' achievement in their study of mathematics, unquestionably an important school subject, has considerably deteriorated. Trend analysis studies on achievement patterns in mathematics, among Nigerian secondary school students clearly show that between 1979 and 2001, there was a steady average of. 1.7% annual decline, in students' A_1 to C_6 grade of acceptable achievement in mathematics at the West African School Certificate Examinations (Osuji. 1979; Obioma. 1982; Ah, 1984; 1986, and 1998; and Usman, 2002). Similar deterioration in secondary school teacher-made achievement tests in mathematics has also been reported (Akinmade, 1984: and Kobina, 1999). Most existing research reports suggesting ways and means of addressing the problem of poor achievement among secondary school mathematics students appear to dwell more on teacher effectiveness factors rather than student factors. A large number of such

> suggestions focus on the role of the teacher of mathematics in effectively using specified teaching methods for motivating students of mathematics. The studies of Lassa (1978) and Ah (1991) come to one's mind here. Other workers, Iding Banda and Musa, (1997) and Imeh (2004) have suggested the improvement of the cognitive demand levels of the secondary school curriculum in mathematics, in terms of its teachability. There has been little improvement reported in the literature based on the adoption of this and other related suggestions. Very little work has been done on how achievements in mathematics can be improved by focusing attention on the student from which efforts at improvement should emanate. One of such areas which appears to have received limited research attention in Nigeria is the secondary school students study habits in mathematics. Study habits have been defined by Olson (2004) as ...

In the background, make sure that all the variables/factors of interest in your study are learly presented and discussed. This is very important. Some important variables in social science and educational research are location, gender, school type, type of political regime, past and present events, methods of rural development models, models of town planning, teaching methods, age, socio-economic status, cognitive styles, economic regime, cognitive development, levels of reasoning, on-task abilities, and so on. Consider this example, in continuation of the study skill example above:

> there is very little in the literature, on work done in Africa on what constitutes secondary school mathematics students' characteristics of good study habits (Koleoso, 2003) or how these habits can be inculcated in the students in the mathematics teaching-learning process. Also, an extensive internet and library search shows that there is currently no literature in Nigeria on the effect which the possession and demonstration of good study habits in mathematics among secondary school students, have on their study of mathematics. Evidence available in the literature was based on works done in Japan, by Futura (1989); in the United Kingdom, by Elke (1998); in the United States, by Schmuclcler (l998) and in Kenya, by Ombima (2003) which clearly show a significant positive

> link between students' good study habits in mathematics and their achievements in the subject. While the findings of these studies appear conclusive they suggest the need for undertaking a similar study, using Nigerian secondary school mathematics students. The studies of Schmuckler and Ombima raise two major questions that are of considerable concern to the present study. The first question concerns the determination of the various man and Psychological constructs which constitute good study habits. The Second question concerns how good Study habits can he imparted secondary school mathematics student who are uninterested, unmotivated in and have. largely negative attitude towards mathematics.

You probably have noted ¡n this paragraph, the inclusion of five major considerations which serve as strong basis for writing an acceptable background of this study. The first consideration is the *opener statement* which immediately underscores a major problem in the study of secondary school mathematics, i.e. the deteriorating achievement in mathematics which is real and pervasive; evidence for this is provided at two levels, in the school certificate public proficiency examinations and in the in-school teacher-made examinations. You may need to provide a tabular data on Nigerian secondary school certificate results, in mathematics by total number of candidates who sat for mathematics examination in Nigeria, by year; total number of credit and above passes, total number of failures; percentage of passes and failures, per year, from 1979 to 2003.Such data are readily available in the West African Examinations council's Annual Report or in the Council's web page. The importance of such data is hardly arguable; if achievements were high then there would be no problem to study. The second consideration has to do with presenting concise and clear information on how other research studies have focused on this issue, or the attempt made earlier to address the particular problem you want to presently investigate and what were their results; if such results ate of studies done abroad or are inconclusive, then these observations will help you to

create a gap for your present study to investigate and fill. The third Consideration is the fact that there is an area of suggestion which has to be investigated; study habits of students. Three broad problems occur here on what good study habits are, how they can he imparted on students, and the effects which such imparted good study habits may have on Secondary school students achievement in mathematics in Nigeria. The fourth important consideration in the background is the citation related and relevant studies on the Subject, as reported in different parts of the world, both educationally developed (U. K., U.S., Japan) and educationally developing Country, in Africa (Kenya). The fifth consideration is the conceptual definition of important terms in the research topic, e.g. the definition of what Constitutes good study habits in secondary school mathematics and how these habits can be imparted on students, and the effects they have on students' achievement in mathematics based on studies done elsewhere, since presently you have shown in your literature review that there is a paucity of studies done in Nigeria, on the subject of study habits in mathematics.

Clearly, this background to the study succinctly highlights present gaps, lapses, the nature and scope of the problem, its importance in education and the need to investigate it. It also provides information on all the variables the researcher is interested in investigating; all the variables of a study need to be in the background of the study. Some of the variables upon which logical reflections will be useful and which must analytically be reported in perspective, in the background, include location, gender, cognitive development, cognitive styles, age, socio-economic status, marital adjustment, mental maturation of subjects and so on. Once these variables are well developed in the background, they can then be well represented in the Statement of Problem, Purpose, Significant, Research Questions and Hypotheses. Thus, if you included variables such as gender location; thinking processes; financial management models; cultural practices; etc. each of these

variables or concepts must be properly referred to and clearly and succinctly presented and discussed in the background showing gaps, needs, rationale for re-investigating them your present study. In all your thesis write up and especially in Chapters 1, 2, 3 and 5 avoid one sentence paragraphs, avoid the use of colloquial words, jargons over-praising of your supervisor far-fetched opinions, etc. Spelling, paragraph checks during computer-based word-processing arc essential.

The next section of Chapter 1, the Statement of Problem is one of the most important sections of any research. The problem should be so clearly stated and early enough that the reader does not have to search for long before finding it n an obscure sentence or even miss it entirely. The problem is not a statement of what you want to do. It is not to be confused with the purpose. So, what is the problem? Where or at what level does it exist? It is an identificatory sentence or two about or on the subject-matter of the research, preferably posed as a question. The one or two sentences should be really well loaded as to include information on all the factors of independent and dependent variables, their relationships and any other useful and relevant information. What constitutes the problem should not be vaguely worded or left to the reader to determine or decipher. A long, winding and digressed statement of problem distorts information about what was investigated, its importance, and in retrospect, what was found from literature review. This is why it is suggested that a statement of problem should be quite brief and clear. Brevity and clarity are usually attained and "honed in" ultimately, after the background has been discussed well enough and whatever the statement of problem is, can then be posed as a question, in line with the suggestion made by Erlinge (1981) and Tuckman (1987). Let us consider one example:

Recently, a number of studies in mathematics education worldwide, has more actively focused its research activities on identifying ways and means of reversing

the deteriorating secondary school student achievement in mathematics. Research studies in most of these areas have dealt with curriculum issues, teaching effectiveness the use of student-friendly instructional materials and Students study habits in mathematics. Of all these Studies, there is no literature evidence in Nigeria about how to impart good Study habit on mathematics students as well as the effects which Secondary school Study habit, in mathematics have on their achievement in the subject; this warrants this study. Therefore, the problem of this study posed as a question, as suggested by Ali (1996) is: What arc the classroom-based go Study habit characteristics of secondary school mathematics study in Nigeria and how do the Possession and demonstration of like identified good study habits affect their achievements in their study of mathematics

Note that the statement of Problem should neither have any citation of literature, (uñless dirély needed, as in the case of Ali (1996) which is not a citation on the statement of problem but on how best to state ä research problem) nor be too long (two paragraphs or so and, without any background-type of references).

