NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: ESM304

COURSE TITLE: Research Methods and Field Trips in Environmental Science

ESM 304 RESEARCH METHODS AND FIELD TRIP IN ENVIRONMENTAL SCIENCE

BY

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UNIT 1 ENVIRONMENTAL RESEARCH AS A WAY OF THINKING

CONTENTS

1.0 INTRODUCTION

Environmental Research is undertaken within most earth sciences and professions. More than a set of skills, environmental research is a way of thinking and examining critically the various aspects of your environment (drainage, water bodies, slum environment, desertification, etc.); understanding and formulating guiding principles that govern a particular procedure; and developing and testing new theories for the enhancement of your environmental knowledge. It is a habit of questioning about what you do in your environment, and empirical examination to find answers to environmental problems, with a view to instituting appropriate changes for a more environmental friendly habitat. Let us take some disciplines as examples.

2.0 OBJECTIVES

By the end this unit you should be able to

- Explain environmental research as a way of thinking-Identify various questions that are relevant in environmental research
- Be able to obtain answers that address environmental problems

3.0 MAIN BODY

3.1 As environmental impact assessor

Suppose you are working in the field of environmental health or environmental impact assessment, you might be a front-line service provider, supervisor, or health administrator/planner. You may be in hospital environment or work as an out-reach community environmental worker. In any of these, positions, some of the following questions may come to mind:

- What are some of the most common environmental conditions prevalent where my patients live?

- What are the causes of these environmental conditions
- Why do some people in a particular environment have a particular health condition whereas others do not?
- What are the environmental health needs of the community?
- Why do some people use the service while others do not?
- What do people think about the environment?
- How satisfied are the inhabitants with their environment?
- How natural is the environment?
- How can the environment be improved?

You can add many other questions to this list. At times it may be possible to ignore these questions because of the level at which you work. At other times you may make an effort to find answers on your own initiative, or sometimes, you may be required to obtain answers from the residents of the environment for effective administration and planning.

3.2 As a worker in the oil and gas industry:

Let us take another environmental issue. Assume that you are working in the oil and gas industry. Again, you can work at different levels: as a researcher, advocate, academic or environmental activist, piping engineer. The list of questions that may come to mind is endless. The types of question and the need to find answers to them will vary with the level at which you work in the organization. You may just want to find out the monthly fluctuation in the level of flood in lowland region of a selected locality, besides this, there could be many other questions for which you require answers. For example:

- What is the best strategy to promote hygienic environment?

- How many dumpsites are needed for effective disposal of waste in the area?
- What is the effect of government involvement in waste disposal?
- How satisfied are the residents of the area in terms of waste management?
- How much are residents prepared to spend on waste disposal?
- What do residents like or dislike about waste management?
- What type of awareness programme is needed to promote clean environment?
- What are the attributes of a good or clean environment?

3.3 As environmental activist:

To take a different example, let us assume that you work as an environmentalist, lawyer, environmental activist, environmental health officer or sanitation officer, environmental counselor or social worker. While engaging in the process you may ask yourself the following questions

- What are the most common environmental problems?
- How do people react to these environmental problems?
- What is the socio-economic implication of existing environment?
- What are the causes of the existing environmental conditions?
- What resources are available in the community to help the residents' need?
- What are the coping or intervention strategies appropriate for this problem?
- How satisfied are the residents in this environment or area?

3.4 As a supervisor of an environmental agency:

As a supervisor, administrator or manager of an environmental agency, again, different questions may come to mind. Find example below:

- How many people are coming with complaints to my agency?
- What are the socio-economic and demographic characteristics of my clients?
- Why do some people use the service and while others do not?
- How effective is the service?
- What are the most common needs of clients who come to this agency?
- What are the strengths and weaknesses of services?
- How satisfied are the clients?
- How can I improve these services for my clients?

