GCE 410
Empirical Research Methods for Projects
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Vice-Chancellor’s Message

I congratulate you on being part of the historic evolution of our Centre for External Studies into a Distance Learning Centre. The reinvigorated Centre, is building on a solid tradition of nearly twenty years of service to the Nigerian community in providing higher education to those who had hitherto been unable to benefit from it.

Distance Learning requires an environment in which learners themselves actively participate in constructing their own knowledge. They need to be able to access and interpret existing knowledge and in the process, become autonomous learners.

Consequently, our major goal is to provide full multimedia mode of teaching/learning in which you will use not only print but also video, audio and electronic learning materials.

To this end, we have run two intensive workshops to produce a fresh batch of course materials in order to increase substantially the number of texts available to you. The authors made great efforts to include the latest information, knowledge and skills in the different disciplines and ensure that the materials are user-friendly. It is our hope that you will put them to the best use.

Professor Olufemi A. Bamiro, FNSE
Vice-Chancellor
Foreword

The University of Ibadan Distance Learning Programme has a vision of providing lifelong education for Nigerian citizens who for a variety of reasons have opted for the Distance Learning mode. In this way, it aims at democratizing education by ensuring access and equity.

The U.I. experience in Distance Learning dates back to 1988 when the Centre for External Studies was established to cater mainly for upgrading the knowledge and skills of NCE teachers to a Bachelors degree in Education. Since then, it has gathered considerable experience in preparing and producing course materials for its programmes. The recent expansion of the programme to cover Agriculture and the need to review the existing materials have necessitated an accelerated process of course materials production. To this end, one major workshop was held in December 2006 which have resulted in a substantial increase in the number of course materials. The writing of the courses by a team of experts and rigorous peer review have ensured the maintenance of the University’s high standards. The approach is not only to emphasize cognitive knowledge but also skills and humane values which are at the core of education, even in an ICT age.

The materials have had the input of experienced editors and illustrators who have ensured that they are accurate, current and learner friendly. They are specially written with distance learners in mind, since such people can often feel isolated from the community of learners. Adequate supplementary reading materials as well as other information sources are suggested in the course materials.

The Distance Learning Centre also envisages that regular students of tertiary institutions in Nigeria who are faced with a dearth of high quality textbooks will find these books very useful. We are therefore delighted to present these new titles to both our Distance Learning students and the University’s regular students. We are confident that the books will be an invaluable resource to them.

We would like to thank all our authors, reviewers and production staff for the high quality of work.

Best wishes.

Professor Francis O. Egbokhare
Director
General Introduction and Course Objectives

As it is in many life events, there are producers and there are consumers. In the field of learning too, there are producers and there are consumers. In the earlier years of your study (the 100-300 levels), you were probably consumers of knowledge. During those years, you merely absorbed the facts made available to you by your lecturers and the textbooks.

There is a significant difference between those earlier years and the 400 level when you are not only expected to know the facts available thoroughly, but in addition, expected to produce knowledge by conducting original studies. At the 400 level, you are expected to do extensive reading, show initiative, originality and creativity by looking for a researchable topic, design a research, collect data, organise data and make newsworthy inferences. This outlined sequence of thinking is called empirical research methodology. This is what you are being exposed to in GCE 410. The major goal of the course is to transform you from a stage of knowledge consumption to an active producer of knowledge.
LECTURE ONE

Nature and Concept of Research

Introduction
In this lecture, you will be exposed to the nature and characteristics of research. In it, research is conceptualised as an orderly, organised, systematic and consistent, pattern of thinking that gives structure and direction to an investigator's knowledge of facts and methods. Your awareness is also increased about the various misconceptions about research before a comparison of the differences between empirical and historical research methods are treated.

Objective
At the end of this lecture, you should be able to establish the fact that research is a systematic way of thinking rather than an agglomeration of high sounding statistical or technical jargons.

Expectations
You are expected to know the basic concepts of empirical research such as:

1. research
2. empirical research
3. historiography
4. validity of historical data sources.

Pre- Test
1. Explain the concept of research.
2. What is empirical research?
3. Describe the concepts of historiography.
4. List five characteristics of research and explain each.
5. In tabular form, compare empirical research with historical research.

CONTENT
The process of research can be exciting if the investigator understands how to go about it. Research is a method of thinking in an orderly sequence. The researcher should try to assume an inquisitive posture. Such a posture helps him to carefully scrutinise the facts before they are accepted. Also central to the concept of research is that it represents some orderly, organised, systematic and consistent pattern of thinking that gives structures and directions to an investigator's knowledge of facts and methods. The usefulness of a research design may sometimes lie in its simplicity. Adequate background thinking and the logical connection of the various factors under investigation in a simple way is often more productive than a complicated arrangement of factors that may not be clear.

Research often starts in the mind of the investigator with a question; why, what, where, which, how, etc., of the events of the world. Having started with a question, the researcher needs a direction and orientation so that the process of data collection becomes practically clear in his mind. In the final analysis, research may be defined as an orderly, organized, systematic and consistent pattern of thinking that gives structures and directions to an investigator's knowledge of facts and methods. Research is a method of thinking that leads investigators nearer the truth about the various problems and questions that are asked in the world. The power of research to explain the frontiers of knowledge lies in its acceptance of limitations, namely: that its methods are not perfect and that the whole design can be improved with increased knowledge about the issue. It is an ever improving methodology.

Characteristics of Research
It is a common practice for people to label what is not research as research. This is why some characteristics of research are indicated in the following sections:

1. Research begins with confusion in the mind of the researcher. The confusion about a phenomenon leads him to ask the questions. The questions raised by researchers form the beginning of an orderly and systematic sequence of thinking about some aspects of the
problem.
2. Research requires a plan.
3. Research questions must be posed in researchable forms.
4. Research requires a proposal.
5. Research problems should be hierarchically organized and broken down into researchable problems.
6. Research is factual not impressionist, not taking a strong stand but flexible according to evidence.
7. Research involves tests of hypotheses or answering of questions.
8. Research requires the operational definition of terms.
9. Research is objective, not based on beliefs.
10. Research is a circular, a forward and backward process, dynamic in nature.

Strategic Differences between Empirical and Historical Research

The primary focus of this book is the explanation of basic concepts in empirical research methodology. It is necessary, however, that a brief comparison of the empirical and historical methodologies is made to articulate the focus.

Historical research methodology may be simply explained as an attempt made by the researcher to systematise as accurately as possible the past events of human activities. The preoccupation of the historical researcher includes a consistent explanation of the past by the use of Primary and Secondary sources. He may observe, read, or study archival records in collecting, organising, analysing, synthesising and making inferences. There are two important strategies in the work of the historical researcher. These include:

1. Historiography: and
2. Chronology.

Historiography is the genuine method of historical research. It is the sensitive collection organisation and interpretation of events. It is the supreme court of the historical methodology. Chronology, on the other hand, is not research. It is the chronological arrangements of historical events according to dates. Even though attempts are made thereby to
explain the events, it is not research. It is important to note. However, that
dimensions of historical time and historical space are important aspects of
history methodology. Historical time imposes the temporal influence of
events on the interpretation of historical data. The historical space
imposed the influence of context of events on the data and its
interpretation. Hence to note that an event happened long ago is not
sufficient, where it happened brings another dimension to the
interpretation of data.

Another important aspect of the historical research is the issue of
external and internal validity of sources. External validity wants to know
the authenticity of the sources of the historical information. How true
(genuine) is this information? Is it primary, first hand information
(primary source)? Internal validity is the issue of meaning. What does the
information mean? What was the motive of the author? Is the information
logically put, exaggerated, counterfeited, distorted or minimized? How
accurately has the meaning reflected the motives of the original author?
These issues are central to historical methodological thinking. Historical
methodology relates to the empirical methodology in only one aspect, that
is, it is the type of methodology that is used in the organisation of the
review of literature, or the background to an empirical study. It is to be
noted here that the strictly historical researcher still does more than a
reviewer.

Since details of the empirical research methodology will be given
later, a simple comparison of the two methodologies are given below:

<table>
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<th>Table 1.1 Comparison of Historical and Empirical Methodology</th>
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<td>Historical Methodology</td>
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<tr>
<td>1. Study of archival records of past events using primary, secondary and tertiary sources</td>
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<tr>
<td>2. Historiography</td>
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<tr>
<td>3. Uses external and internal validity to check the authenticity and meaning of information from sources</td>
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<td>4. Makes inference with consideration to:</td>
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Summary
Research is an orderly, organized, systematic and consistent pattern of thinking that gives structure and direction to an investigator's knowledge off acts and methods.

Post-Test
1. Explain the concept of research.
2. What is empirical research?
3. Describe the concept of historiography.
4. List five characteristics of research and explain each.
5. In tabular form, compare empirical research with historical research.

Reference
LECTURE TWO

The Context of Research

Introduction
In this lecture, you are exposed to the steps to be taken in selecting a population for study. This is because the success of a particular research effort lies in the accuracy with which the population is selected from the real world.

Many times; time, resources and other constraints may not allow an investigator to observe the whole population selected for study. He needs to select a sample of the population for study. The accuracy with which he selects the sample is also vital to the success of the investigation. This is because inferences about the population are made through the sample. Another issue to consider is the feasibility of the research within the natural context.

Objective
At the end of this lecture, you should be aware of the critical importance of accurate isolation of the population and sample using objectives sampling strategies.

Expectations
After this lecture, you should be able to know how to choose populations and samples for study objectively.
Pre-Test

1. What is the research population? Explain the steps to be taken in isolating a population for study.
2. What is a sample? Explain the concepts of
   a. Objective samples and
   b. Subjective samples
3. What are random samples?
4. Describe the technique of the selection of a stratified random sample.
5. Discuss the importance of careful consideration of the feasibility of research before staking materials, time and money on a research project.

CONTENT

The context of research defines the place where data is collected. This context of research is very vital to the overall productivity in empirical research. The context may be homogeneous. Since the collection of data presupposes that the context has been carefully defined and the target population specified, it is important that any empirical behavioural research should carefully understand this concept.

Population

Most empirical researches in the behavioural disciplines often begin with the specification, and definition of the target population. The population does not represent the census of a place. Rather it is a collection of all elements with one or more attributes in common. The population represents a specified segment of the real world with common definite specified characteristics. The population may be homogeneous or heterogeneous depending on the elements of units within it. Thus one can speak of the thirteen year olds in Nigeria. All the thirteen year olds within the Nigerian country, representing a population.