Once the statement of problem has been precisely and clearly stated, next, is the Purpose of the Study. The purpose is stated in line with the context of what the objectives of the study are and within the context of the problem to be investigated. Tile purpose of the study therefore is, the statement of what was done or is done, bearing in mind your topic, the background are statement of problem. Ideally, the purpose should be put in two parts -the first part states what was done, in general, followed by a specific part which breaks down into discrete itemized pieces of what is to be done, or done as drawn from the general purpose. Consider this example:

> the purpose of this study was to determine how good study habits can be inculcated in secondary school mathematics students and the effects the possession and demonstration of

> good study habits have on Nigerian secondary school students' achievements in their Study of mathematics.
>
> Specifically, an attempt was made to identify (1) the human and Psychological constructs which constitute good study habits, (2) identifla how study habits can be imparted in a randomly draw secondary school samples as well as to (3) determine the effects which the imparting and the demonstration of such good study habits have on students' achievements in the mathematical topics they were taught and expected to learn.

The specific items of the purpose are serially numbered. Each purpose item must be presented in short, crisp and quantifiable or measurable language, in line with the problem that was investigated.

In some universities, the next section after the purpose, is the research question section. The Research Question section contains four or five statements in form of question probing into the issues addressed in the study. Some research works merely involve investigating research questions thus seeking answers describing events rather than testing cause-effect relationships, as in experiments. Research questions serve the useful purpose of seeking and obtaining information for describing observed events. In some research studies, describing events by investigating and exploring research questions may be a more profitable and relevant approach to finding new knowledge than testing hypotheses related to such events. Research questions must be directly derived from the problem being investigated; they cannot be at variance with each other. Clear, precise and brief questions are preferred to long, winding, unquantifiable confusing and shallow questions. Again probing questions such as those that begin with "why", "how" and "which" are preferred because they are more revealing in terms of the answers elicitable from them when compared to general purpose questions which usually begin with "what", "which", "Is", "Are", "when" and "If". Let us consider three examples of a basic research question:

1. How does good study habit ¡n mathematics affect male and female students' mean score achievements in their study of senior secondary school mathematics?
2. Why do secondary school mathematics Students achievers show higher mean positive study habit who are high characteristics than their low achiever counterparts?
3. Based on pre-determined criteria of achievement and content overage which curriculum yields better post test mean score for good and poor study habit students, a teaching curriculum or an examination curriculum?

Note that the index of research group Comparison that must be embed in any research question may be the mean achievement, meal' rating, mean cut-off point, and so on. Such quantitative benchmark provide an acceptable basis for comparison of data of research studies (test scores, rating scale, questionnaire responses, observation data, etc), on the basis of the observed group mean differences. After the research questions, the next session is the hypothesis.

Hypotheses are declarative statements of assertion indicating one's expectation of outcome on a cause-effect relationship, if any, between the independent variable and the dependent variable. Hypothesis guides and allows a study to be focused on some construct, issue, etc, thus providing it a clearly defined direction of investigation ultimately lending itself to making a conclusion based on data obtained through an experiment. For instance, if a study is on use of token material for behaviour modification of educable mentally retarded (EMR) teenagers, the stated hypothesis will give the study the dimensions, specifications and depth regarding what the researcher has to do to enable him reach a conclusion inferable to the population from which the sample for the study was drawn as far as the effects, if any, which the use of tokens has n the mean behavior changes of EMR teenagers Hypothesis

should be stated operationally and quantifiably and these are more readily attainable if the logical justification establishing it as a viable, verifiable option is sound and reasonable. This is partly why a very good description of the concepts, theories and empirical basis surrounding the variables implicit in the hypothesis to be tested ¡S Very important in the background section of the research report. Therefore, an acceptable hypothesis is one which is derived from the major problem of the study, with comparative independent and dependent variables that can be measured because they had been operationally and quantifiably defined in the background. The hypothesis should be stated in line with the theoretical, empirical and practical basis closely linked with the subject matter of the research. Let US consider two examples of hypotheses:

1. Nigerian junior secondary one students who are taught population control strategies, in social studies, using role life simulation teaching method will demonstrate better mean achievements on a family living concept test in social studies (P<O.05)-than their counterparts taught the same topic in social studies using lectures only. .
2. Senior secondary two students who are taught Boyles Law, using guided practical laboratory lessons, will not achieve significantly better mean posttest score results (P<O.05) on a senior secondary school Chemistry test, than their counterparts taught Boyles law using teacher demonstration teaching method.

Ideally, for an experimental study, there may be the need for balance between descriptive aspect of the study involving obtaining descriptive or qualitative answers to research questions, and the establishment of cause-effect relationship through, the quantitative inferential aspects of the study, involving testing hypotheses. Too much of either aspect of both would impose much work on the researcher. The experience

of this author with regards to maintaining this balance is to seek answers to four or five research questions and test one or two hypotheses. When you have too many research questions and or too many hypotheses, you invariably give yourself too much work and perhaps additional unnecessary work in your study.

The Scope of Study is an indication of where and on what issues or content the study was carried out; the levels at which the study was carried out; an (l any other additional information which would enable the reader gain a firm and clearer grasp of the issues of coverage and depth of the study. If for instance, a study involved the use of male adolescent migrant fishermen in Delta State of Nigeria, as subjects the researcher should say so as well as give the specific characteristics of where the study was carried out, these should be described or included under the scope. If there are any socio-cultural, socio-technical or socio-academic peculiarities about the research environment and or research subjects and which would be of interest to the reader or to the research work itself, such peculiarities should be included and described under the scope of study. Let us consider an example to illustrate the points being made.

> This study was carried out in all the five educational zones that of Anambra State of Nigeria. Anambra State is one of the thirty-six states which currently makes up the Federation of Nigeria. The five education zones are Awka, Onitsha, Ogidi, Aguata and Nnewi. Only senior secondary school three students were involved in the study since they had completed two years of Chemistry. this is Because, the Chemistry heads of Departments in the sampled schools hold did not agree to cooperate with the researcher in his request for them to teach the research students of this study Chemistry laboratory practical's, other Chemistry teachers who are not heads of departments taught the science practical classes. The content of the practical work in chemistry covered the following senior secondary two topics, namely Titration and Separation Techniques

Note that there are basically, in most research studies, two components or two types of scope. These are the geographyeal scope and the content scope. Geographic scope relates to the location where the study was done and with what type of subjects. For instance, did the study involve rehabilitatable 20-50year old short-term male or female prison inmates in Federal Prisons in Jos, Calabar and Auchi? Thereafter, what did the actual experiment involve - reaching them socialisation skills, such as temperament control, courtesy, eye-hand coordination, word recognition in reading, and attention span control; these specific socialisation skills are the content coverage or content scope of your research. In other words. Content scope explains how far, in expanse and depth, the content of your study covered. You also need to justify the choice of your geographical and content scope; why did you choose a certain event, area or contents, and not others.

The Significance of the Study presents information on the theory upon which your work was done or the theoretical benefits and rationale for doing the study. To undertake any research project, the basis for doing so must be stated and found persuasive otherwise it would be pointless doing the study. A study may be justified and therefore considered significant on two important grounds. These are that the study may involve the development of better theories, better techniques or tools for teaching and learning or that the study would provide us a means of extending the frontiers of knowledge and understanding of socio-cultural events, and educational activities within the given area of research both of which would be found useful. Such usefulness rests on whether the findings of the study have any theoretical and practical relevance and utility as a basis for improving the social life of the people as well as in teaching and learning, administration of schools, counseling of students, planning of social and educational programmes, development of the curriculum and so on. Justification of a study is so critical that when it is missing or when the logic

for it ¡s presented haphazardly it creates a gap as to why the researcher even bothered to do the study. This must be avoided. Let us consider one example of a theoretical significance. There is a growing concern about the role which the teaching carried out in Nigerian secondary schools can play in reversing recent deteriorating trends in students interests and achievements in their study of science. Some suggestions have been made regarding the identification of science teaching methods which better motivate students to learn and achieve superior results in their study of science. This study is deemed theoretically significant because it provided insights into the currently existing theories, on science teaching and leaning in, secondary school science which have been known to motivate students particularly in western countries. In particular, two of such theories (Kuhn and Brandwein, 1999) were investigated and the findings of the present study is considered to be theoretically significant because it contributed additional empirically-derived theoretical body of knowledge on Kuhn's and Brandwein's theories on science teaching, this time using subjects drawn from secondary schools in three states of Nigeria. The findings of this study is bound to stimulate more research interest in this area.