3.5 As a professional environmentalist:

As a professional environmentalist you might be interested in finding answers to theoretical questions, such as:

- Which are the most effective intervention measures for a particular environmental problem?
- What causes X or what are the effects of Y?
- What is the relationship between two environmental phenomena?
- How do I measure the effectiveness of self-effort employed by my clients?
- How do I ascertain the validity of my questionnaire?
- What is the pattern of program adopted in the community?
- Which is the best way of finding out community attitudes towards environmental issues?
- Which is the best way to find out the effectiveness of a particular environmental strategy?

- How can I select an unbiased sample?

3.6 As a Service Consumer

In this age of consumerism you cannot afford to ignore the consumers of a service. Consumers have the right to ask questions about the quality and effectiveness of the service they are receiving and you, as a service provider (e.g. waste manager), have an obligation to answer their questions. Some of the questions that a consumer may ask are:

- How effective is the waste-collection service that I am receiving?
- Am I getting value for money paid for waste disposal?
- How well-trained are the service providers?

Most disciplines in environmental sciences would lend themselves to the questions raised above.

It is impossible to list all of the issues in every discipline but this framework can be applied to most disciplines and situations in the environmental sciences and resource management. So, you can identify, from the viewpoint of the above perspectives, the possible environmental issues in your own locality or area.

4.0 CONCLUSION

This unit provided you with an interesting overview of your ability to think, test existing theories and knowledge in environmental science. The unit has opened your understanding to the habit of questioning about your environment and some environmental problems commonly found in your environment. You have also known how to examine or ask questions on issues relating to your environment.

5.0 SUMMARY

We have learnt how the various dimensions that we can approach when asking questions on our environment. You would have noticed the differences in question structure with regard to particular environmental discipline. You also noticed that the type of question and the need to find answers to them will vary with the level at which you work in an organization. This unit therefore has built in you the habit of questioning about what is happening in your environment and your ability to find answers to these impending questions so as to solve the environmental problem.

6.0 TUTOR MARKED ASSIGNMENTS

1. As an environmentalist, set research questions that will answer the waste disposal problem in your environment.

2. Highlight some environmental questions that will be used to address behavioural patterns of residents in urban areas.

7.0 REFERENCES

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Drury, S.A. (1990) A Guide to Remote Sensing: Interpreting Images of the Earth, Oxford University Press.

Hagerstrand, T. (1975) Space, Time and Human Conditions, In A. Karlqvist, L. Lundqvist and F. Snickars (eds) Dynamic Allocation of Urban Space, Farnborough: Saxon House

Martin, D. (1996) Geographic Information Systems: Socio-economic Applications, 2nd edn, London: Routledge.

Watson, G. (1987) Writing a Thesis: A Guide to Long Essays and Dissertations, London: Longman.

UNIT 2 ELEMENTS OF RESEARCH

CONTENTS

1.0 INTRODUCTION

At this point, you can prepare the contents page. You need to include separate pages for figures and tables. Also provide the title and relevant page numbers for each Figure and Table. These will act as useful guides to any reader who may remember some results that you mentioned earlier in the dissertation but is not sure precisely where they were. Some original essays will not include figures or tables and these pages can be omitted.

2.0 OBJECTIVES

At the end of this unit, you will be able to

- Write an abstract that will present a clear idea of what the entire research is about.

- Identify the various subsection of the research which must be handled with care.

3.0 MAIN BODY

3.1 The Abstract

Many people who pick up your dissertation will not read any more than the acknowledgements and the abstract. The abstract should provide a clear idea of what the research is about, what the major findings are, so that they can make an informed decision. It should summarize the main questions that the research examined, the basic approach that was used and the most important findings in reader-friendly language. Turk and Howard (1983) refer to this summary as a map, as readers can absorb information better if they are aware of what the main conclusions will be. Without a carefully structured abstract, any slight digressions from the main topic in the body of the text may lead the reader down the wrong road.

Consequently, producing an abstract is not a simple task and the fact that it must be short exacerbates the problem. You should give it careful attention as anyone examining the work critically will continually refer back to the abstract to make sure that you have a clear idea of the subject matter.