Sample

The sample is an important element within the context of empirical research. This is because, operational issues connected with data
collection are often done by the selection of the sample and then inference about the population is made through the sample.

\[
\text{"Real World Population Sample } X \rightarrow \bar{X} \rightarrow \mu \bar{X} \rightarrow \mu
\]

**Figure 3.1 Sample Data**
The relationship of the real world, population and sample is represented diagrammatically as in Figure 3.1.

**Sampling**
When a researcher collects a group of observations in order to answer questions about a larger population, he has collected a sample. This is why a sample is often defined as a sub-unit of the population. The sample selected should represent the mother population as closely as possible.

If for example, a researcher intends to study the Biology achievement of all class three adolescents in Nigeria, he has to collect a sample of these adolescents, since he cannot obtain all the adolescents in this category spread all over the country. The researcher may also want to study all the adult neurotic people in the country. He must be sure that his sample of neurotic subjects represents as closely as possible all the adult neurotics in the country.

Because it is not always possible to identify all the relevant strata of a population or know what is typical, researchers often resort to the sampling process. That is, researchers select subjects or observations from a population by a predetermined scheme which should avoid any bias. It is the techniques and procedures which researchers use in selecting observations or elements from a population that is called the *sampling process*. Sampling is undertaken:

a. to avoid bias of selection;

b. reduce cost of research operations;

c. speed the process of research; and

d. collect samples of observations or recorded observations where the
whole population cannot be easily reached.

Characteristics of population vary from time to time. For examples, populations may be:

a. Homogeneous mass of discrete units
b. Discretely defined strata of different units (heterogeneous)
c. Heterogeneous mass containing definite strata but with differing units within it
d. Cluster of elements or units.

Hence, any procedure or technique for selecting elements from any given population must be designed to suit the structure of the population. On the basis of their selection, samples are broadly classified into two broad categories:

1. Subjective or purposive or non-probability samples
2. Objective or non-purposive or probability samples.

**Subjective Sampling Techniques**

Subjective samples are also called purposive samples because they are products of selection techniques based on the researcher's perception of their usefulness. It is a non-probability sampling technique where all the individual members of the population do not have an equal chance of being selected. Non-probability sampling is less expensive and it is easier to generate samples using this technique, however, bias is usually inevitable. Examples of non-probability samples are;

**Convenient Sampling:** this is also known as haphazard sampling because it involves getting participants wherever you can find them and from a convenient place. For example, you need 100 students for your study and you stand at the school gate and ask every student entering the school to participate in your study.

**Quota Sampling:** this involves ensuring that the sample is like the population on certain characteristics, though not sampled from the population randomly. The researcher just selects participants wherever he finds them and through whatever means is convenient.
Objective Sampling Techniques

The main force in the objective sampling technique lies in the fact that it ensures unbiased selection of elements within the population. It is a probability sampling method because every member of the population is given an equal chance of being selected. There are many ways of sampling to ensure representatives:

1. **Systematic sampling technique**: This technique may select every \( X \)th element of a population. For example, in a city, the researcher may select every 4th student in a classroom, every 5th house in an area for his study.

2. **The random sampling technique**: The importance of this technique is that it is more likely to lead into an unbiased selection of elements if it is properly carried out. The main technique lies in the fact that every element in the population is given an equal chance of being selected for study. This could be done by:
   a. The hat method. Give every element serial numbers written probably on small pieces of paper. Then mix thoroughly and select a sample. This procedure is continued until the sample size has been selected. The product is a random sample.
   b. The table of random numbers could also be used to select a random sample.

3. **Stratified Random Samples**: When a population is greatly heterogeneous, it might be necessary to first stratify it by dividing it into a set of mutually exclusive sub-populations. Random samples are then selected from each sub-population.

4. **Multistage Random Sampling**: Sometimes, when a population is terribly heterogeneous, it might be necessary to select random sample in stages. For example, a researcher might randomly select some schools within a number of schools in a state. At another stage, he can then randomly select some schools from his selected schools.

5. **Cluster Samples**: In many school settings, each class may have about 30 students who have the same age, sex, etc. These are natural clusters for each school level. Data may be collected from these clusters without the fear of bias.
Feasibility of Research

Many times, young researchers conceive interesting ideas that may not be empirically feasible. This is because data collection may be impossible, the population of interest may not be available for sampling, and there may be many other administrative problems mediating observation of phenomenon. These are feasibility problems. These should be considered at the early phases of research thinking.

Summary

The context of research describes the real world, population and sample observed in a study. The feasibility of research is critically indicated by a consideration of the research context.

Post-Test

1. What is the research population? Explain the steps to be taken in isolating a population for study.
2. What is a sample? Explain the concepts of
   a. Objectives samples and
   b. Subjective samples.
3. What are random samples?
4. Describe the technique of the selection of a stratified random sample.
5. Discuss the importance of careful consideration of the feasibility of research before staking materials, time and money on a research project.

Reference

LECTURE THREE

Problem Definition in Research

Introduction
This is an unusual fascination for the birth of an idea, the idea behind any research investigation is a description of the creative thought processes mobilised by an investigator in isolating a problem for study, it is thus a problem solving exercise.

You are exposed to the fascination of looking for a researchable problem in this lecture. In the lecture, your awareness is increased about the sensitivity, tenacity and orderly sequence of ideas that make the problem to be investigated crystal clear.

Objective
At the end of this lecture, you should be exposed to the step by step procedure which you have to follow to get a researchable problem.

Expectations
After the lecture, you should be able to look for a researchable problem without much worry.

Pre- Test
1. Why is it often difficult for an investigator to isolate a researchable problem?
2. Explain the ideas behind any research endeavour.
3. List and explain five creativity principles that are useful in developing a research topic.
4. How can an investigator develop adequate background to his study?

5. What is the use of a literature review in an empirical study?

CONTENT

When one writes about the idea behind research, one is really writing about creativity. There is an unusual elegance associated with the birth of a new idea. The idea behind research is a description of the creative thought processes mobilised by an investigator in describing or putting forward a researchable problem. It represents the various attempts made by the investigator to see all the sides to his ideas until they are stated in a researchable form. It is the fun of research and the greatest moment of excitement in research endeavours.

If an investigator is ignorant about the systematic of creative thought processes behind a research, he may wonder and vacillate for hours until he is illustrated. In short, he is robbed of the moments of excitement and the periods of nm which are the reinforcing elements in research endeavours. This is why this section is devoted to explaining some basic principles of creativity on problem finding, problem definition, problem acceptance and the research process.

Problem Finding

The first step to take in carrying out a research is to discover a problem which forms the basis for the research. At this stage, a lot of students find it very difficult to rightly define the many ideas they have on their mind. There are many avenues to selecting a research problem for a study;

The easiest approach to finding a problem is to start with the ideas of others. Many researchers have carried out several researches on various topics. As a beginner, you can carefully study their researches and identify the gaps in that study which can form a basis for your own study. For example, a researcher may have carried out a study on the predictors of academic failure, identifying certain variables that could possibly be responsible for academic failure. You can take a lead from there and investigate other variables the previous researcher did not address in his study or investigate possible solutions to the problem already discovered.

Secondly, students can arrive at a problem of interest by reviewing various
theories in their area of study. Theories that are of interest to the students can suggest possible problems that could be addressed by the applicability of those theories. For instance, Albert Bandura’s theory of self-efficacy could suggest to the researcher the relevance of self-efficacy belief to students writing an examination without cheating.

Thirdly, another avenue to finding a problem in research is through natural observation. On a daily basis there are lots of events that occur that poses a form of concern to man. These concerns generate some questions on the mind of the individuals concerned which can be well framed into a researchable topic. For example, based on observation, the researcher can ask questions like; why do some students continuously cheat in an exam while some others don’t attempt it at all? Why do some husbands beat up their wives even to death while some others care so much for their wives?

Another avenue students can arrive at a problem of study is from the practical problems encountered in daily life. Research is primarily aimed at proffering solutions to practical problems in daily life. Students can identify some problems that need to be addressed and investigate possible solutions to them. For instance, the issue of campus unrest can be of a concern to students and can prompt them into investigating possible solutions to that problem.

Basic creativity principles in searching for a researchable problem include ability of the researcher to be:

1. sensitive to problem. This includes his ability to describe many specific problems which could be appropriately attacked. Ability to articulate many elements of the situation and ability to employ available elements to extend an analysis of possible problems.
2. able to define problems by recognising all the aspects of the stated question. At times he may attempt to broaden or redefine by asking why, what, how, etc. Identify several sub-problems which are more manageable.
3. able to break away from habit bound thinking.
4. able to defer judgement. Here, the researcher should be able to produce many responses, give responses without imposing internal evaluations, and refrain from evaluating responses before he has recorded them.
5. able to see new relationships by identifying similarities and
differences among a set of mutually exclusive properties (variables).

6. plan for implementation of ideas by identifying specific sources of difficulty in implementing ideas, and demonstrate the use of implementation checklists, key work lists, so as to recognise and overcome possible blocks to implementation.

7. able to observe carefully and discover facts by listing many attributes or characteristics of the problem, describe factors which may influence observations and describe the features, characteristics, and functions of the important parts of the problem.

8. able to use effective techniques for discovering new ideas.

9. able to refine strange ideas into useful ones (use the synectics method).

10. able to use systematic approach to problem solving. Use the formation of direct creativity fact finding, problem finding, idea finding, solution finding and acceptance finding.

If these creativity strategies are consistently followed, one is bound to get a researchable problem within a short period of time.

A much more important step in the process of searching for a problem is the amount of available literature on the topic. Hence the researcher should learn how to search for background literature.

**Finding Related Literature**

Many creative thinking processes start with some basic ideas serving as building blocks. It is important for the researcher to master the background literature to its research topic very well. He has to use the library tool very carefully to get the basic theoretical concepts in his topic of interest. He can start by reading a number of basic text books in his discipline. Using psychology for example, he may want to read books like:


The researcher should also consult annual reviews like:

1. The Annual review of Psychology
2. The Review of Educational research. etc.

He should also consult people who are knowledgeable in the discipline.