From the above example, of Theoretical Significance of the Study, it can be seen that it should address two major issues. It should be written in a way to justify the contributions your study will make with regard to adding to our knowledge and understanding of the theory upon which your research problems, purposes, research question and or hypotheses were based. ¡f there are theoretical gaps which your study is expected to fill or eradicate, say so, and justify it. On the other hand, practical significance deals with the issue of who will benefit from the findings of your study and how they would do so. Remember, your findings will not solve any problem; rather the application of your findings may provide solutions to the problem investigated. Against this background then, you must indicate clearly, the utility

value of your study, for whom and how that can be achieved. One way of publicize the utility values and significance of a study is through publishing the findings or letting professional bodies have access to your study.

Definition of Terms is the section in high attempt is made to define the major constructs, concepts or terms in the context in which they were used in the research. Doing this is important so as to enable the reader fully understand the meaning of such terms, from the researcher's perspectives. Dependent and independent variables of a study need to be quantitatively described quite early in the background as well as quite clearly and functionally. In addition to describing the dependent and independent variables, some words when used in a study in social science and education may be easily differentially interpretable or misunderstood. Such words which may need to the described include: core-curriculum, return to basics, open market operations, piracy, peacekeeping, e-commerce, cult-war, accountability, corruption, dictatorship, deschooling, migrant education, 'giftedness, underachiever, teaching curriculum, examination curriculum, discovery and so on, thus enabling a common interpretation between the reader and the researcher, even if you still have a section titled Definition of Terms.

There are two approaches to defining terms in a research study. The first approach, which is preferred because of its convenience, is the immediate definition of a term the first time that it appears in the report. The second approach is to have a separate section in Chapter One of the research report where terms are defined. Terms should be defined in the words of the researcher, after due consultation with his supervisor as well as after an extensive literature review. Dictionary, every-day definitions are unacceptable, since they may not be sufficiently technical, meaningful or apply squarely in an expected manner to the problem of the study. However, professional dictionary definitions may be acceptable.

Chapter Two of the research report is the LITERATURE REVIEW. The major aims of literature review are to explore and elucidate on the background of the study as well as provide the reader the theoretical, practical and empirical basis for doing the study. This is with regard to highlighting the problem which informed addressing the research questions and formulating of the hypothesis tested in the study. The review also aims at providing the researcher the opportunity of defining, refining and explaining some of the major Constructs, Concepts, ideas, previous findings referred to in the study or which directly relate to the Present Study. Once a review of literature loses these aims, it becomes difficult for the reader to identify the gaps and lapses covered 1fl the background and problem of the study as well as understand the major constructs of the study and others related to it, and which were cited in the review It, is usual and quite easy for a review to lose its aims in circumstances where the researcher merely thinks that his review should and indeed become a long winding catalogue of citations, one after the other. The discordance arising from doing this makes the review to lose its purpose, and on many occasions lack perspective. Thus, literature review must be put in perspective to the research work. This is achieved mainly by relating your present research work with any literature cited especially as it concerns the present study's methodology, findings, conclusions and major research issues as against the studies and, theories you cited. For instance, are what you referred to, relevant to your present work? What are the weaknesses of studies you cited and how would you overcome them here? Once this is not done, the literature cited loses its focus and it is left hanging. Many authors (at most, about-four citations are enough) should not be cited to support or reject a particular point of view or position. Citations must be presented in an increasing number of order of years. Outdated references, i.e. references more than 5-10 years old and which add no new recent knowledge, unless for historical reasons, may not be cited or when cited, must be justified in terms of their usefulness. Thus, look for

current facts, correct ideas, especially if they are correct modern ideas, views, theories, etc on what you want to investigate. Literature review should be presented under three broad sections. Theoretical Review which reviews the theory upon which your work is based or done and defines concepts used in the work; Empirical Review which reviews earlier related research studies similar to yours including observed shortcomings or gaps in methods used in the studies and the observed lapses which your study will take care of; and Summary of Literature Review which is a paragraph or two that, present(s) the major highlights of your literature. Summary of literature review should not have any Citations, rather ¡t should recapitulate the major views and research findings directly related to your present research problem and the variables investigated in the study.

Two of the above three sections of the review of literature (theoretical and empirical review) should be broken into sub-sections. Each sub-section of the Theoretical and Empirical review should begin with a sentence introducing the purpose and content of the sub-section. There may be need to have many sub-sections say, five sub-sections, under each of the theoretical and empirical sections given above but ideally the fewer the Sections, the more compact and strong it is. Each sub-section should aim at capturing the main elements of the particular title. For instance, a sub-section, "Theoretical Basis of Human Intelligence" should define human intelligence as well as present experts thoughts ç the nature and scope of human intelligence as it relates to your study and how these have changed with time. Only aspects of information which are relevant and helpful to your study in terms of sharpening its focus, statement of problem and the ultimate formulation of testable hypothesis should be cited. Beginning researchers usually cite information with little or no practical significance or thoughts of their own; the reference is completed without any of their input of theirs.

This is very wrong and Unscholarly. While a beginning researcher may be considered a novice and a non-expert in his area of research interest, he may have had considerable field-based practical experience which may add a new, different or interesting dimension to the subject matter of the research. His experiences either a a teacher, a student, an administrator, a planner, a counsellor, a project organiser or Custodian and so on are sources of information which may be cited in a review once those Views are substantiate able. Nonetheless regardless of what is cited, the citation must be analytically. critically and logically presented in a sequence. For to instance, two citations made may disagree with each-Other you need to state where they disagree and some of the possible explanations for the disagreement Again, a study cited may b; Similar or different from what you planned to do or did, in terms of methodology; the cited work may have used fewer subjects, instruments whose psychometric properties were not given or the earlier researcher may have used Constructs that were too broad, nebulous and therefore intractable. You have to indicate how your work is different from and an improvement on the earlier ‘work. The frequency of as well as the length of presentation of a particular citation are dependent on the relevance of the particular work to yours. However, you must not overcite one or two ‘works either because they are ‘your supervisors or lecturers. Indeed, this brings up the question about who to cite. Cite work of experts mostly but not exclusively; sometimes laymen have views, thoughts and perceptions which bring in a breath of fresh air on an issue. They should not be excluded. As much as possible, experts cited should be drawn from a wide spectrum of views, regions, countries and era. If one in a historical study deliberately cites work reported only in the last ten years or so, doing this may be faulty if not unfair given that it may well be that such uncited earlier works may aid more grasp, historical depth and provided direction to the researcher as well as a historical trend on how the particular problem was viewed earlier on. compared to recent times. At the end of each section

of your review, a summarizing sentence should be included for summarizing the trend of information in that section.

We ‘are inclined to prefer the American Psychological Association (APA) format of contextual referencing to Kate Turabian format because of the formers ease of use. Consider this example of APA: Fox (1989) and Karanja (1990) have argued for the use of teaching curricula maeria1s which are tailored to the needs, interests and abilities of the learner, for teaching him. While this argument has considerable research evidence in support two issues which Fox and Karanja ignored in their studies were those of cost and timing... Note the referencing style and the latter point being pursued by the author. Note that this referencing is not article-by-article presentation style. Where the researcher merely repeats views or findings of one cited researcher after the other, they lack continuity, organisation and focus. Also, note that there were no quotations. When quotations become too many, review then tends to be tiresome and difficult to follow through. When you use quotations in your work anywhere and the statement quoted is more than 40 words, the statement should be indented and at the end of the quotation, the author and page of the quotation must be indicated: Ah (1990: 39). Thus, where a secondary rather than a primary source was used for a quotation, this may become problematic if the source did not include pagination, but only the author. Quotations should be sparingly used and they should be used only when doing so would not spoil the flow of thoughts under discourse. Somehow, APA writing style gives greater leeway in achieving these objectives than the Turabian style. This is partly because APA does not require footnoting, use of ibid (in the same place) op cit (already cited elsewhere in the present wjrk). The researcher should make sure that all the citations are completely, correctly and properly listed in the reference section of the research project report. We shall discuss three specifics regarding how to present the references. However,

the researcher is well advised to list any author referred to in a pocket-size notebook from which the reference section can ultimately be prepared, again after going through the whole work to ensure that all the publications and authors cited are listed in the reference section. It is quite disgusting to read through a research work, become interested in work cited therein only to get to the reference section to find that the author, the title of the article or the publisher of the work is missing. Too many of such missing references or relevant information on the literature cited casts doubt about the researcher's integrity. Ali (1999) has discussed how to use the library and the Internet for building tip your literatures, Internet browsing for locating and referencing literature materials is a major sustainable mains of ensuring that your literature is enriched, comprehensive, global and up-to-date.