A practical approach to writing the abstract is to leave it until the end. As described above, the writing experience is a thinking experience and, as you will reinterpret your findings as you go along, you should expect the contents of the abstract to change during the process. Having completed a first draft of the essay, you can work through it underlining the major points for inclusion in the abstract. However, if you are determined enough, there is no better way of forcing you to think seriously about what you have achieved than to write the abstract first, even if you revise it at a later stage.

3.2 The Introduction

Parsons and John (1980) stress that the introduction is essentially part of the logical argument you are putting forward. Clearly state the aims of the dissertation by briefly describing what the main findings on the subject have been previously. You can then highlight why you think that more work is needed and how your research is going to achieve this, perhaps through the use of a new data source, an original methodology or a different study area. You may, of course, have a series of study objectives rather than a single one. These should link together to produce an overall aim for the project and this will prevent you from being criticized for lacking a clear direction. Providing such a bold statement about what you are aiming to do may be a little unnerving initially, but it will undoubtedly impress the reader. Although an obvious point, it is worth emphasizing that you should not identify aims which are not examined subsequently – too many students provide a list of grandiose aims that are never actually realized in the body of the work.

You must also remember that the introduction precedes the detailed literature review that follows and therefore the reader may not be familiar with the previous work on the topic. The level at which you pitch the introduction must reflect the reader's potential lack of knowledge on the subject. At the same time you must not over simplify the introduction so that the more expert reader finds it naïve. Above all, the introduction must be interesting, so that it encourages the reader to continue with the remaining part of the essay. More specifically, you may want to justify the methodology that you used, perhaps by contrasting it with the methods used by others. You may also want to explain briefly how the work was carried out and justify the logical structure of the remainder of the essay.

3.3 Literature Review

Undoubtedly, there will be a wealth of published material that is relevant to your topic. Your original choice of topic will probably have been influenced by work that you have read or been taught and your analysis is an addition to these previous studies. If your research is especially original you might find that few studies have dealt with the precise topic, but there will be work in the broad field of your research that you should cite. The literature review cannot include every relevant publication; rather you should aim to cite those which are the most pertinent and those which have been most influential in the field (you can identify these by the regularity that they are cited by others). It should also show that you are aware of the most up-to-date literature on the subject. Your intention should be to prove that you have become something of an expert in your chosen field, and one way is by being knowledgeable selective in your decision about which literature to cite. If there was a single study that influenced your work substantially, discuss it and draw attention to those aspects that were different from your research, rather than running the risk of being accused of plagiarism.

The structure of the literature review in environmental science may be experimental with more contemporary studies that have added to the examination of the research problem. Alternatively, you may structure the review geographically, describing studies that deal with the research problem at a broad geographical scale, followed by more focused papers that use specific case studies.

3.4 Methodology

Describe the procedures that you used in your research in the methodology chapter. This may require a number of sections depending on the methodological complexity of the study. You may want to explain why a quantitative approach was preferable to a qualitative one and then whether the approach was deductive or inductive. For example, more practically, the description of an experimental structure in environmental study may need sections describing the sampling strategy used, when and how the information was gathered, the layout of the environment, and the techniques or scale used elsewhere (e.g. regional or global), but that rather simpler techniques were implemented in your study. Acknowledging the improvements that may have resulted from these advanced techniques indicates that you are at least familiar with them, even if you did not implement them. It is this section that will convince the reader that your choice of methodology was informed by a good understanding of the potential approaches that are available.

3.5 Results

The results chapter of your research is often one that causes difficulty as it is tempting to include too much material. It should not include methodological discussions that precede this chapter, nor should it include the discussion and interpretation of the results if you have a dedicated 'discussion' chapter as suggested below. Even in quantitative dissertations the interpretation of results may vary between researchers, and consequently it is helpful to separate these two aspects of the research. This is not to say that it is unacceptable to interweave the results and discussion, as long as you make sure that you have not sacrificed interpretation at the expense of an over-elaborate presentation of the results.