There are psychology journals that are devoted to broad reviews and dissemination of current findings. Psychological Bulletin is a good example. There are abstracts that can bring the summaries of recently conducted studies to the investigator. Psychological abstracts is a good example. Of course there are dictionaries and encyclopaedia which can give important directions about the topic the various dictionaries of psychology, the dictionary of psychological and psychoanalytic terms English and English. etc. are useful examples. Having thus imbibed the best of literature in the field, the investigator can then consider the following steps:

1. Develop the confidence and courage to try. People who never try hard never get
2. Do not be inhibited or blocked. There are cultural, perceptual and emotional blocks to creativity. Avoid any of these possibly by the use of the deferment of judgement principle for your ideas. That is, do not judge your ideas for their quality until you have written them down.
3. Use the brainstorming technique in a group to get your problems solved. Criticism is not allowed when this method is used.
4. Use the creative problem solving approach.
   a. see all the parts to the problem
   b. magnify it
   c. minimise it? - make smaller
   d. reverse it
   e. remove something
   f. add something.
5. Consider different aspects of the problem one at a time.
6. Talk to people about it.
7. Try and observe the problem if you can.
8. Use the work rest strategy. Take occasional rests.
9. Evaluation of your ideas should come last.

Summary
The idea behind a research investigation is often a confusion about the topic to be investigated. This is why the problem solving strategy is suggested as a way out of such confusion. The investigator needs to:
- Develop a point of view
- Identify and define the problem
- Find ideas that can solve the problem
- Choose the best of the ideas
- Try out the best possible solution.

Post-Test
1. Explain the ideas behind any Research endeavour.
2. What is the use of a literature review in an empirical study?
3. List and explain five creativity principles that are useful in developing a research topic.
4. How can an investigator develop adequate background to his study?

Reference
LECTURE FOUR

Empirical Research Methodology and Designs

Introduction
In this lecture, you are exposed to the step wise sections of the empirical research methodology. Empirical research methodology is considered to be a product of careful observation, careful records of what is observed, careful analyses of what is recorded and careful description and explanation of the patterns obtained. Hence, empirical research methodology is considered in this lecture as a description of what can be observed, investigated, measured, analysed and explained.

Objective
The major objective of this lecture is to learn the concepts that empiricism involves careful observation, measurement, recording and explanation of behavioural phenomena.

Expectations
At the end of this lecture, you should be able to discuss the fact that observations, measurements, careful recording, analyses and explanation of findings form the bed-rock of empirical research methodology.

Pre-Test
1. What is empirical research?
   Explain the reasons for the label empirical.
2. Explain the following attributes of empirical research methodology:
   a. Observation
   b. Analyses and organisation of data
c. Verification

d. Generalisation.

3. What is measurement?
   Explain the nominal, ordinal, interval and ratio scales of measurement.

4. Explain three methods of objective observation in empirical research methodology.

5. Discuss the reasons for investigators preference for empirical methodology for investigating behavioural phenomena.

CONTENT

Empirical research method is simply derived from careful observation, careful records of what is observed, careful analyses of what is recorded and careful description and explanation of the whole procedure as they impinge on the senses. This is why this method of investigating the truth of a problem is described as empirical. That is, what can be observed, what can be investigated and what can be measured, analysed, described and explained. The power of the empirical research methodology lies in its emphasis of methods, procedures and techniques rather than content. This is why it continues to improve itself by re-examination of existing methods. Content of knowledge is often a product of active empirical research activities; it is not the main emphasis.

   Empirical research methods can then be described by the following characteristics:

   1. **Observation**: Any study that is empirical should utilise the technique of careful and controlled observation. Observation may not always be visual; the researcher might use any of the senses to observe, e.g., the ear, the skin, the nose, etc. Many empirical research studies observe events by the use of scales, check-lists, questionnaires, inventories and so on. After careful observation, empirical research goes ahead and makes recorded observations. It is the recorded observations that are often described as data.

   2. **Analyses and Organisation**: Having made recorded observations (collected data) empirical researcher moves a step further and organises his data into meaning aggregates. This is done by classification of data from which meaningful inferences are made.
3. **Verification**: Having observed, and having collected data which is classified, the empirical researcher goes ahead to test his hunches by looking at his results and how they relate to his tentative guesses (hunches and hypotheses). This sort of exercise establishes or rules out the truth or validity of the facts that the researcher has been considering.

4. **Generalisation**: The results of his observations, analyses and hypotheses testing guide the researcher in making general inferences, rules and laws concerning the knowledge area he has been investigating. This generalisation helps him to build theories and constitutes the core of the knowledge accumulated by the researcher. This approach has been carefully developed and its methods have been reduced to a set of rules which can be followed by many aspiring researchers.

**Research Designs**

While all empirical designs utilise the scientific method, there are a lot of differences in the ways the scientific method is utilised by design. This is why it is probably necessary that some of the empirical research designs are first listed and briefly described so that some of the differences might be isolated.

Empirical research designs include the following:

1. Descriptive survey research
2. Developmental research
3. Correlational research and
4. Experimental research.

There are many more empirical research designs, these few examples are enough to illustrate the peculiarities of empirical designs.

**Descriptive Survey Designs**

One of the most frequently used designs within the empirical research methodology models is the descriptive survey method designs. Here, the
researcher starts inductively from observation and carefully studies the existing attributes of a particular event in the real world. It is this careful and methodical observation of events that is called the descriptive survey method. Any study that utilises the descriptive survey method relies very heavily on careful observation of existing events in the real world. This method does not manipulate anything in the specified aspect of the real world for study. It does not add to it or delete; it only carefully observes and records information as they naturally occur at the point in time when the study is being conducted.

**Administering the Survey**

There are various methods of surveying but we will consider three methods along sides their advantages and disadvantages – mail survey, telephone survey, and personal interview.

**Mail Survey** – this is a method of collecting data, whereby the researcher writes down a number of questions for a target population and sends them either through the traditional mail system or through e-mails. The respondents are expected to answer the questions and send them back to the researcher. It is important to note that a mail survey must be clearly written in simple terms and self-explanatory because the researcher will not be physically present to explain terms not well understood by the respondents.

**Advantages of Mail Survey**

1. It saves time and it is less expensive because the researcher could send a number of mails at the same time and receive the reply within a short period of time.
2. It allows the researcher to collect data on more sensitive issues because the respondents may not be willing to discuss their personal lives with the researcher face to face.
3. Emails can be sent to all part of the world i.e it creates room for a wider coverage
4. It eliminates the researchers bias because there is no personal contact with the respondents

**Disadvantages of Mail Survey**

1. In cases of ambiguity, there could be misinterpretation because the researcher will not be present to properly explain his intensions to
the respondents.

2. Not all the mails may be returned to the researcher as some respondents may be nonchalant.

3. The questions can be attempted by some others who are not his target respondents, providing wrong information.

**Telephone survey** – this involves telephoning the participants and reading the questions to them. This avenue will enable the researcher clarify any question that is not clear to the participants. It further gives the researcher the opportunity of probing further if not satisfied with the answers of the respondents.

**Advantages of Telephone Survey**

1. The researcher is more likely to get a better and more immediate response using a telephone than when sent to a mail.

2. Participants are more likely to express themselves on the telephone than in mails.

3. The researcher has a greater chance of getting information from his target population than in a mail where someone else could respond to other than the actual respondent.

**Disadvantages of Telephone survey**

1. In our contemporary times, people are more suspicious of telephone calls than mails

2. The respondent can easily be agitated if the researcher is probing further than expected

3. The telephone conversations can easily be interrupted by poor signals

4. It is more time consuming and very expensive

**Personal Interview** – this involves the researcher having a face-to-face conversation with the respondents. This avails the researcher the opportunity of asking the respondents questions directly and receiving instant responses than the mail and telephone survey.

**Advantages of Personal Interview**

1. It allows the researcher to record not only the verbal response of the participants but the bodily expressions which portrays the true intent of the respondents in most cases.

2. Participants devote more time in answering the researcher than on
1. Responses are usually quick and instant
2. Ensures appropriate selection of participants

**Disadvantages of Personal Interview**

1. The interviewer may be bias probably due to his perception of the respondents
2. The participants may give socially desirable answers which may be wrong for fear of stigmatization.
3. It is highly expensive and time consuming

Certain basic conditions should be fulfilled before a descriptive survey study is conducted:

1. The researcher should know the meaning and variety of observations.
2. The researcher should carefully isolate the population aspect of the real world he wants to observe and study.
3. The researcher should carefully choose his sample.
4. The researcher should choose a statistics that is adequate for bringing out the meaning out of his data.
5. The researcher should be methodical so that he does not distort information which often result in wrong conclusions

**Correlational Research Design**

The correlational research design may be described as a type of empirical research design which attempts from the onset data collection to find relationships between operating variables in a particular population. It uses the strategies of the descriptive survey design. The correlational researcher may, therefore, observe a number of characteristics such as the peer group’s problems, juvenile delinquency, developmental and other psychological problems of adolescents. This could be carried out in a country, a state or a community. Having collected data on these adolescent adjustment problems, he may want to know how peer group problems are related to juvenile delinquency problems. He may also like to know how developmental problems are related to other psychological problems.
researcher can in fact decide to engage in a multi-correlational research endeavour and hence attempt, in a study, to find the relationships between all these adjustment problems of adolescents.

**Experimental Research Designs**

There are times when the researcher is interested in what is *causing* what in a particular population. Since the question of *Cause* and *Effect* cannot be resolved by mere observation or description of events as is done in descriptive survey designs, the researcher has to adopt some other designs. It is useful to remember that in the descriptive survey designs, the experimenter was a keen observer of events. He did not cause things to happen, he did not do anything, to the self concept of adolescent he only attempted to observe his behaviour as nature has made it to occur.

In experimental designs, the researcher is not only a keen observer of events; he makes some deliberate efforts to make things happen in a population. In conducting an experiment, an experimenter attempts to find a cause and effect relationships between two variables by producing a change in one, in the hope of changes in the other.

**What is a Variable?**

A variable is a set of mutually exclusive properties such as sex with a set of boys and girls, height with a set of tall and short, self-concept with a set of adequate and inadequate and so on. A number of symbols are used in the design of experiments. The symbols denote the experimenter's variables.

**Types of variables in an experimental research**

In conducting experiments, there are three main variables. These include the independent, the intervening and the dependent variables.