Chapter Three is the RESEARCH METHODOLOGY OR RESEARCH METHODS section, It is the presentation of the detailed account of how the study was carried out. It is broken into a number of sections including design, area of study, population, sample and sampling procedure, instrument, research conditions, data collection and analysis technique. This chapter is very important in that it is expected to be very closely linked with Chapter One; while Chapter One mainly focused on what the problem was that needed investigation, Chapter Three is expected to present 'a logico-sequential order of how the investigation was carried out.

The first section of Chapter Three is presentation of information on the Research Design used for the study. The researcher must state what his design was by name, define it, state how it was applied in the study, and why the particular design was chosen and used for the study in terms of it's appropriateness, usefulness and versatility. Almost always, some changes, here and there, are made in the design, from the beginning to the end of the study. The need for some changes become apparent as others read through one's design and suggest modifications, if need be,

toward improving the plan of the investigation as well as the actual investigations itself. The description of the design usually spans one page of typescript or a little lesser than this. If you use a design which is not commonly familiar to your readers e.g. Solomon's Four Group Experimental Design, you must describe it very well and justify its use.

The next section, Populations is a detailed description of the total number of individuals in a group, the total number of objects or events, from which those who participated in the investigation were drawn. A rati6nale for the use of a particular population is necessary even though, in some cases the title of a study may well indicate the population attributes such as its size, educational status in terms of literacy level, age, range, socio-cultural dimensions, I.Q., gender and so on. Description of population should be brief and geared to providing the reader information on the presence. of population attributes useful to the research work itself. Any information about the population which k of no use to the study or directly related to the study should not be included in the description about the population. Populations are used on the basis of whether they are the only ones accessible to you (accessible population) or the particular one to which your findings will be targeted (target population) or generalizable to.

The Sample of a study, also known as subjects (S_s) describes the persons, events or objects that participated in a study. Such detailed description 6f how many and or who took part in the study and how (sampling techniques) they were sampled is useful. The detailed descriptions are useful for two major reasons. It enables the reader to determine the extent of representativeness of the sample vii-à-vis the population from which it was drawn, randomly or selectively. Such information is also useful for another researcher who may wish to compose an identical sample if he wishes to duplicate the study reported by the present researcher. In short, the

section on sample must include information on who the sample is; how it was composed (volunteers, selected, randomly drawn; etc.) why it was deemed appropriate for use in the study; what it was expected to do or did in terms of its participatory status; their characteristics in terms of age, sex, educational status, I.Q., socio-economic status; and so on. If, for instance, the sampling done was through strategize the details of each of the strata and how sampling on each stratum was done should be indicated; criteria for identifying characteristics or levels of interest, or sampling frames, sampling units vis-à-vis the purpose of the study, etc, as well as how these characteristics or levels were sampled from, should all be described. The school setting, the immediate community and any other information which can throw additional light on the sample in terms of how these may have singly or in combination affected the research variables should be included. For instance, a community's attitude to education or family life may directly affect students' attitude to school. The curriculum, the quality of teaching, the administration of a school, the geographical area of the school, all have some influence on the students, teachers and so on, and these can affect sample's behavior in a study. These information are quite important and how (extent, etc) they are presented should be agreed upon between the beginning researcher and his supervisor. Let us consider one example of the introductory description of the sample to bring to fore the point we are making:

The sample of this study consisted of all the thirty-nine socially maladjusted and educable mentally retarded students currently enrolled in four privately-funded in-house low-level career skill training programmer in four urban centres in Nigeria. Fourteen of these subjects are males while the remaining twenty-five are females. Six of the sampled subjects were from the Lagos branch of the training programme outfit; nine were from Enugu branch twelve were from the Jos branch and the

remaining twelve were from the Sokoto branch. Human Resources Development Consortium runs the skills development programme for handicapped young persons from ages 11-21. It obtains its funds from voluntary organisati0fls individual and from other local income sources such as through endorsements and the sale of its farm products and so on. Participants are not charged any fee rather they are accommodated and fed free, provided skill training in work settings similar to those that exist in society to which they are expected to be main-streamed into following the end of their skill training. Each skill raining session lasts from three to seven years depending on each inmate abilities, interests and needs.

Complete the rest of this section providing your own information about the subjects' age range; their family and previous educational backgrounds; the nature and scope of their social and emotional maladjustment behaviors; their I.O.; and so on Always attempt to see that you use a large sample size for your study. This is because the larger the sample, the more likely it will truly resent the population attributes from which it was drawn. If a particular population is small and meets the attributes you want to investigate, there may not be any need for sampling; the total population is used as the sample; when this happens, the sample is said to be a purposive sample. The method of sampling must include information about how it was possible for the researcher to compose homogeneous sample, especially where two, three or more groups were involved in an experiment. This is because the expectation is prior to the commencement of an experiment, the researcher must ensure that all the research groups are equivalent or homogeneous on the major attributes of the population of interest to the study.

The next section is the Instrument. This section starts with information on the name of instrument and then describing what the instrument was, by name its different purposes and sections; how it was developed, how many were sent out/received

back; how and when it was used, and by who; how data from its administration were collected, collated and so on. If the instrument used was merely selected from a list of pre-existing commercially produced ones or modified and therefore not original, the author should state so. For instance, if it was modified to suit the work undertaken by the researcher, the extent of modification as well as how exactly the instrument was modified should be indicated. Ideally, each of the stages of development of an instrument should be described in terms of item generation based on a named model as well as issues of validity, reliability, marking scheme, etc which in fact is similar, in part, to reporting field-trial whose aim was partly the development and validation of the instrument used in the study. A neat and final draft of the instrument should be put in a numbered and titled appendix "you will need to describe the instrument". Some universities insist on having an instrument subjected to validation prior to its use. Face validation may require giving draft copies of the instrument to an expert or experts in the field. Such experts are required to make their input in terms of format, clarity, message, coverage, content and face appeal. Another form of validation is through field trial leading to the determination of the psychometric properties of the instrument. Details of the approaches for doing these have been discussed under the chapter instrumentation.

The next important section, if the study is experimental, is the research condition. This section is a full and detailed description of what the research study's major tasks and activities were against the background of the independent and dependent variables. The research-related steps taken to control for threats and errors so as to avoid inter-group contamination as well as to ensure subjects compliance to research conditions should be presented. It also includes the major controls and considerations exercised by the researcher. If there was a treatment condition, what it was by name, its dimensions, regularity extent, modifications, timing etc must be

fully described. Any design-related activities experienced by each group or all the groups during the study should be described. This is also true, if there was control. An experimental treatment activity may involve training sessions given to the subjects or participant teachers. It should be described in terms of the nature and scope of the training, its contents, purposes who received it and how the researcher was able to determine that the training objectives had been achieved prior to the commencement of the study or data collection stage, as the case may be. In some studies, the cost of carrying out the treatment condition should be indicated. It is also important that during the recording of data of experiments (records of. observation), carefulness and patience should be exercised in doing so: what are to be observed; what severity of what is observed should be recorded; how often should what is observed be recorded: who will do the observation and recording; how would what was observed be recorded, collated and analyzed. These are issues that should be resolved under the section, method of data analysis.