Of course, there are various ways of presenting the results in environmental studies depending on the style of the original essay. These may vary from detailed cross-tabulations of field data to the results from statistical tests. But in every case, they should be logically structured. Qualitative findings may simply be ordered temporally, while quantitative results may increase in complexity throughout the chapter. For instance, positive results are usually more interesting than negative results, but this does not mean that you should ignore the latter. Negative findings are often interesting in themselves, particularly if they fail to conform to conventional ideas, and researchers often fail to recognize their importance because they are unexpected. Even if the results of speculative hypotheses turn out to be incorrect, it is worth presenting the results so that the reader is aware that you did examine the question.

3.6 Discussion

If a separate discussion chapter is used it should bridge the gap between the results section and the conclusion and provide a personal interpretation of the results. Even if the research question was interesting and original, the field work was undertaken sensibly, and the analyses of the results were correct, this is where you have the opportunity to shine. Interpreting the results is not a simple task and a clear and logical discussion will confirm to the examiner that your work is of a high standard.

You may want to include references to other work as you describe how your results confirm, or conflict with, previous findings, and you are well advised to think about the structure of your discussion chapter long before you begin writing it. Inevitably, you will alter this structure as the write- up progresses, but having a clear picture of the final product at an early stage is a useful guide. You need to note that the points you raise should be consistent with the presented results.

As discussed above, this section is a useful place to identify the limitations of the study and, given the resource constraints upon dissertation work, it is inevitable that the research will not be perfect. Acknowledging these programs confirm to the reader that you have considered them, rather than being unaware of them.

3.7 What goes into the conclusion

There are two meanings of the word conclusion. It can mean concluding remarks, which are simply the final statements, or it can mean a logical outcome implied from the previous work (Turk and Kirkman, 1989). You should aim to produce the later of these, remembering that the reader will refer to the conclusions more than once. The conclusion is definitely not the place to report findings and, even though it is the final part of the dissertation, it is not necessary for it to be long. Concise conclusions get the major points across more effectively, displaying the author's ability to synthesize material.

The style of the conclusion also needs some thought and the type of research that you have done will influence this. In some cases you may feel that your findings are original and interesting enough to build the dissertation into a climactic ending, but as Wolcott (1990) points out, this is not necessary. He warns against advancing beyond what is to what ought to be, because the leap from the descriptive to the prescriptive imposes someone's judgement, whether originating from the researcher or one of the respondents. Personal opinions are not frowned upon necessarily, but it is important to label them as such.

Additionally, the conclusion can also include avenues for future work that would extend logically out of the work that you have presented. Interesting results you have identified might usefully be explored in another context, or you may recognize that the methods you adopted were not as technically advanced as they might have been.

3.8 References

Bibliographies include lists of publications that are relevant to the subject, while reference lists contain only those references that you have cited. Clearly, this list should be extensive, including general background material and specific studies that are particularly relevant to the work you did. If your institutional guidelines do not specify a format for referencing, you may wish to take the references which appear at the end of this book as a guide. For instance, papers from journals should appear as for Bondi and Domosh (1992), chapters in edited books as for Dorling (1994), and author and include all of the relevant information so that the reader will be able to find the references easily if they wish. If you use more than one reference from the same author these should be ordered with the earliest publication first. If two or more were published in the same year, you need to attach letters to the data, both in the text and in the reference list, as for example Gregory (1994a) and Gregory (1994b).

3.9 Appendices

Now that you are almost done with the report of your research, reserve information that is peripheral to the argument, or that would interrupt the flow of the text unnecessarily, for appendices. You may decide that you can effectively describe the mathematical models instrumentations and measurement/apparatus or equipment you were using in the text, but that the detailed equations are needed in an appendix, or you may want to provide one example of the checklist that you used. Copies of important correspondence or institutional data which aided your research should also be included here. However, do not use the appendix as a place to jettison all of the additional material that you accumulated during the research, but could not justify including elsewhere – reams of statistical output that are not referred to in the text will be ignored by the reader, for example.