**Independent Variable** – this is the variable which the experimenter changes and it is denoted as (I.V.).

**Dependent Variable** (D.V.) - this is the variable which is observed to see whether there is an effect brought about by the independent.

**Intervening Variables** – these are the variables in an experiment that may mediate a direct relationship between the independent and the dependent variables.

An example is given to illustrate the types of variables: to study the way stimulation of self-concept in adolescents can affect their anxiety levels
when examination is approaching. The experimenter can design an experiment where self-concept is manipulated to see changes in the adolescents' level of examination anxiety. The experimenter has to make an initial observation of both self-concept and examination anxiety in the experiment. The first observation of self-concept and examination is denoted \((0)\). The experimental treatment (manipulation of self concept) is denoted \((X)\). The observation of self-concept and examination anxiety after treatment is denoted \((0_2)\), the variable manipulated in the experiment is the self concept. This is the independent variable \((I. \ V)\) the variable observed to see effect is examination anxiety. This is the dependent variable \((D. V)\). A number of possible intervening variables might be such things as the adolescents’ level of intelligence, socio-economic status, genetic pre-dispositions and anxiety proneness. All the elements in the experimental design can be tied together to show the main features of a typical experiment.

Thus:  
\[
\begin{array}{ccc}
0_1 & \times & 0_2 \\
0_1 \text{ Self-concept} & \times & \text{Treatment} & \times & 0_1 \text{ Self-concept} \\
\text{Exam. Anxiety} & \times & \text{Treatment} & \times & \text{Exam. Anxiety after Treatment}.
\end{array}
\]

A change in dependent variable produced by the independent variable is known as experimental effect.  

**Experimental effect** may be known through the analysis of the difference between \(0_2\) and \(0_1\) \((0_2 - 0_1)\). A plan is absolutely necessary in conducting experiments, It is this \(I. \ V = \text{Level of Self-Concept}\) and plan that is called the experimental design. See Table 8.1.
Table 8.1  I.V. Levels of Self-Concept and Examination Anxiety

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Non-Treated Self-concept before treatment</th>
<th>Treated self-concept after treatment</th>
<th>Exam. Anxiety before treatment</th>
<th>Self-concept after exam anxiety treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>S₁</td>
<td>80</td>
<td>50</td>
<td>120</td>
<td>50</td>
</tr>
<tr>
<td>S₂</td>
<td>70</td>
<td>60</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>S₃</td>
<td>90</td>
<td>60</td>
<td>105</td>
<td>80</td>
</tr>
<tr>
<td>S₄</td>
<td>50</td>
<td>58</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>S₅</td>
<td>60</td>
<td>70</td>
<td>110</td>
<td>80</td>
</tr>
<tr>
<td>S₆</td>
<td>80</td>
<td>80</td>
<td>200</td>
<td>70</td>
</tr>
<tr>
<td>S₇</td>
<td>85</td>
<td>65</td>
<td>120</td>
<td>65</td>
</tr>
<tr>
<td>S₈</td>
<td>70</td>
<td>70</td>
<td>150</td>
<td>80</td>
</tr>
<tr>
<td>S₉</td>
<td>75</td>
<td>81</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>S₁₀</td>
<td>60</td>
<td>60</td>
<td>150</td>
<td>120</td>
</tr>
</tbody>
</table>

The features of the experimental design show:
1. The variables (Independent and Dependent).
2. The Pre-treatment observations (0₁)
3. The experimental Treatment (X) and
4. The Post-treatment observations (0₂).

A general observation of the changes in the level of anxiety shows that subjects level of examination anxiety tended to increase as the self-concept was increased.

Summary
Empirical research methodology is best described under 4 sub-headings:

- Observation and data collection
- Analyses and organisation of data
- Verification
- Generalisation.
Post-Test

1. What is empirical research? explain the reasons for the label empirical.

2. Explain the following attributes of empirical research methodology:
   a. Observation
   b. Analyses and organisation of data
   c. Verification
   d. Generalisation.

3. What is measurement? Explain the nominal, ordinal, interval and ratio scales of measurement.

4. Explain three methods of objectives observation in empirical research methodology.

5. Discuss the reasons for investigators preference for empirical methodology for investigating behavioural phenomena.

Reference

LECTURE FIVE

The Scientific Method

Introduction
This lecture critically exposed you to the fact that the method derived from using the set of rules of the empirical research methodology is often described as the scientific method.

Science is described in the lecture as a body of systematised knowledge. The knowledge is accumulated by rigorous use of the scientific method. The investigator pays more attention to the sensitivity of the science method rather than the body of knowledge accumulated (though the knowledge is important).

The important requirements of the scientific method are emphasised in this lecture.
The requirements include:
1. Abundant knowledge of facts
2. Abundant information about methods

Objective
At the end of this lecture, you should be able to discuss the fact that the scientific method always adopts the scientific emphasis in the search for knowledge.

Expectations
After this lecture, you are expected to know the following generalisations about Science. For the Scientist:
1. Truth is an unattainable ideal.
2. Science denies finality.
3. Science is a self-appraising discipline.
4. Science assumes that nature is ordered.
5. There is a distinction between scientific knowledge and scientific methodology.

Pre-Test
1. Differentiate between empirical and scientific methodology.
2. Explain the following requirements of scientific methodology for the researcher:
   a. Abundant knowledge of facts
   b. Abundant information and methods
   c. Scientific methodology.
3. Explain the basic generalisations about science.
4. Differentiate between scientific subject matter and scientific methodology.
5. Explain the relevance of inductive and deductive logics as used in scientific methodology.

CONTENT
Science is often described as a body of systematised knowledge. Here, in this definition, the common man may be putting his emphasis in the wrong direction if he feels the importance of science lies in the knowledge accumulated. The definition clearly shows that for any information to be called a science or scientific, careful analysis of how such information has been accumulated must indicate that it has been systematically derived. Hence, the definition of science lays more emphasis on how a body has been accumulated. When it is systematically accumulated, it may be described as science. When one cannot systematise the way such body of knowledge has been accumulated, one cannot describe such information as science. Hence, the factor present in scientific endeavours is scientific thinking. The scientific method utilises a set of rules for describing and explaining the problems of the real world. It may be said that the scientific method is a problem solving strategy for describing (achieving the empirical goal of science) and explaining (achieving the theoretical goal of science) phenomena.

Three important requirements stand out clear in scientific
methodology.

The scientific needs:
1. Abundant knowledge of facts;
2. Abundant information about methods, strategies and technique; and
3. Scientific thinking, courage and adequate ideas to give direction to his knowledge and methods.

It is the scientific thinking (ideas) that gives shape and direction to scientific operations.

Scientific method is characterized by the fact that it rests firmly on operational definitions, controlled observations, repeated observations, generalisation, confirmation and consistency. It never claims finality, this is its power in that it continues to struggle to improve and make its strategies more sensitive.

Scientific method also utilises overlapping logic patterns.
1a. inductive logic
   b. Deductive logic.

**Inductive Logic**
Inductive logic assures that the researcher begins his investigation by observing certain separate instances of its occurrence. As a result of his observations, he makes a statement or proposition concerning his observations. This simple outline describes the process of inductive logic.

**Deductive Logic**
Deductive logic starts with statements of proposition. From such statement, it attempts to arrive at truth. This is why deductions are often preceded by logical reasons to support the conclusion.

This is also why inductive logic tends to overlap with deductive logic on a continuum or even circular in that conclusions from deduction can lead to further induction.
Attempts are often made by researchers to relate one variable to the other by statements of guesses or hunches. Such statements are often described as hypotheses. Such explanatory statements help in organising and reducing data. It is from the tests of these explanatory statements that the rules of science are generated. In other words, any statement made to relate variables in studies constitutes the principles that characterise science. These include:

1. The principles of operational definition
2. Controlled observations
3. Repeated observations
4. Confirmation and
5. Consistency.

From the above outline about science, one can see that the only common factor running through all accepted sciences, is the Methodology by which facts concerning certain problems are gathered. Hence, the contribution of science to knowledge is more its methodology rather than facts.

The Scientific Emphasis in the search for knowledge includes the following principles:

1a. Science may be described as an empirical search for order.
   b. Science seeks to discover, describe, and utilise lawful relationships among events.
   c. The events of science may range from the activity of a single
brain cell to the actions of a large social group.
d. Variables are a set of mutually exclusive properties that can vary in terms of quantity, quality, and type.
e. Science seeks orderly relationships between the values of these variables.

2. The common assumption among laymen is that science is the royal road to research success and that:
a. Truth is an unattainable ideal.
b. Science denies finality.
c. Science is a self appraising discipline.
d. Truly unique or undescribable phenomenon fall outside the realm of Science.
e. Science assumes some degree of determinism or order in value.

3. There is a distinction between:
a. Scientific subject matter; and
b. Scientific methodology.

Scientific subject matter is virtually any topic about which testable statements can be made. While scientific methodology is a loosely structured collection of techniques that have been found useful in observing or describing lawful relationships among variables.

Summary
The scientific methodology rests firmly on the principles of:
  - Operational definition
  - Controlled observation
  - Repeated observations
  - Generalisations
  - Confirmation and consistency.

Post- Test
1. Differentiate between empirical and scientific methodology.
2. Explain the following requirements of scientific methodology for the researcher:
a. Abundant knowledge of facts
b. Abundant information and methods
c. Scientific thinking.
3. Explain the basic generalizations about science.
4. Differentiate between scientific subject matter and scientific methodology.
5. Explain the relevance of inductive and deductive logics as used in scientific methodology.

Reference

LECTURE SIX

Testing Research Hypotheses and Answering Research Questions

Introduction
The scientific method involves the use of a number of standard procedures for ensuring validity, reliability and accuracy. One of such procedures is the setting of hypotheses (the null hypotheses) which should be tested in the research studies. The statistical hypothesis or the null hypothesis which is an explicit statement about the characteristics of a population under study is the major substance of this lecture. The findings from the test of such hypotheses form the contributions to the discipline.

Objectives
The main objective of this lecture is to teach you how to state and test statistical or null hypotheses.

Expectations
At the end of the lecture, you are expected to be able to state and test hypotheses.