The Method of Data Analysis section is a presentation of information on what the data were, how they were collected, collated and analyzed. The description must provide a one-to-one link or correspondence between the data of the study with the research questions and hypotheses; the instrument used for eliciting data, and the method of statistical analysis used for summarizing the data. Such a sequenced orderliness is essential in providing free-flow of thoughts and activities which are in harmony with the research itself, in its totality. For instance, a major area of weakness in method of data analyses presentation made by many beginning researchers is their inability to recognize that the statistical tool used in data analysis must be appropriate and in harmony with the kind of data collected. Deceptive data in nominal forth, for instance, cannot be inferentially analyzed, yet many beginning researchers try to do this. If the research work involved a wide range of data types

or if there were a number of different hypotheses how each of these were statistically handled should be stated specifically one hypothesis after the other. These should be stated and with reason justifying the user of the particular statistics indicated.

Chapter Four is the **DATA ANALYSIS OR RESULTS**. All the results or findings and contents of the tables form the actual presentation of the analysed data of the study. This is a very important chapter and should be organised and presented in direct introspection with the research questions and hypotheses. The data relevant to a particular research question or hypothesis are textually discussed, then presented as table, figures, graphs etc. When all the data of the serially numbered research questions have been presented and discussed those of the hypotheses also follow in that order.

Presentation of a research question direct1y related to a hypothesis can be jointly discussed rather than treating both separately. One table with the related data sets should be presented and used for answering the research question and testing the related hypothesis respectively. Tables, figures, graphs etc should be used for illustration purposes and when they have been adequately and analytically presented and discussed, they throw more light on the veracity and substance of the study. Such presentations and discussions must be clear, simple and informative, bringing out significant data set values, patterns, relationships and so on, where they exist as well as pointing them out where they do not exist. The researcher should not inject his views, expectations, opinions, beliefs etc into the data which he collected and or analysed. Research data should be seen as the facts of a case, not the truth, views, opinions etc as seen or perceived by the researcher. If the data suggest an unanticipated or unexpected trend, result or information, these should be fully presented, explained and discussed, as they were obtained. Similarly, any factors or weaknesses in the design, instrumentation, sampling and research controls which

were unaccounted for should be noted. They should not be mixed up so as to avoid confusion in the textual and data presentation. When, for instance, the same table is used for answering research question and testing hypothesis, the table may become overloaded, confusing and doing this may be counterproductive. The basis upon which any generalization is made should be drawn from the data of your study; wild, unsubstantiated generalizations made are unacceptable and merely water down the substance of one's research work. Ideally, each research question and related hypothesis should be fully and completely discussed before going to the next, under the heading, Research Question and Hypothesis One. For instance, the research question or hypothesis is restated in an indentation. The textual discussion follows as paragraphs, with the reader being referred to the particular data in the table concerning the particular research question. If the data suggests the acceptance or rejection of Particular hypothesis this should be so stated. However, the researcher should report his results quite modestly rather than bogusly or too loudly

Scholars should have a quality of restraint or modesty by being objective in their analysis as well as their style of presentation of facts. But more importantly, proper collection of facts and accurate interpretation of subjects' behaviors generally depend on neutrality, objectivity and open-mindedness of the researcher. Thus, an important aspect of data analysis is the need for ensuring that the data obtained are accurate and reliable, through, for instance, the use of valid and reliable instrument, as well as reporting the results correctly and dispassionately. This chapter should end with a page or so, summarizing the results in the order of research questions and hypothesis of the study. Finally, ensure that data of tables are well presented with correct tittles, figures and numbers. Tables should be serially numbered and well-centered in the appropriate places. One table should not spill-over to two or more

pages; rather it should be abridged on one page while the full table of more than one page should be taken to the appendix.

Chapter Five is the DISCUSSION OF THE RESULTS, CONCLUSIONS, IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS. The chapter should begin with atone or two introductory sentences on of the problem investigated, the procedures used for data collection and a sentence or two on the data analysis and results. Certainly, such an introduction must not exceed one paragraph. This is then followed by the findings which can be organized around the research questions and or hypotheses. Findings are statements of facts based on the data obtained and analyzed in retrospect to the research questions and hypotheses. Conclusions can then be drawn from findings. Conjunction can be generalized to the population, in line with whether the hypotheses were accepted or not, and or based on the facts of or the trend of answers to the research findings failed to materialize, this should be reported and possible explanations given for what was observed; this should not be frustrating at all to the researcher. Again, the researcher should not fall shy, of fully taking advantage of and reporting his findings and Conclusions based on the data of his study the other hand, he should not exceed what the data suggest or even begin to speculate and reach conclusion not supported by the data or available evidence. All major findings and conclusions should be reported. Care should be exercised by the researcher to ensure that he does not confuse findings with conclusions; both are not the same. Consider these statements: "One of the major findings of this study was that Nigerian Primary school children who were reinforced in their study of mathematics with episodic (non-fixed interval) material reinforcement of candies and biscuits performed better in this subject than their counterparts who were not reinforced at all. The conclusion derived from this finding is that the use of material reinforcement at unregulated times during instruction in

mathematics enables pupils to perform better in mathematics". Thus, findings are evidences derived from the data while the conclusions are interpretations of the evidences, in some broad sense. The Implications of Findings should be drawn from the conclusions. If a conclusion is drawn, the implication of the conclusion can be discussed in terms of the possibility of applying the findings to the real world of schools or communities, to bring about some changes.

In doing this, the researcher must create a rich picture of reality or the real world in his mind in terms of reality and the possible consequences of adopting the researcher's views expressed in the implications. These issues must be answered in the implications: What would be the impact of applying his findings? how has he been able to link the theoretical basis of his study to the research questions raised and hypotheses tested, the methodology used in addressing the research questions and the testing of the hypotheses as well as the rigorousness of the analysis with his findings and conclusion. Thus, the researcher's imaginative abilities as well as his ability to critically, analytically and clearly think through each of these links and fill any gaps, form an important part of the consideration in the presentation of the implications of study. For instance, a conclusion of a study may be the finding, that children who have big heads were observed to do better in mathematics. An implication here is trite and difficult to make since we cannot change children's heads in any way in order to make them bigger and consequently get them to do better in mathematics. The *post hoc fallacy* implicit in designs of casual-comparative (Ex Post Facto) studies of this nature should be enough reason to avoid doing studies in which Ex Post Facto design are used.

Limitation of the Study

If there were problems with locating and sampling the subjects, locating and using the desired instrument, was not available, administering the research conditions, collecting and collating data, and. so on, these should be discussed especially on their effects on the outcome of the study. Limitations of a study should not include lack of funds, logistical inconveniences, and time at the disposal of the researcher. Such limitations may affect the outcome of the study carried out, but these are generally unacceptable as limitations. Wars, epidemics, constant coups, constant strikes, instability in schools or seasonal or remoteness-caused difficulty of accessibility to his subjects, are all forms of limitations of a indicated as limitation must be backed up with strong convincing fact.

Suggestion for Further Research

It is often important to suggest to others who are interested in the subject-matter of one's research, possible areas they too can direct their future research attention so that a broader and clearer picture of the area of research focus or aspects related to it, can be obtained through further research. Suggestion of topics to be researched upon should he based on one's findings, conclusions and implications, and should not generally be more than five topics in number. They could be suggestions for others to duplicate or replicate the present study at another location, with different types and levels of sample and school subjects, and so on.

Finally, the chapter should have a Summary of the Study which is a very brief outline of the theoretical issues, the problem, the purpose, the procedure of investigating the problem, major findings made and two or three major implications. These should be presented in about a page or two.