3.10 Editing and presentation

One reason why it is important to begin writing early is that it is useful to have a lengthy period before the deadline when you can put the project to one side and forget all about it. When you return to it, you will have forgotten the precise line of thought you were following when you wrote it, enabling the identification of glaring mistakes. Additionally, you will spot habitual uses of certain phrases or words that you missed previously. As Wolcott (1990:52) admits: 'I've always written with too many buts, but I have a hard time eliminating them.'

Being able to step back from the research is the most useful result of carefully planning your timetable and most are surprised by the improvements that come from this strategy. Distinguishing between revising and editing the manuscript is helpful, as the former relates to content and the latter to issues of style. Bear in mind that 'writing right' is not possible the first time and a careful editing process will be necessary however hard you worked on the first draft. Tightening up the manuscript allows you to reduce unnecessary complex sentences and remove repetition. This is also the time that you can reduce the length of the dissertation as the first draft will usually be too long.

Editing strategies will vary between individuals. One method is to read it out quickly or loudly, rather than in your head, which is how you have dealt with the manuscript until this stage. Wolcott (1990) uses a mechanical strategy where he aims to remove an unnecessary word from each sentence and an unnecessary sentence from each page. Three helpful techniques are to identify and remove irrelevant diatribes, where you go off on a tangent from the main point, to omit duplication, paying particular attention to quotations which repeat the same point, and to make sure that the beginning of sections are to the point and do not ramble.

You may find it helpful to produce a posterior plan noting the main point from each paragraph. This allows the logic of the structures to be investigated and identifies repetition. It is also useful to ask someone else to read the final product before you submit it. This may be fellow student, although someone without a geographical or environmental background will still be able to spot problems of style and clarity. You should bear in mind that there will be diminishing returns from editing and you should not fall into the trap of chaining words for the sake of it.

Nowadays, most students use word processors, which are invaluable aid to the writing process. Their main advantage is the ease with which a document can be edited and altered; they are particularly useful for producing plans because of the ease of moving sections of text around in the document using the cut and paste facilities. The final product should be stylish. Spelling errors can be spotted and easily corrected, electronic thesauruses enable you to replace commonly used words with alternatives, and even the grimmer can be checked.

You should be wary of the wonders of the word processor, however. The ease with which you can move text means that awkward links between points can result if the altered version is not re-read carefully. You should not be tempted to copy and paste parts of the text which seem relevant in more than one part of the document, as this repetition will be frowned upon if it is spotted by the reader. Although the package will check spelling for you, it will not identify places where an inappropriate, but correctly spelt word was used. More practically, you should also refrain from printing numerous copies of the document after every slight alteration that you make.

Generally, a clearly laid out dissertation which is not over-elaborate is best. Use diagrams and tables to replace words. They are useful aids for breaking up the text and they should be correctly numbered and referred to in the list of figures and tables. The diagrams may include photographs, which is fine, but bear in mind that reproductions of your work will probably not be in color. You may produce the tables using a statistical packages, but often it is sensible to reproduce them in your word-processing packages as the style will match the next better.

But when thoughts and words are collected and adjusted, and the whole composition at last concluded, it seldom gratifies the author…. He is still to remember that he looks upon it with partial eyes.

Finally, it is worth emphasizing that your work will never be perfect in your own eyes. You will be aware of certain pitfalls in the design and analysis, but this does not mean that the work is not commendable. Some of the points that see obvious to you, because you have been so close to the study, will not be obvious to those reading the work. The whole project, including the writing-up stage, where the final product takes shape, should be a rewarding experience. This is probably the largest, most important and most individual piece of work that you have done and you should be proud of your achievement. The final, and perhaps most important, piece of advice that you can be offered is that once you have done all of this work, make sure you hand it in on time!