Pre-Test
1. What is a conceptual hypothesis?
2. What is a statistical hypothesis?
3. Explain the role of the critical region in the test of hypotheses.
4. Explain the importance of the choice of significance level in testing hypotheses. Why is 0.05 level of significance often chosen as the highest that can be allowed in behavioural studies?
5. In what ways are:
   a. significance level
   b. degrees of freedom
   c. critical region related in the test of hypotheses?

CONTENT
The quest of the researcher is often stated as questions in a study. This is usually the practice in exploratory studies where the researcher has got no detailed conceptual models to build upon. He may decide to ask simple questions about his population of interest. After he has observed, collected data and analysed the data he may answer his questions directly from the results of his analysed data.

Thus, a researcher may ask: “What are the main concerns of Nigerian adolescents?” After collecting information about observed concerns of these adolescents, he may analyse the data by rank ordering the concerns. The main concerns of the subjects could thus be known to some extent. Questions may guide researchers about the operating phenomena of a population even in more complicated studies. In short, one can ask questions and answer them through the operation of any research design ranging from casual observations to the most sophisticated experimental designs. The content of a research report is, in fact, not affected by whether questions are posed and answered or whether hypotheses are tested.

On the other hand, researchers may want to pose some tentative or intelligent guesses which are called conceptual hypotheses. Such tentative guesses are often derived by a careful consideration of the existing knowledge in the field. Hypotheses, therefore, represent some form of theoretical models which are specifically meant to coordinate and give direction to the researcher's predictions.

A conceptual hypothesis may be stated thus: “There is a significant difference in the self-concepts of counselled and non-counselled adolescents”. This is a conceptual hypothesis which can be tested after the study. After data collection and analysis, the researcher may find that there is a significant difference in the self-concept of the counselled and non-counselled adolescents in favour of the counselled adolescents. The researcher can on the basis of his findings retain his tentative guess (prediction). Many inexperienced researchers tend to state their
hypotheses in a conceptual form. Such researchers make one mistake. This is the fact that they tend to confuse the conceptual hypothesis with the statistical hypothesis. There are differences between the way these hypotheses are expressed and stated. For example, the statistical hypothesis is often described as an explicit statement about certain population characteristics. It is often described as the NULL hypothesis in some texts. This is usually represented by the formula Ho. The statistical hypothesis offers a more distinct and clearer experimental or statistical prediction in a study. To state the example, "there is a significant difference in the mean performance of counselled and non-counselled adolescents" could be expressed in the formula of statistical hypothesis: First, the researcher should state the opposite (NULL) of his belief (i.e. the Ho)

\[ Ho: \mu_1 = \mu_2 \]

Then he has to state his belief as H₁

Thus \( H_1: \mu_1 \neq \mu_2 \)

The researcher has to subject the statistical hypothesis (Ho) to statistical test of significance using prescribed significant levels such as .025, .024, .01, .001, etc. If he is able to reject the Ho in the sense that it is not significant at any of the specified signified significant levels, he can then accept H₁: this type of inductive logic overlaps intimately with the deductive logic in empirical studies. This is the way region and sensitivity is brought into empirical studies.

**Locating the Critical Region**

In testing hypothesis, decisions on acceptance or rejection of the hypothesis is based on probabilities. This is why significance or alpha levels are set at the proposal stage for rejection or acceptance of hypotheses. Typical significance levels include: .025, .05, .01, .001, .0001, etc. The critical region of rejection is defined by those sample variations that deviate so much from the population mean that their inclusion will distort the results of the study. Hence, the critical region
leads to the rejection of the hypothesis. This critical region is affected by the hypothesis directionality the researcher wants to consider in his study. Generally, a population has a mean, an upper region (above the mean) and a lower region (below the mean).

<table>
<thead>
<tr>
<th>Lower Region C.R.</th>
<th>Upper Region C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-ve</td>
<td>+ ve</td>
</tr>
</tbody>
</table>

In a non-directional hypothesis, (i.e. the experimenter is not particular about which of the subjects is superior over the others). The critical region is defined by dividing the significance level into 2. Thus, if the significance level is .05, the critical level will be .05/2 = .025. This is because the researcher can look for his critical region below or above the population mean. On the other hand, in a directional hypothesis, (i.e. the researcher is interested in whether the subjects' means is superior or inferior), the researcher needs to look for his critical region in either the upper or lower section of the curve, if the significance level is .05. The critical region is also .05. The non-directional hypothesis is represented thus:

\[
H_0: \mu_1 = \mu_2
\]

\[
H_1: \mu_1 \neq \mu_2
\]

The directional hypothesis is represented thus:

\[
H_0: \mu_1 = \mu_2
\]

\[
H_1: \mu_1 < \mu_2\]

Choosing the Significance Level

The significance level describes the probability that an hypothesis will be rejected or not. When a researcher is testing an hypothesis, he specifies certain probabilities that the observations he has made may not be so. This probability is the significance level. They are often stated in form of .025, .05, .01, .001, .0001, etc. The significance level is largely determined by the nature of the study. Studies that involve lives might choose extremely small significance levels while other social studies might choose significance levels as high as .05.
Errors in Testing Hypotheses

Errors could be committed while testing hypotheses if the researcher is not very careful. For instance, it is too easily possible that a researcher may reject a true hypothesis or accept a false hypothesis while attempting to make inference. These errors can totally spoil the researcher's effort even at the time of hypothesis testing. The issue of acceptance or rejection of an hypothesis is a delicate balance which scientific methodology has not been able to quite stabilise. The pity of it is that the findings of the whole study might be terribly distorted if the researcher carelessly handles this delicate balance. A table is drawn below to illustrate the nature of the balance. (Decision) about the truth.

Table showing the ways Types I and II errors can be committed.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>ACCEPT</th>
<th>REJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H_0$ IS TRUE</td>
<td>POWER</td>
<td>TYPE I ERROR</td>
</tr>
<tr>
<td>$H_0$ IS FALSE</td>
<td>TYPE II ERROR</td>
<td>POWER</td>
</tr>
</tbody>
</table>

When a researcher rejects a true hypothesis in his study, he has committed a type I error. Whenever he accepts a false hypothesis, he has committed a type II error. It is the probability of committing a type II error in testing a hypothesis, the power of test in a study is defined by $1 - B$ this is because $X$ (probability of committing a type I error) and (probability of committing a type II error) is equal to 1.

In short, as a researcher fails to commit type I error, he may be tending towards committing a type II error and vice versa. It has been observed, however, that it is much more serious to commit a type II error than a type I error. This is not encouraging a researcher to commit type I error which is also bad. This is why researchers are advised to evolve research designs that can eliminate these errors in testing hypotheses. This is why the empirical research methodology emphasises that adequate delineation of topic: operational definition, adequate sampling procedure, careful operation of the study and adequate statistical analysis should precede hypothesis testing. Systematic approach to empirical research studies is the only safe approach known to avoid type I and II errors in
hypothesis testing.

Summary
The statistical hypothesis is also the null hypothesis which should be tested in an empirical study. It is often represented by Ho in research methodology courses. The statistical hypothesis may be tested directionally or non-directionally.

Post-Test
1. What is a conceptual hypothesis?
2. What is a statistical hypothesis?
3. Explain the role of the critical region in the test of hypotheses.
4. Explain the importance of the choice of significance levels in testing hypotheses. Why is 0.05 level of significance often chosen as the highest that can be allowed in behavioural studies?
5. In what ways are:
   a. significance level; 
   b. degrees of freedom; and 
   c. critical region related in the test of hypotheses?

Reference
LECTURE SEVEN

The Research Proposal

Introduction
The research proposal ties the fragments of the bits and pieces of research methodology together in a practical way. This Lecture is designed to increase your awareness about how to write a research proposal.

Objective
The main objective of lecture twelve is to help you examine how to write a research proposal.

Expectations
At the end of the lecture you are expected to be able to write a research proposal for any behavioural study.

Pre- Test
1. Explain the major components of the research proposal.
2. Why is a background review important in a research proposal?
3. Explain the components of the methodological dimension of the research proposal.
4. What are the main issues to consider in the procedure sub-dimension of the research proposal?

CONTENT
The research proposal describes the whole plan of the research. It is basic to the successful execution of researches. The research proposal is like the architectural plan of a building. Without it, one cannot conduct a
systematic research. In fact, without it, the researcher may make omissions or do what he should not do. There are different types of research proposals but for this study, we will focus more on a thesis research proposal.

A thesis research proposal is a proposal submitted to an academic institution for the purpose of a higher degree. A good proposal should provide the outline of the first three chapters of the dissertation. These outlines include;

Chapter one

Background to the study – the first step to take in writing a research proposal is to frame a good research topic that reveals the nature of problem being investigated by the researcher. The background to the study should be able to introduce the readers to the problem under study, the prevalence of that problem in the society, the possible causes, the effect it has on the stakeholders and possibly your interventions in proffering solution to the problem.

Statement of the problem – the statement of the problem should reflect the nature of the problem, its consequences and the need for an urgent intervention in resolving or managing the problem. Statement of the problem should also include isolation of areas of need and concerns and basic difficulties with existing facts on the problem.

Purpose of the study – this reflects the aim or the goal of the researcher in carrying out a research. These goals are explained in general terms and in specific terms.

Significance of the study – these are the benefits of the study. The researcher should be able to state who the stakeholders are and what they stand to benefit from your study.

Scope of the study – this is the area of coverage the study is limited to. The researcher is expected to state both the conceptual boundaries and the geographical boundaries in the study. For example, a researcher may decide to limit his study to secondary school students in Ibadan, which is the scope of the study.

Operational definition of terms – there are major terms in the topic that could have a different meaning other than the meaning the researcher has in mind. The researcher is expected also to define the major keywords in the topic as he has used it in his study.
Chapter two

**Literature review** – this involves reviewing previous studies, theories and comments that are related to the variables under study. This review avails the researcher the opportunity of knowing what areas have been covered and areas yet to be covered and what technique will be most effective in his investigation. Literatures must be reviewed both theoretically and empirically. Theoretical review involves reviewing theories that are germane to the variables under study while empirical review involves reviewing past studies as it relates to the study.

**Conceptual model for the study** – this is a graphical illustration of the nature of the study. For instance, if a researcher is investigating the effect of certain variables on a problem variable to get a desired result, he is expected to graphically explain how the effect of the independent variable will bring about the desired change on the dependent variable.

**Research questions and hypotheses** – these are questions and intelligent guesses that guide the researcher in his investigation.