The REFERENCE section is a list of all the references cited in the research report. The different departments, faculties, universities have different approved referencing formats for use by students. The format used here is that of the American Psychological Association, as shown in the spring 2005 Publication Manual of the American Psychological Association (This publication can be obtained from: Publication Sales, American Psychological Association, 1200 Seventeenth Street, N.W., Washington, D.C. 20036, U.S.A. for a small fee.) References are not to be separated as books, journals,' newspaper, or unpublished articles. Format of referencing is Surname of authors first, in alphabetical order, followed by their initials, date the work was published, title of publication/journal title (underlined), volume of the journals and number of the presentation for journal articles. For others, first surname, then initials, name of book (underlined) date, place of publication and publisher and so on are required. So, regardless of whether it is a journal or book, all references are usually listed alphabetically by author's surname, and initials, followed by date in brackets, title of article, name of journal underlined volume and number of journal if it is a journal. If it is a book, the author's surname and initials come first, the date of publication the title of the book underlined, then a full stop the place of publication followed by the colon (:) and then the name of the publisher Inconsistency in alphabetical order, punctuation and other referencing format are unacceptable. Common errors observed over the years by this author include inconsistency (e.g. use of Turabian and APA styles, interchangeably); mix-up with punctuation marks including commas, the use of strange, incorrect and unknown names written in full and in other places as abbreviations; the use of authors first name in full and in other places as abbreviations, the use of strange, wrong and unknown abbreviations; dates in the main body of the research being at variance with the dates in the reference section, etc. We cannot address all the nitty gritty aspects of punctuations involved in properly referencing work cited order than to

request that you see examples below. Two references, one a journal and the other a book are shown as follows:

All, A (1988), Effects of a training programme on good study habits on students? attitudes, motivation and achievements in mathematics among Nigerian Secondary School Students, *Nigerian Journal of Education*, Vol. 1, No. 1.

And

Tuckman, B. (1978). Conducting Educational Research. New York: Harcourt, Brace, Jovanovich Inc.

In some journals, references in the text appear as numbers (e.g. 6) and at the end of the article, the references are listed in the order of number in which they appeared in the article. This is the format used in the Journal of Experimental Education. Consider this example:

Ngoka, G.N. (1991). Status of Infrastructural Facilities for Teaching Introductory Technology in Nigerian Secondary Schools. Review of Education, Vol, 7, No. 1.

If an article referred to in the text is by an association or does not have author's name, it can be listed alphabetically with the association's name or Source of publication Consider these two examples:

- Association of Researchers for Better School: Manual of Research in Education (1991). Onitsha, Nigeria: Kensworth Ikenna Book Inc.

And

- Daily Mirror of Nigeria (1990), Assessment of Migrant Education in Northern Nigeria, Page 12, July 14.

If the article referred to is written by several authors, it can be presented as follows:

- Underwood, B.J., Duncan, P.C., Taylor, J.A. and Cotton, J.W. (1990). Elementary Statistics. New York: Appleton - Century - Crafts Inc.

INTRODUCTION

(By Dr. Bello Ganiyu)

1.1 Introduction

This opening chapter provides general introduction to the research study. Its conventional' to organise i.e. chapter into these subheadings:

1. Background to the study
2. Statement of the problem
3. Purpose of the study
4. Research Questions
5. Research Hypothesis/hypotheses
6. Significance of the Study
7. Scope Delimitation of the study
8. Clarification/Definition of Major Terms.

The chapter is the foundation upon which other chapters in a research project rest. It is therefore necessary that it should be presented correctly and concisely. The content of each elements in the chapter listed above are examined below Relevant examples were provided where appropriate to further illuminate the content of each element.

1.2 Background to the Study

This is the general introduction to the Study. The researcher needs to provide a clear picture of the conditions that surround the investigation including their influence on the problem being investigated, the study. All information needed to understand the problem area under investigation should be concisely and logically explained. This may necessitate making references to earlier related studies. events and relevant

theories. The researcher s free to organise content of the study in his/her own way by making use of his/her thinking skills. It is not out of place to organise the background information into units such as historical background, theoretical framework etc. Essentially, the researcher must build up a case for the study by examination what research paradigm constitute the problem under investigation vividly Consider the example below:

Presently the study of Biology can no longer be considered entirely a descriptive science since it has become and hypothetic entirely a deductive science as rightly observed by Lewis (1988). However, the descriptive component of Biology is indispensable. In fact the bulk of the content of secondary School biology curriculum is deceptive where the students study the morphology, anatomy and physiology of wide range of organisms. To enhance meaningful learning, diagrams of various parts of organisms become essential, in this area of biology. Biology diagrams are sign usually used in presenting visually Biology concepts as they are absolutely essential in Biology textbook written basically for beginners and ordinary level Biology courses.

> Biology diagrams in textbooks are means of presenting information that can easily be comprehended by the readers. This is in realization of the fact that words alone are not enough to bring about comprehensive conceptualization of some biology concepts. However, a Biology diagram can effectively and accurately present information to the reader regardless of its other merits only when labels in the diagram are appropriate and error free. Without labels, Biological diagrams become difficult if not impossible to comprehend meaningfully.
>
> Hence, in selecting Biology textbooks for students use, it is necessary to assess the labels of biological diagram in the book (Bello, 2000).

1.3 Statement of the problem

Problem solving is an integral component of our daily life activities.

It is certain that problems must exist before solutions are provided. Research study deals essentially with identification of problems and providing solutions to the identified problems. A researcher should therefore, clearly indicate the problem being addressed in his/her study. This should be done through concise explanation of the problem under investigation, preferably in the form of declarative statements. This would help to provide direction to the study as well as set the boundary of the problem under investigation. There should be a strong link between the statement of the problems, title of the project and background to the study. Indeed, the statement of the problem should be a detailed explanation of the problem under investigation highlighted in the background to the study. Experts in educational research are of the view that statement of the problem helps the researcher in making appropriate statistical technique to be used for data analysis. Study the example to buttress the case in point.

> The poor performances of Nigerian senior secondary school students in the final senior school certificate examination in Biology has been widely reported in science education. Reasons adduced for the poor performance of students in Biology by Nigerian Science education include students' misconceptions of biology concepts, inadequate laboratory facilities, ineffective mode of instruction, students' poor attitude to Biology, etc. Attention was not directed towards the adequacy of teachers' knowledge of biology as a possible contributing factor to the observed poor performance of students in biology. Teachers mastery of the subject matter in a discipline is crucial to their role as facilitators of learning. It is therefore necessary to probe teacher's knowledge of subject matter in Biology. This is the issue underlying this study (Bello. 1998).

1.4 Purpose of the study

Undertaking a research study is a decisive action Hence, researchers are obliged to declare their intention in carrying out their studies. A researcher needs to state the purpose of embarking upon his/her research study in simple unambiguous statements The main reason for embarking upon the study should be stated in simple declarative statements, it should be derived from the statement of the problem and must be within the scope of the research topic. In fact, the purpose of the study should illuminate the research topic. Essentially, the purpose of the study should indicate existing knowledge gap that the researcher intended to fill up.

Study the example below.

a. The purpose of this study is to identify the problems facing the teaching of social studies in primary schools
b. This study sought to investigate the readability levels of widely used English language textbooks in secondary schools.
c. The purpose of this study is; to determine whether or not students possess adequate knowledge of volcanic eruption. It also sought to identify the students' misconceptions related to volcanic eruption.
d. This study intends to analyse students performance in the final West African School Certificate examinations in Agricultural science between 1990 and 1299.

1.5 Research Questions

We are continuously bombarded day by day with numerous life problems such as scarcity of basic needs. Consequently, daily we carryout search for solutions to these problems seeking for solutions to these problems often do involve formulating

some basic questions to know about what was previously unknown to us as part of process of solving these problems.

Formulating the research questions is also an important integral component of educational research study.

Research questions are basically derived from the purpose of the study. Hence, they are formulated after stating the purpose of the study. They can be formulated from relationship between variables, or effect of one variable upon another. The research questions could equally be based on comparison/differences between two variables or mere identification of variables.