4.0 CONCLUSION

You would realize that there are some major subsections of the research that must be carefully handled. That is the unit has allowed you to appreciate the value of environmental research. You have seen the opportunity to put up a logical argument, clear statement of research objectives and highlight reasons for the work and how you can achieve the set goals. Your broad-based literature review is an important instrument and asset that could massively influence your work. You may want to explain the various methods of analysis and reasons for their choice. Do not forget that the data analysis subsection is tied to the overall research process and as such must be carefully handled.

5.0 SUMMARY

We have learnt how the various elements of research are interconnected. The arrangement of your dissertation is clearly built in this unit. You therefore have to be very familiar with this elements and conform strictly to their scope and application in any environmental research. In addition, an awareness of the contents of each element and how they interlink to provide additional knowledge in environmental science.

6.0 TUTOR MARKED ASSIGNMENTS

1. Write short note on the following: (a)abstract (b)introduction

2. Differentiate between conclusion and summary

7.0 REFERENCES/FURTHER READINGS

Howard, K. and J. A. Sharp (1983) The Management of A Student Research Project, Aldershot: Gower.

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UNIT 3 CONCEPTS IN ENVIRONMENTAL RESEARCH

CONTENTS

1.0 INTRODUCTION

There are several ways of obtaining answers to the existing environmental problems and questions. These methods range from the fairly informal sources based upon clinical impressions to the strictly scientific, adhering to the conventional expectations of scientific procedures. Research is one of these ways. When you say that you are undertaking a research study to find out answers to environmental questions, you are implying that the process:

1. Is being undertaken within a framework of set of principles;
2. Use procedures, methods and techniques that have been tested for their validity and reliability; and
3. Is designed to be unbiased and objective.

2.0 OBJECTIVES

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

- Differentiate between validity and reliability
- Define subjectivity
- Identify types of research in environmental science

3.0 MAIN BODY

3.1 Your Orientation

Your orientation in environmental science and resource management may seem from one of the two paradigms in research-positivism and naturalism-and the academic discipline in which you have been trained. The concept of validity can be applied to any aspect of the research process. It ensures that in a research study correct procedures have been applied to find answers to a questions. ‘Reliability’ refers to the quality of a measurement procedure. ‘Unbiased and objective’ means that you have taken each step and drawn each conclusion to the best of your ability and without introducing your own vested interest. The author would like to make a distinction between bias and subjectivity. Subjectivity is an integral part of your thinking that is conditioned by your educational background, discipline, philosophy, experience and skills. Bias on the other hand, is a deliberate attempt to either conceal or highlight something. For example, an environmentalist may look at a piece of information differently from the way an anthropologist or a historian looks at it.

However, the degree to which the criteria are expected to be fulfilled differ from one academic discipline to another. For example, the expectations of the environmental research process are markedly different between the environmental or physical sciences and the social sciences. In the physical sciences a research endeavour is expected to be strictly controlled at each step, whereas in the social sciences rigid control cannot be enforced and sometimes is not even demanded.

Within the environmental sciences, the level of control required also varies markedly from one issue or subject to another. Despite these differences among subjects or disciplines, their broad approach to inquiry is similar. The research model in this course material is based upon this philosophy.

As beginners in research you should understand that research is not all technical, complexes, statistics and computers. It can be very simple activity designed to provide answers to very simple questions relating to day- to-day activities in our environment. On the other hand environmental research procedures can also be employed to formulate intricate theories or environmental laws that govern our lives. The difference between research and non research activity is, as mentioned, in the way we find answers: the process must meet certain requirements to be called research. To identify these requirements let us examine some definition of research.

The word research is composed in two syllables, re and search. The dictionary defines the former as the prefix, meaning ‘again’, ‘anew’ or ‘over again’ and the latter as a verb meaning ‘ to examine closely and carefully’, ‘to test and try’, or ‘to probe’. Together they form a noun describing a careful, systematic, patient study and investigation in some field of knowledge, undertaken to establish facts or principles.