Chapter three – this indicates the methodology the researcher will adopt in his research these include:

**Research design** – the design shows the nature of the study. This could either be a descriptive design of a survey type or ex-post facto type or an experimental design with factorial matrixes etc.

**Population** - this is the entire element in the study.

**Sample and sampling technique** – the sample is a fraction of the population which must be a good representative of the entire population. The sample is selected using the various sampling techniques.

**Instrumentation** - the instrument the researcher will use to collect information from the respondents. It must be valid and reliable

**Procedures** - this is the step by step actions the researcher will take when collecting his data.

**Inclusion and exclusion criteria** - this is stating the criteria the participants must meet to be eligible to participate in the study.

**Data analysis** – the type of statistical tool the researcher will use to analyse his data. This is determined by the nature of the study.
Summary
The research proposal describes the master plan for conducting a study. It usually includes:
- A title,
- Introduction and background,
- Methodology, and
- Cost or budget.

Post-Test
1. Explain the major components of the research proposal.
2. Why is a background review important in a research proposal?
3. Explain the components of the methodological dimension of the research proposal.
4. What are the main issues to consider in the procedure sub-dimension of the research proposal?

Reference
LECTURE EIGHT

Tools of Research and Analysis of Research Data

Introduction
For an investigator to be able to conduct a research, he needs to be armed with certain research tools. This is why you are exposed to three major tools of research in this lecture.

These include:
   a. Assessment tools
   b. Statistical tools
   c. Library tools.

Objective
At the end of this lecture, you should be able to discuss the critical roles these three tools play in a research investigation.

Expectations
One is expected to know how to use assessment instruments, statistical tests and the library for meaningful conduct of research after the lecture.

Pre-Test
1. Explain the use of assessment tools for the execution of behavioural researches.
2. What is the behavioural observation? In what ways can it be used in the conduct of research?
3. What is behavioural statistics? Why are they important in the conduct of research?
4. Discuss the role of the Library in the conduct of researches.
5. What principles should guide an investigator in the choice of a statistical analytic package for analysing a research data?

6. When do you use:
   a) the chi-square
   b) Pearson's product correlation coefficient;
   c) the t-test;
   d) the analysis of variance for analysing behavioural data?

**CONTENT**

The empirical research is particularly done through some sort of observation using a number of tools. Data collection is the bedrock of this type of systematised approach towards truth. Certain tools are, however, indispensable in data collection. Without these tools, research may be impossible. The tools may be broadly grouped into three categories. These include:

1. assessment tools;
2. statistical tools; and
3. library tools.

**The Assessment Tools**

Assessment encompasses the whole spectrum of methods and processes including the measurements and measures of the attributes the researcher is interested in. It includes:

a. Observations with rating scales, checklists, anecdotal techniques, questionnaires and sociometric techniques.

b. The various tests, inventories and scales.
   i. Formal and informal tests
   ii. Power tests
   iii. Time tests
   iv. Diagnostic tests
   v. General ability, etc.

c. Evaluations and appraisals.
Apart from this general knowledge, the researcher should be able to construct and validate some of the assessment tools. He should be familiar with the various places where the scales can be obtained.

The Statistical Tools
While collection of data is basic to the empirical research endeavour, the data do not mean anything until they have been organised to form meaningful patterns. It is the attempt to organise data in meaningful ways that introduces the statistical principles into the work of the researcher. It is, therefore, important that the researcher is quite familiar with the basic concepts and language of statistics.

What is Statistics?
Statistics is a special language, a tool for organising data so that it becomes more meaningful. Research statistics are often discussed under two principal categories.

a. Descriptive statistics.

b. Inferential statistics.

Descriptive Statistics
Descriptive (nonparametric) statistics is often used when it is possible for the researcher to collect data from the whole population. Having collected data, he organises it into frequency distributions; central tendency, that is, the mean, median and mode. He also finds the measures of central tendencies the range, interquartile range. Semi-interquartile range, the standard deviation and possibly the variance.

Inferential Statistics
At times, measures of relationships (correlations) and chi-squares are found in an attempt to understand the pattern of data distribution. In most behavioural researches, however the total population may not be available. Hence, the researcher resorts to the collection of data from a sample. He then attempts to make inferences on the population from the sample he has collected. The statistical procedure used in doing this is described as inferential statistics.
Signs in statistics are

- Equals
- Not equal to
- Population size
- Sample size
- Sample standard deviation
- Population standard deviation
- Null hypothesis
- Researcher's hunch
- Factorial
- Greater than
- Less than
- The absolute value of x without + or- designation
- The square root of x
- Infinity
- Equal to X or greater than X
- X is very much less than Y
- X is greater than or equal to Y
- Each individual observation.

The general formulae in descriptive statistics with which the researcher must practice include:

1. \( X_i \)
2. \( f_x \)

**Descriptive and Inferential Statistics in Research Methodology**

Research is the scientist's way of finding answers to his questions. He makes systematic observation of some kind: collects data and studies and analyses the observations to find his data. It is in the study and analysis of the data that statistical procedures are used. The question the researcher asks and the kind of data he collects determine which statistical procedures he uses.
Raw Data
This is data in their original form, just as they were collected. These are usually a mass of numbers or words that represent the researcher's observations of the process or subject which interests him. The first step in a research study is to organise these raw data into a table or graph so that the results can be inspected. Sometimes the table or the graph makes the results clear and there is no need for further statistical operations. Also, inspection of the data in some organised form is usually indispensable to a full understanding of the results.

Data may be classified into:
   a. Categories
   b. Ranks
   c. Measures.

Categories
Data are classified into categories when the observations consist essentially of words or names of things. For example, if we record for each student in a class whether he does or does not intend to look for a long vacation job. He will have simply a collection of words, Yes's or No's. There are no numbers to sum, multiply or divide. All we can do is classify each observation in one of the categories 'Yes' or 'No', and count the number of observation in each category.

Ranks
Ranks are numerals that order a set of observations from most to least along a continuum of interest. The rank of a given observation indicates its relative position in the set of observations. When observations can be ordered from 'most' to 'least', so that ranks can be assigned, the resulting numerals are ordinal. Ordinal numerals do not indicate the amount of difference between observations, it is their order that is related to each other.

Measures
A measure is any numerical observation that is intended to convey an amount or magnitude, as opposed to a simple relative position. Unlike ranks, which indicate only order, measures are truly quantitative. There
are many kinds of measures. Besides the familiar inches, pounds, temperature, etc., in psychology, there are test scores and ratings of various kinds:

a. Measures of performance like number of trials or number of errors.

b. Reaction time.

c. Rate of response, etc.

To be useful measures must meet certain standards of reliability.

Choosing the appropriate statistical tool for your data

Many researchers are usually confused in selecting the appropriate statistical tool for data collected. This is important because statistical analysis suitable to a particular study is often selected with the research design.

The factors to consider in selecting appropriate statistical tools are;

The nature of the data: Data are classified into categories, ranks and measures.

Categories are not measure as such. Such data are often obtained from descriptive surveys that require a ‘yes’ or ‘no’ responses. Here, the appropriate statistics is just a simple analysis showing proportions, percentages and so on. The data cannot be subjected to any other robust analysis than these. Descriptive statistics and other graphic illustrations such as bar graphs could be used to describe the data.

Ranks are of numerals showing probably "most" to "least". The data is only showing a rank order. Here the data may be described with certain aspects of descriptive statistics such as bar graphs, charts, histograms, frequency polygons and so on. This type of data cannot be called a measure as such for the data is not terribly quantified.

Measure, which are numerical observations that are intended to convey an amount or magnitude; there are a number of tools in both the descriptive and inferential statistics that could be used to handle such data.

The way the data is organized which is either discrete or continuous

Discrete data are data existing independent of others such as the number of oranges on a tree, the number of pawpaw in the basket, the number of students in a classroom or the number of rats in a cage. These are discrete data. Appropriate statistics to handle such data is simply descriptive
statistics to know what proportions and so on.

**Continuous**, such as the age of students, then one has to choose a statistics that will be able to describe such data. Most behaviours which are observed and recorded as data in psychological, educational and other social studies are continuous. Hence, within the continuous data category may be categories, ranks and even measures depending on what the researcher wants to find.

Data could be organised according to scale types; Nominal, Ordinal, Interval and Ratio scales.

**The Nominal Scales** – do not have a magnitude, no zero starting point neither does it possess equal intervals. It is, therefore considered merely for "naming" for identifying different elements. All discrete data types are nominals and are not real measures. Hence, one cannot do serious statistical analysis but just describe.

**The Ordinal scale** has only one attribute that is magnitude. Hence, one cannot do more than rank order from highest to least in a category. Also, this is not a serious measure, only descriptive statistics is appropriate. Mean, mode, median etc. could be used.

**The Interval scales** have magnitude and equal intervals but no zero starting point. Hence one can add, subtract, and so on. But one cannot multiply and divide. Descriptive statistics such as bar graphs, frequency polygons, cumulative frequency and cumulative percentage graphs, including the shapes of curves could be used to describe data. The normal curve could be utilised in analysing data as some of the curves may be approximating it.

**The Ratio scales** are hardly obtained in most social studies. In the category of scale types, the ratio scale has all the characteristics magnitude, zero starting point and equal intervals, hence all statistical processing are possible with such data. It should be noted that many psychological, counselling, educational and other social studies have data falling within this category.

**The hypotheses to be tested or questions to be answered:** the hypotheses wording reveals the type of statistical tool to use. For example, When you have two or more groups and you want to find the significant difference between them, you use T-test
When you have more than two groups i.e three or more groups and you want to find the significant difference between them, you use ANOVA – Analysis of Variance

When you have two groups and you want to find the significant association among them, you use Chi-Square

When you have two or more groups and you want to find the significant relationship between them, if it is quantitative, you use PPMC – Pearson Product Moment Correlation, but if it is qualitative, then you use SRRC – Spearman Rho Rank Correlation.

**The Research design:** this could be a descriptive design; of a survey type or correlational type or an ex-post facto type. It can also be a quasi experimental study. In other words, the nature of the problem determines the nature of questions or hypotheses; the nature of design; questions determine the design and statistics which will be appropriate. All these should be settled before data collection. These steps generally ensure that the study is feasible in that all equipments and analytic tools are available.