Examples of these four common ways of formulating research questions are given below:

a. What is the effect of demonstration instructional method on students' academic achievement in social studies?
b. Is there any relationship between self-concept and students' academic achievement in Geography?
c. Do students from broker home perform belier than their counterparts from intact family in public examinations?
d. What are the factors responsible for students' poor academic achievement in science disciplines?

From the questions raised above, it is obvious that the first question is about the effect of one variable upon another, whereas the second question is concerned with relationship between two variables The focus of the third question is on comparison and differences between two variables while the last question is about identification of variables. Essentially, research questions are raised to clarify and sharpen the problem under investigation. Consequently, providing answers to research

questions readily becomes the focus of attention of the researcher Therefore, research question is an important tool in realising the stated purpose of the study to be a useful tool. Research questions should be.

i. locally drawn within the scope of the study;
ii. related to the title of the study;
iii. stated in simple and unambiguous words and;
iv. grammatically correct.

There is no limit to the number of questions to be raised in a research study. But experts cautioned against stating too many questions. However, sufficient questions should be raised to effectively cover the scope of the study. The research questions must be in accord with the stated purpose of the study.

At this juncture, it is essential to differentiate between research questions and research questionnaire. A research questionnaire is an instrument for data collection. It usually consists of several items designed to obtain the needed data from the target population of the study. All items in the research questionnaire must be directly related to the research questions in such a manner that responses to items in the questionnaire would produce useful data for providing answers to the research questions. Unlike research questionnaire, research questions usually contain fewer items which are derived from the statement of the problems and purpose of the study.

1.6 Research Hypotheses

Research hypotheses are testable statements that provide direction and tentative explanation of a given phenomenon. Hypotheses are crucial components of empirical studies, it describes the relationships/differences that the researcher expects to find from his/her study. It is a powerful tool for determining the reliability

and validity of research results. Hypotheses dictate the nature of data to be gathered in order to provide answers to the research questions raised in a study. They equally determine the statistical techniques to be used for data analysis in order to determine the relationship or differences between variables. Hypotheses are considered to be probable stations to research problem.

In the field of educational research, hypotheses can be generated to:

a. establish relationships between variables;
b. give two or more variables, events, and groups of people;
c. describe a phenomenon; and
d. find cause and effect phenomenon.

Hypotheses can also be generated from literature search, experience, logical thinking, among others. There are two major forms of hypotheses namely, the null and alternative hypotheses.

a. **Alternative Hypothesis:** This type of hypothesis claims that the population parameter value is different from the one hypothesized. It is the statement that the researcher intends to test; It is the expectation of the researcher based on some theories and assumptions. It is always stated in positive form and not subjected to any form of statistical testing Alternative hypothesis is represented with the symbol H1. Study the examples below
    i. There is gender difference in students' academic achievement in physics
    ii. Students exposed to computer-assisted instruction in Economics will perform better than those exposed to expository instruction in Economics

iii. Pupils schools located in rural areas will perform better than their counterparts in schools located in urban areas in public examinations.

iv. Students academic achievement in Chemistry is significantly related to their attitude towards the study of Chemistry.

v. The socio-economic background of students is directly related to their level of academic achievement.

b. **Null-Hypotheses** This type of hypothesis is a testable statement which asserts that the observed results is completely due to chance, it is always stated in negative form and subjected to statistical testing, it represents a doubt about the researchers' assumption. Hence, it helps to reduce bias in the researcher's mind, A null-hypothesis can never be proved. Conclusions drawn from testing null hypothesis are inconclusive since it rests upon inductive logic. Hence. technically, a researcher can only reject or fail to reject a null hypothesis but cannot accept it. The corresponding null-hypotheses to the five alternative hypotheses stated earlier are as follows;

i. There is no significant difference between male and female students academic achievement in Physics.

ii. The academic performance of students exposed to computer-assisted instruction in Economics and those exposed to expository instruction in Economics are not significantly different.

iii. A significant difference does not exist between the performances in public examinations of pupils in schools located in rural area and their counterparts in schools located in urban area.

iv. There is no significant relationship between students' academic achievement in Chemistry and their attitude toward the study of Chemistry

v. Students' socio-economic background is not significantly related to their levels of academic achievement

There are various ways to state null hypothesis as indicated in the examples above The essential element is the negative term expressed as no, not. etc.

Hypotheses are sometimes classified as: Directional, Non-directional, Deductive. Inductive, Simple, and Composite hypothesis. Whenever a researcher formulates an hypothesis such that it specifies the direction of the expected results of the study the hypothesis is referred to as a Directional Hypothesis Study the example:

i. Female students would perform significantly better than male students in sex education
ii. There is a significant positive relationship between students from high socio-economic background and their academic achievement in science.

Sometimes, in-depth knowledge derived from extensive literature search on the problem under investigation in the study does stimulate a researcher to formulate directional hypothesis. Such researcher, to some extent, is certain that the results of the study could not be in another direction. When an hypothesis is stated in a such that the direction of the expected results of the study is not specified, such hypothesis Is called Non-directional Hypothesis. Consider the examples:

i. There is no significant difference between the academic performance of male and female students in biology.
ii. The is no significant relationship between students intelligence level and their academic achievement in social studies,

As stated earlier, hypotheses and research questions are crucial components of empirical studies. They both provide, clear direction to research endeavours.

Although research questions are not testable, they can be used to generate hypotheses that are testable. Study carefully, the research question that follow

i. What are the facts ‘s responsible for students poor performances in science
ii. Is there any significant relationship between students gender and their academic achievement in home economics?

A research hypothesis cannot be generated from the first question because it is not concerned with any form of interaction between two or more variables. It therefore, lacks testable implications from which hypothesis could be generated for testing. The answer to this research question would be a fist 01 factors/reasons for students’ poor performances. The second research question however, has testable implication because it is concerned with at least two variables, (gender and academic achievement). The corresponding research hypotheses for this research question could be stated as follows:

i. There is no significant relationship between students’ gender and their academic achievement in Home Economics
ii. The achievement of male and female students in Home Economic do not differ significantly.

It is obvious from above that a research study could contain more research questions than hypotheses but not vice versa it is also certain that the number of answers cannot be more than the number of questions A research hypothesis in this sense should be considered to be a tentative answer to a research question. The basic aim of testing null-hypotheses ¡s to falsify or reject it, hence, the need to state it in negative form However, only statistical tests can be used to decide whether an hypothesis should be rejected or not there are several inferential statistical

techniques such as chi-square, the correlational statistics, regression analysis, test, analysis of variance, (ANOVA), Analysis of co-variance (ANOVA), et.c., that can be used to test hypotheses. Conventionally the basic approach in testing hypotheses is to compare two mutually exclusive hypotheses namely, alternative hypothesis and null-hypothesis. When a null- hypothesis ¡s rejected at a specific level of confidence, the same hypothesis may not be rejected at another confidence level (level of significance/alpha level). A researcher does not have to accept the alternative hypothesis because the focus of attention of the statistical test is on the null-hypothesis not the alternative hypothesis. The aim of the statistic test is not to accept or reject the alternative hypothesis. However, the researcher is permitted to some4iow affirm alternative hypothesis with caution.

For example if a researcher failed to reject a null-hypothesis, which states that: There is no significant difference between the performance of male and female students in mathematics. The researcher could with caution affirm the corresponding alternative hypothesis follows:

(i) There seemed/appeared to be significant difference between the performance of male and female students in mathematics or

(ii) This result suggests that significant difference exists between the achievement of male and female students in mathematics

A confirmation statement such as, “There is a significant difference between the performance of male and female students in mathematics, should be avoided as much as possible. This is because of the earlier statement that, the same hypothesis that the researcher failed to reject at a given alpha level could be rejected at another alpha level. Similarly this is also because no decisive conclusion could be drawn from inductive logic. Hence, researchers need to avoid logical error of affirming alternative hypothesis in a conclusive manner.