Grinnell (1993) further added that ‘research is a structural inquiry that utilizes acceptable scientific methodology to solve problems and creates new knowledge that is generally acceptable’.

Lundberg (1992) draws a parallel argument between the environmental research process, which is considered scientific, and the process that we use in our daily lives. According to him:

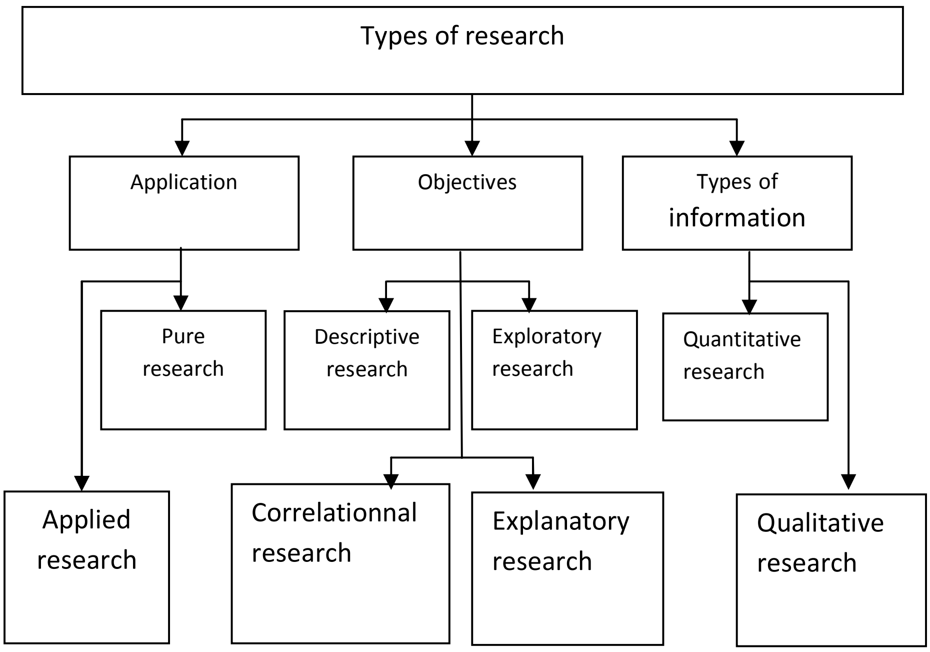
Scientific method consists of systematic observation, classification and interpretation of data. Now, obviously, this process is one in which nearly all people engage in the cause of their daily lives. The main difference between our day- to- day generalizations and the conclusions usually recognized as scientific method lies in the degree of formality, rigorousness, verifiability and general validity of the findings (Lundberg 1992: 5). Burns (1994: 2) defines research as a systematic investigation to find answers to a problem.

3.2 Types of Research

Research can be classified from three perspectives:

1. The application of the research study;
2. The objectives in undertaking the research; and
3. The type of information sought

These three classification are not mutually exclusive-that is, research study classified from a view point of 'application' can also be classified as 'type of information sought'. For example, a research project may be classified as pure or applied research (from the perspective of application), as descriptive, correlation, explanatory or exploratory (from the perspective of objectives) and as qualitative or quantitative (from the perspective of the type of information sought).



3.3 Application

If you examine a research endeavour from the perspective of its application, there are two broad categories: pure research and applied research.

Pure research in environmental science or resource analysis involves developing and testing theories and hypothesis that are intellectually challenging to the researcher but may or may not have practical application at the present time or in the future. Thus, such work often involves the testing of hypotheses containing very abstract and specialized concepts.

Pure research in environmental science is also concerned with the development, examination, verification, and refinement of research methods, procedures, techniques and tools that form the body of research methodology. Examples of pure research include: developing a sampling technique that can be applied to a particular situation; developing a methodology to assess the validity of a procedure; developing an instrument, say, to measure the vibration level in the earthcrust ; and finding the best way of measuring earthquakes or volcanoes. The knowledge produced through pure research is sought in order to add to existing body of knowledge of research methods.