**Library Tools**

The library is indispensable to the researcher. The library is the repository of the knowledge of ages. It is needed by the researcher to develop background to his study, define his problems in researchable form, collect data, test hypotheses and make inference. The knowledge of others tends to reinforce the researcher's idea and makes it much more productive.

The easiest and most effective way of knowing how to use a library is to use it regularly. The library user needs to study the hours, the resources and the cataloguing of the library before he can effectively use it. One of the most important things that the library user has to know, however, is the classification system. This is the aspect of the library function that uses certain classification numbers to indicate where the reader can get a book in a whole forest of books.

Two commonly used classification systems are:

a. The Dewey decimal classification system; and
b. The Library of Congress classification system.

The **Dewey system** converts human knowledge into ten basic categories
such as:

000 general Works
100 Philosophy
200 Religion
300 Social Sciences
400 Language
500 Pure Sciences
600 Technology, and Applied Science
700 Useful Arts
800 Literature
900 History

The Dewey system then classifies each of the ten categories into their subcategories. Thus, the reclassification of the General Work category (000) may be tendered as an illustration:

000 General works
010 Bibliography
020 Library Encyclopedias
040 General collected essays
050 General periodicals
060 General Societies
070 Newspaper Journalism
080 Collected works
090 Manuscripts and rare works.

This trend is followed for the remaining nine categories and could be expanded further.

The LIBRARY OF CONGRESS is another commonly used system of classification but instead of numbers, it uses letters. Thus:

A Philosophy
A General works
B Philosophy, Religion
Apart from mastering the classification systems, the researcher should learn to physically and sometimes manually go round the library, especially the serial section to discover hidden treasures of knowledge.

Some libraries have the undergraduate, the graduate and reference sections properly delimited. The researcher should study the character of the library nearest to his research activities so that he can best utilise the library tools.

**Summary**
The major tools of research are assessment tools such as observations, interviews, tests and questionnaires: statistical tools including descriptive and inferential statistics and the Library tool.

**Post-Test**
1. Explain the use of assessment tools for the execution of behavioural researches.
2. What is the behavioural observation? In what ways can it be used in the conduct of research?
3. What is behavioural statistics? Why are they important in the conduct of research?
4. Discuss the role of the Library in the conduct of researches.
5. What principles should guide an investigator in the choice of statistical analytic package for analysing a research data?
6. When do you use:
   a) the chi-square
   b) Pearson's product correlation coefficient;
   c) the t-test;
   d) the analysis of variance for analysing behavioural data?

Reference

LECTURE NINE

Examples of Analysis of Behavioural Data

Introduction
Many students who did not have a strong mathematical background may find analysis of their data difficult. At times such students may ruin a well designed and properly executed study through distortion of the results. At times, students may ignorantly choose the wrong statistics.

This lecture gives what may be described as statistical recipes to help such students achieve their goals.

Objectives
The main objective of the study is to guide students to analyse data by following a step by step procedure of calculating the various statistical values.

Expectations
At the end of the lecture, you are expected to be able to analyse data and make logical inference.

Pre- Test
1. When is a chi-square statistics used in analysing behavioural data? How do you interprete the chi-square values derived by following the steps in calculation?
2. The Pearson product correlation coefficient is a measure of what? Explain the statistical assumptions underlying its usage.
CONTENT
This lecture provides steps in calculating some statistical data.

1. If the researcher sets out to find relationship between variables, he has to first decide the nature of his data. If the data is from an extensive descriptive survey of large populations, then he can use the various available population correlational statistics such as:
   a. The Pearson Product moment correlation (if the X and Y are continuous).
   b. Biserial correlation if X is continuous but Y is artificially dichotomous as in Pass/Fail.
   c. Point biserial if X is continuous but Y is truly dichotomous as in the mathematics ability of boys and girls.
   d. Tetrachoric correlation if X is/has artificial dichotomy and Y also has artificial dichotomy, but should not be used for nominal and ordinal data.
   e. Phi Coefficient if both X and Y have true dichotomy.
   f. Widespread biserial correlation if X has widespread artificial dichotomy but is continuous.
   g. Triserial correlation if X is continuous but Y has a dichotomy.

There are correlations options for non-parametric data. Thus:
   a. Spearman Rank Order when correlating X and Y that are both ranks. (When 2530 it looks like Pearson r.)
   b. Partial correlation is used when correlating more than two variables.
   c. Multiple correlations is used when correlating one variable with many variables.
   d. Contingency coefficients when correlating X which has two or more categories with Y which has 2 or more categories.
   e. X2 can be used to find independent relationship between variables which are categorised in two ways.
Whereas  
\[ X = \text{Scores on the X variable} \]
\[ Y = \text{Scores on the Y variable} \]
\[ XY = \text{Summation of the products of X \times Y Scores} \]
\[ X^2 = \text{Summation of squared X scores} \]
\[ (\sum X)^2 = \text{Square of the summation products of x scores.} \]
\[ N = \text{Number of pairs of scores.} \]

The correlation coefficient is calculated in the following steps:

1. Arrange the X and Y scores into vertical columns side by side.
2. Multiply each X score by each Y score and sum all the XY products.
3. Multiply the result from step 2 by the number (N) resulting from addition of the number X's with the number of Y's.
4. Square each X score and sum the squares.
5. Multiply the result of step 4 by N.
6. Sum the X scores.
7. Square the result from step 6.
8. Square each Y score and sum the squared scores.
9. Multiply the result of step 8 by N.
10. Sum the Y scores.
11. Square the result from step 10.
12. Multiply the result of step 6 by the result of step 10.
13. Take away the result of step 12 from the result of step 3.
14. Take away the result in step 7 from the result in step 5.
15. Take away the result of step 11 from the result of step 9.
16. Multiply the result in step 14 by the result in step 15.
17. Find the Square root of the result of step 16.
18. Divide the result of step 13 by the result of step 17. The quotient of this division defines the Pearson Product Moment Correlation Coefficient (r).
The Value of $r$ falls within the range $r = +1.00$ to $-1.00$. That is, the range from perfect positive relationship to perfect negative relationship.

**Steps in the calculation of the Chi Square**

(A Non-Parametric) Statistic

The Chi-Square is defined by the formula

$$X^2 = \frac{\sum (O - E)^2}{E}$$

Where $O$ = The observed frequencies in a cell.

$E$ = Expected frequencies in a cell.

The $X^2$ is calculated in the following steps:

**Steps in the calculation of T-Values when Independent Samples are used in a Study**

1. Arrange scores into rows and columns such that the rows represent a level of the factor and the columns another level of the same factor being studied.

2. Sum all the scores in a table to get the overall total.

3. Add all the scores in each row, i.e., obtain sums of rows.

4. Sum all the scores in each column, i.e., obtain sums of columns.

5. Calculate $E$ for each cell by multiplying the sums in rows by the sums in columns for a cell. Divide the product by the overall total obtained in step 2.

6. Find the difference between observed and expected frequencies. Find the square of each of the differences.

**Steps in the calculation of T-Values when Independent Samples are Used in a Study**

$t$ is defined generally by:
\[
t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(X_1^2 - \frac{\sum X_1}{N_1})^2 + \sum X_1^2 - \sum X_2^2}{N_1 + N_2}} + \frac{1}{N_1} + \frac{1}{N_2}}}
\]

Where

- \( \bar{X}_1 \) = Mean of the first group
- \( \bar{X}_2 \) = Mean of second group
- \( X_1^2 \) = Sum of the squared scores from the first group
- \( X_2^2 \) = Sum of the squared scores from the second group
- \( (X_1)^2 \) = Square of the summation of scores from the first group
- \( (X_2)^2 \) = Square of the summation of scores from the second group
- \( N_1 \) = Number of scores in the first group
- \( N_2 \) = Number of scores in the second group

\( t \) is calculated in the following steps:

1. Arrange scores from the first and second groups side by side as 2 columns.
2. Sum the scores in the first group. Squares the result of summation
3. Square each score in the first group and sum the squared scores.
4. Divide the product in step 2 by \( N_1 \).
5. Subtract the result in 4 from the result in step 3.
6. Sum the scores in the second group and square the result of summation.
7. Square each score in the second group and sum the squared scores.
8. Divide the product in step 6 by \( N_2 \).
9. Find the difference between step 8 and 7, subtracting step 8 from step 7
10. Add the results of step 5 and 9.
11. Divide step 10 by \( N_1 + N_2 - 2 \).
12. Multiply the result of step 11 by \( \left( \frac{1}{N_1} \right) + \left( \frac{1}{N_2} \right) \)
13. Find the square root of the result of step 12.
14. Calculate the means of the first and second groups.
15. Find the difference between the means of the first group and second groups. (Take away mean of the first group from mean of the second group i.e. (X₂-X₁).
16. Find t value by dividing the result in step 15 by the result in step 13.
17. Refer your result to the table of t values to determine the significant level of your t value.

Steps in the Calculation of the Correlated t test

The correlated t test is defined by the formula:

\[ t = \frac{\sum D}{N \sum D^2 - (\sum D)^2 / N - 1} \]

Where \( D = \) difference between individual scores in the two treatment conditions.
\( N = \) Number of all the subjects observed on the 2 occasions.

t value is computed in the following steps:
1. Arrange the two scores, pre-text and post-test scores of the subjects side by side into two vertical columns.
2. Subtract each pre-text score from the post-test score (Note the + or-) signs in the difference. The difference represents the deviation score (D).
3. Sum the difference scores (ΣD). Square the summation to get (ΣD)^2.
4. Square each score difference in step 2. Sum, the squared differences to obtain D^2.
5. Multiply ΣD^2 by N.
6. Find the Difference between the result in step 5 and the result in step 3.
7. Divide summation of the differences (ΣD) by the result in step 6.
8. Divide the result in step 7 by N - 1.
9. The result in step 8 represents the correlated t value.
10. The t value obtained is referred to the t test table to find its significance level.