Significance of the study

Educational research are carried out with the primary objective of increasing existing stock of knowledge on educational phenomena and issues. This is to help us to provide appropnate solutions to educational problems and take rational decision on educational Issues. The ultimate goal is to improve upon existing educational Practices and enhance sustaifl3bte development ‘n education, Educational researcher are therefore, obliged to always state the potential contributions and uses of me expected findings of their study ¡n relation to educational settings that are of current interest. This should be done by indicating the likely benefits of the research results to the learners, teachers, instruction, curriculum, educational research, textbook authors, parents, and other stake holders in the education industry. Generally, the focus should be on the value or contributions of the expected findings of the study to knowledge, sustainable development and progress in the field of education. Study the example that follows.

> Result of this study could be of use to science textbook authors in revising existing textbooks to enhance their usefulness. It could equally serve as guide in designing new science textbooks with appropriate readability levels. Science teachers, students and other users of science textbooks could find the results of this study as a useful guide in selecting books for class usage. It could be sensitive science teachers in particular to see the need to design appropriate measures to improve students comprehension of science textbooks during class instructions. Results of this study could equally serve as a useful guide to science education researcher who is interested in science textbook analysis...(Bello 1998)

Scope/ Delimitation of the study

Educational researchers need to clearly state the boundary of their Study with respect to the content coverage and the geographical location. A researcher must

specify in simple language the aspects of problem examined in the study. This ¡ to provide the researcher with a clear focus by delineating the study to a size that researcher can cope with successfully and manage effectively.

Study the example below:

> The geographical coverage of this study ¡s Bonn metropolis, while its content focused only on analysis of students' performance at the final senior school certificate examinations in mathematics between 1990 and 1999.

At this juncture, it as important to distinguish between delimitation and Limitation of a study. Obstacles that could limit the generalizability the findings of a study such as small sample size, validity and degree of reliability of research instrument, etc, are regarded as Limitations of a study. A researcher should always state all problems encountered during a research that could affect the findings of the study. This should be done at the end of the study. Limitation of a study are, therefore, conventionally stated at the last chapter and as the last item

Definition/Clarification of Major Terms

A researcher needs to avoid ambiguity and confusion when presenting a research report. Consequently the researcher must clarify the meanings of important terms used in his/her study. This is done by providing operational definitions for all important special terms used in the study. Common terms such as education, teaching, achievement, learning, etc, need not be defined except when they have special meaning in the study. Dictionary meanings and lengthy, explanations are not required when clarifying the meanings of major terms in study.

REVIEW OF RELATED LITERATURE

Introduction

Digging into the literature to find out what has been written about the topic that the researcher is interested in investigating s called "review of related literature". In dog this, both the opinions of the experts in the field and other research Studies are of interest to the researcher. Investigators therefore need to be familiar with the three basic types of sources-general reference primary sources an Secondary Sources tri undertaking a review of related literature General references are Sources a researcher Consults to locate other Sources Primary Sources are publications in which individuals who conducted researches report the results of their findings Most primary Sources of information in education are journals Such as the journal of Educational research or the journal of Research in Science Teaching or like journal or Science Teachers Association of Nigeria (STAN) or WAJE These journal are Usually Published monthly or quarterly or Periodically and the articles in them typically reflect reports on a particular research study. Secondary sources of information refer to publications in which authors describe the work of others

In Order to select research titles/topics Ndagi (1984) said it is very important that the researcher gets familiar with the findings of previous studies. It is a very serious handicap to select a title/topic which reflects Ignorance or complete lack of understanding of what other researcher have already done. The ignorance of research findings in previous studies can show up in one of three ways

1. The selection to just the need for the proposed study
2. The selection of a particular hypothesis which had already been confirmed or disconfirmed and
3. The use of techniques which previous researchers had invalidated for the particular Study to be undertaken

Essential Step in a Comprehensive Review of Related Literature

The essential steps Involved in a review of the literature for any research endeavour include the following

1. Defining the research problem as precisely as possible
2. Perusing (reading very widely and careful) the relevant secondary Sours the secondary sources refer to publications in which authors de the work of others. The most Common secondary sources include textbooks education encyclopedias research project review.
3. Selecting and perusing an apocopate general reference like Education Index Psychological Abstracts – published by the American Psychological Association Journals Sociological Abstracts etc.
4. Formulating search terms.. Search terms are descriptive word to use to help locate primary source. To do this the researcher identifies the most important words in the problem statement. For example: consider this research question: Do students taught by a team teaching method learn more than students taught by an individual teacher? What we the most important words or the key terms here? The key term here Is 'tear teaching" This term, plus other terms that are similar to it or Synonymous to ¡t, should be listed Possibilities here might include — 'joint teaching", "co-operative teaching" and the like These should be listed alphabetically — and then the general reference work consulted to see what articles are listed under these terms

   The researcher would then select the articles that seem to bear on his or her topic for consideration
5. Searching the general references for relevant primary sources. What is a useful way to search through a general reference? The following is one way

(Franklin and Norman 1990) that is used by many researchers in education. Considering Education index:

i. Find the most recent issue and work backwards
ii. Look to see if there are any articles listed under each of the search terms in the current issue.
iii. List the bibliographical data of pertinent articles on bibliographic cards. If any articles are found that deal with some aspects of the researcher's topic the author, title, page, publication date, and publication source should be listed.
iv. Continue looking through other issues. If after looking through several issues, the researcher finds no articles relevant to the researcher's topic under a particular sea term, the term should be dropped from the search list.

6. Obtaining and reading the primary sources arid noting and summarizing key points in the sources. There are two major types of primary sources to be familiar with in this regard. They include the journals and reports (such as national conference of specialty called professional meetings, by state department of education, by private organisations and agencies, by SPEB, STAN, NERDC, WAEC, CESAC, NECO and by professional association). They are usually far more detailed than journal articles and much more up-to-date in terms of current information.

Writing the Literature Review Reports

After reading and taking notes on the various sources codirected, researchers can prepare the final review. Most literature review, according to Cooper (1984), consist of five parts as follows:

1. The Introduction — This briefly describes the nature of the research problem and states the research question. The researcher also explains ¡n this section what led him or her to investigate the question, and why it is an Important question to investigate.
2. The body of the review — Briefly reports what others have found or thought about the research problem. Related studies are usually discussed together, grouped under subheadings (to make the review easier to read). Major student are described in more detail while less important work can be referred to or cited in just a line or two. Often, this is done by referring to several studies that reported similar reports in a single sentence like several other small-scale studies reported similar results (Adams 1986. Brown1990. Cartright 1981. David 1985. Frost 1987)
3. The summary of the review — This appraisal section of the literature reviewed ties together the main threads, themes revealed in the literature and presents a composite picture of what is known or thought to date Findings may be tabulated to give reader some ideas of how many other researcher have reported identical or similar findings or have similar recommendations.
4. Any conclusions the researcher feels are justified based on the state of knowledge revealed in the literature. Does the literature suggest the appropriate courses of action to take to try to solve the problem already highlighted.

5. A bibliography with full bibliographic data for all source mentioned in the review. Use the APA format of references.

Advantages of Making Review of Related Literature

The review of related literature is a most important aspect of the research process and has the following advantages:

1. It gives the researcher some information about the present state of knowledge in the areas he intends to study or investigate.
2. It gives the researcher some ideas of the type of design and statistical procedure that could be used in conducting his research.
3. It hops the researcher to detect any deficiencies in the existing research and thereby helps him to avoid the errors an pitfalls of previous researchers who studied the same or similar problems
4. It gives the researcher an idea of the relationship of his research topic to the previously completed research
5. It helps the researcher to select a researchable problem/topic.
6. It helps the researcher to delimit the size and scope research problem.
7. It helps researchers to learn the ideas of others who interested in a particular research question.
8. It also lets researchers see what the results of (similar or related) studies of the question have been.

Therefore, researchers need to be able to locate works dealing with their problems and also to be able to this ‘work in terms of its relevance to the research question interest.

Review Questions

1. Discuss the roles of literature review in research
2. Why do we have research questions and research hypotheses in research writing?
3. What is the importance of empirical studies in any research work?
4. Why do we have suggestions for further study in research?