Steps in the Calculation of Statistic in One Way Analysis of Variance (ANOVA)
1. Arrange the scores to fall into treatment columns.
2. Add the scores in each treatment column.
3. Square each raw score and add the squared products.
4. Add the sums of treatment groups in step 2.
5. Square the total in step 4 and divide the squared value by the total number (N) of scores. This product is usually called (C) 'correction term'.
6. Subtract step 5 from step 3 to get the total sum of squares SS\text{tot}.
7. Square the treatment sums and divide by the number or treatment scores. Add the quotients.
8. Subtract step 5 from step 7. The difference is called between treatments. Sum of squares SS\text{bt}.
9. Subtract SS\text{bt} from SS\text{tot} to get within treatment sum of squares SS\text{wt}.
10. Find the degrees of freedom (df) thus:
   \[ \text{df for SS}_{\text{tot}} = \text{total number of scores} - 1 \]
   \[ \text{df for SS}_{\text{bt}} = \text{total number of groups} - 1 \]
   \[ \text{df for SS}_{\text{wt}} = \text{df}_{\text{tot}} - \text{df} \text{bt} \]
11. Derive Means Squares (MS) by dividing SS\text{bt} and SS\text{wt} by their respective degrees of freedom.
12. Determine the F ratio by dividing MS\text{bt} by MS\text{wt}.
13. Compare your F ratio with the critical F values in the F ratio table in the appendix of a statistical table.

Worked Example on the Pearson Product Moment correlation Coefficient.
This is an hypothetical example showing a relationship between the 2
variables termed X and Y.

1. Pair the two observations X, Y as below

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

2. Multiply the two numbers in each pair, and add the products

\[(1 \times 2 + 2 \times 1 + 3 \times 4) = 2 + 2 + 12 = 16.\]

3. Multiply the result in step 2 by the total number of observations

\[(N) \times 16 \times 6 = 96.\]

4. Square each observation from the first variable

\[1^2 + 2^2 + 3^2 = 1 + 4 + 9 = 14.\]

5. Multiply the result from step 4 by N

\[= 14 \times 6 = 84\]

6. Add the observations of the first variable

\[1 + 2 + 3 = 6.\]

7. Square the result of step 6

\[6^2 = 36.\]

8. Square each observation in the second variable, add the values

\[2^2 + 1^2 + 4^2 = 4 + 1 + 16 = 61\]

9. Multiply step 8 by N

\[= 61 \times 6 = 366.\]

10. Add the observations of the second variable

\[2 + 1 + 4 = 7.\]

11. Square the result of step 10

\[7^2 = 49.\]

12. Multiply the result of step 6 with the result of step 10

\[= 6 \times 7 = 42.\]

13. Subtract step 12 from step 3

\[= 96 - 42 = 54.\]

14. Subtract step 7 from step 5

\[= 84 - 36 = 48.\]

15. Subtract step 11 from step 9

\[= 366 - 49 = 317.\]

16. Multiply step 14 by the result of step 15

\[= 48 \times 317 = 15216.\]

17. Find the square root of 16

\[= \sqrt{15216} = 123.3\]

18. Divide the value of 13 by the value of 17

\[= \frac{54}{123.3} = 0.43\]
The value 0.43 is the correlate coefficient (r) if r is positive, it means that there is a positive relationship between X and Y. That is, X increases directly with Y.

If r is very small, this means there is little correlation between X and Y.

If r is negative, that means that there is a negative relationship between X and Y.

**Post-Test**

1. When is a chi-square statistics used in analysing behavioural data? How do you interpret the chi-square values derived by following the steps in calculation?

2. The Pearson product correlation coefficient is a measure of what? Explain the statistical assumptions underlying its usage.

**Reference**

LECTURE TEN

Writing the Report of a Study

Introduction
One of the most important aspects of a research study is communication of the results to colleagues. There are many ways of writing the research report. This Lecture is designed to expose you to one of the most acceptable ways of writing the report of a behavioural study.

Objectives
The main objective of this lecture is to teach you how to write the report of a behavioural study.

Expectations
At the end of the lecture, you are expected to be able to adequately write the report of a behavioural research study.

Pre-Test
1. What is the abstract of a research report?
2. Explain the steps involved in writing a research report.
3. Describe the sub-dimensions of the research methodology of a research report. How best can you write and layout the various parts of the research methodology aspect or a research report?
4. What are the differences between references and bibliography?
5. Describe the steps to follow in writing a journal reference.
CONTENT

One of the most important aspects of a study is communication of the results to others. This important aspect can be accomplished through the report. There are many patterns that could be followed in writing the report of a study. Many empirical researchers tend to agree on the format explained below:

1. Most reports start with the Title. The title is the label given to the report. It should be written in such a way that the reader can easily tell what the study is about even without reading the whole report. In experimental research studies, some authors tend to include certain elements of the study including the independent and dependent variables. Usually, the title of a report should not be too long. Some workers even feel that a title should not be more than twelve words at most.

2. After the title comes the Abstract. Usually, the abstract should contain important ideas of the study. Even though the abstract is a brief summary of the whole study, it should contain the main steps in the study. Hence the abstract should include a statement of purpose, the type of subjects, brief statement of design, data analysis, results and findings. Usually the abstract should not be more than 120 words.

3. After the abstract comes the Statement of the Problem. Readers should be properly introduced to the problem. After the introduction should come statements about the background of the problem. Such statements should include possible social needs and urgency, controversial results related to the problem and possible educational importance. Statement of the problem should include isolation of areas of need and concerns and basic difficulties with existing facts on the problem.

Statement of the problem should also include statements about the purpose of the study. Such purposes may include possible practical uses and objectives for the findings of study. Other issues on the problem include review of literature and clarification of assumptions and concepts leading to evolution of a rational and conceptual frame works when appropriate. Other issues include delimitation of the research problem in variable terms, definition (conceptual and operational terms) of terms and asking of possible
questions or statements about testable hypotheses. If hypotheses are stated, they should have been generated from adequate background knowledge of the literature related to the problem.

4. Background and review of literature ends with stating hypotheses.

5. After the statement of the problem and review of literature come a section which is very important to all empirical research studies. This is the Design and Procedure (methodology). Here, the researcher should clearly explain step by step the:
   a. nature of design;
   b. the sample (subjects);
   c. the instrument; and
   d. procedure of the study.

Under the Design, the report should clearly state and describe the design whether it is a descriptive survey, correlational or experimental design. After the explanation of the design, the report should explain the characteristics of the sample including number, sex, age range and sampling procedure.

The researcher should also carefully explain the instruments which serve as the main tools for obtaining data. The explanation under instrument should include the name of the instrument, the author and psychometric characteristics. After the above outlined element of the design has been settled, the report should now bring in a step by step description of how the study was conducted. This is what is often described as Procedure in research designs. Included under procedure are the details of how the data was collected. Who were the subjects, where they were and how the instruments were administered. All statements made during the process of experimentation and study should be reproduced word for word under procedure.

6. After the procedure come the Results. While there are many ways of presenting results, many empirical researchers tend to agree that as much as possible, results may be presented in form of tables, graphs, lists or figures to which the reporter refers when stating the results. The important thing under presentation of results is that all tables, charts, graphs and terminologies used should be clearly explained so that readers may understand the report. Most empirical results that carry out statistical tests of significance
should include all statistical formulations that led to the rejection or acceptance of stated hypotheses. These statistical terminologies should however, be carefully explained and be written to follow acceptable patterns. Most empirical results should refer to the tables or charts or and barely state what the figures indicate rather than rationalising.

7. After the results have been thus clearly stated, the next stage of the report is, the *Discussion* it is important that the reporter states clearly the limitations of the study before discussing his results. Under the discussion, the results should be carefully explained hypothesis by hypothesis or question by question as the case may be. Part of the discussion should include explanations of the results within the contexts of existing knowledge of the problem. Do the results contradict or corroborate other findings? Or does the result stand out clear on its own? Are there unexpected results? Why? Here the reporter should explain, argue and possibly speculate on his finding. Here lies the researcher's contribution and creativity. Of course, the beauty of research may be screened and spoilt at the discussion stage.

8. The final thing on reporting is *References*. References are those works which the researcher cited in his report only. This does not include all other works he consulted but did not cite. If, however, the researcher wants to include a list of the works he consulted but not cited, then he is not writing a reference but a *Bibliography*. Usually, references or bibliographies are listed in alphabetical orders. First, the author's family name, initials and the title of the work. If the cited work is a journal, the journal name is underlined, then year, then volume and pages. If the cited work is a book or other materials, the title is underlined, then the country or publication, publisher and year should be indicated. Reporters should note that it is better not to indicate a reference than indicate it so poorly that the reader cannot get at it.

**Project Evaluation Scale**
Readers can rate themselves over 100 by this scale which is specifically designed to help you improve your research strategy.
A. **Topic Selection**
   **Topic**
   1. Is related to content 1 2 3 4 5
   2. Reflects knowledge area 1 2 3 4 5

B. **Theoretical Significance**
   **Report**
   3. Provides heuristic suggestions 1 2 3 4 5
   4. Provides challenging ideas 1 2 3 4 5
   5. Clarifies a theory 1 2 3 4 5
   6. Provides meaningful contrast between 2 or more positions 1 2 3 4 5
   7. Integrates related literature into a conceptual model 1 2 3 4 5

C. **Methodological Competence**
   Procedure, Analyses and Inference;
   8. Result in irrefutable conclusions 1 2 3 4 5
   9. Result in logical conclusions 1 2 3 4 5
   10. Maximise statistical controls 1 2 3 4 5
   11. Maximise experimental control 1 2 3 4 5
   12. Specify measurement reliability 1 2 3 4 5
   13. Specify construct validation 1 2 3 4 5
   14. Clarify bases for different results 1 2 3 4 5

D. **Presentation Quality**
   15. Copy is neat 1 2 3 4 5
   16. Tables are in acceptable order 1 2 3 4 5
   17. Report is clear 1 2 3 4 5
   18. Conclusion follows directly from data 1 2 3 4 5
E. Social Importance

Report

19. Has implications for community development
   1 2 3 4 5

20. Could generate national planning policy
   1 2 3 4 5

Total Ratings ________________________________
Signature of Examiner. __________________________

Summary

A research project is not complete without the report. The research report include the title, the abstract, introduction and background, the methodology which includes:

- The design
  - Subjects
  - Instrument
  - Procedure
  - Analyses

The other aspects of the report include results, discussions and conclusions including references.

Post-Test

1. What is the abstract of a research report?
2. Explain the steps involved in writing a research report.
3. Describe the sub-dimensions of the research methodology of a research report.
   How best can you write and layout the various parts of the research methodology aspect of a research report?
4. What are the difference between references and bibliography?
5. Describe the steps to follow in writing a journal reference.
Reference

Further Reading