Most of the research in the environmental sciences is applied. in other words the research techniques, procedures, and methods that form the body of research methodology are applied to the collection of information also various aspects of situation , issue, problem or phenomenon so that information gathered can be used in other ways – such as for policy formulation (environment protection and environmental auditing) administration, and the enhancement of understanding of a phenomenon.

3.4 Objectives

If you examine a research study from the perspective of its objectives, broadly, a researcher's endeavor can be classified as: descriptive, correlation, explanatory and exploratory.

An environmental study classified as descriptive research attempts to describe systematically an environmental situation , problem, phenomenon, service or program , or provides, or provides information about, say, the living conditions of a community near dumpsites, or describes attitudes towards an issue such as waste disposal. For example, it may attempt to describe the types of service provided by an organization, the administrative structure of an organization, and the needs of a community.

Correlation Research

The main emphasis in a correlation research study is to discover or establish the existence of a relationship/association /interdependence between two or more aspects of the environment. What is the impact of deforestation on the climate? What is the relationship between soil and vegetation? or What is the effect of desertification on crop yields? These studies examine whether there is a relationship between two or more aspects of a situation or phenomenon.

Explanatory Research

Explanatory research attempts to clarify why and how there is a relation between two aspects of the environment. This type of research attempts to explain, for example, why afforestation can increase rainfall and reduce temperature is followed by rainfall.

Exploratory Research

The fourth type of research, from the viewpoint of the objectives of a study, is called exploratory research. This is carried out to investigate the possibilities of undertaking a particular research study. These types of research study are also called a ‘feasibility study’ or a ‘pilot study’. It is usually carried out when a researcher wants to explore areas about which he/she has little or no knowledge. A small-scale study is undertaken to decide if it is worth carrying out a detailed investigation. On the basis of the assessment made during the explanatory study, a full study may eventuate. Exploratory studies are also conducted to develop, refine and /or test measurement tools and procedures.

4.0 CONCLUSION

Existing environmental problems in our local environment can be examined in various ways. Undertaking an environmental research is an attempt to find solution to these problem using established framework and principles and procedures and techniques to test the validity and reliability of the subject matter. As a new entrant into environmental research, you should understand that research can be made simple using computer aided softwares in answering day-to-day activities in our environment. Again, you should realize that environmental research can be employed to formulate intricate theories or environmental laws that govern our lives.

5.0 SUMMARY

You have been following the research process. I hope you can appreciate what we have learnt so far. So, in this unit I suppose you now know the need not to deliberately influence or conceal the results of an environmental research. You are also aware of the various types of research and when they are applied. This is because pure research in environmental science is concerned with the development, examination, verification, and refinement of research methods, procedures, techniques that form the body of research methodology.

6.0 TUTOR MARKED ASSIGNMENTS

1. State two definitions of research.

2. Mention and discuss the major types of research in environmental science.

7.0 REFERENCES

Grinnel, Richard Jr (ed) (1993) Social Work, Research and Evaluation, (4th ed), F.E. Peacock Publishers, Illinois.

Lundberg, George A. (1992) Social Research: A Study in Methods of Gathering Data, (2nd ed.), New York, Longman, Green and Co.

UNIT 4 THE EIGHT-STEP MODEL OF RESEARCH PROCESS

CONTENTS

1.0 INTRODUCTION

There are some tasks identified as the operational steps you need to follow in order to conduct an environmental study. Topics identified in rectangles are the required theoretical knowledge needed to carry out these steps. The tasks identified in circles are the intermediary steps that you need to complete to go from one step to another. It is important for a beginner to work through these steps in the proposed sequence, though with experience you can change it.

This course material is written around the theoretical knowledge required to undertake each operational step and follows the same sequential progression as is needed to undertake a research investigation. For each operational step, the required theoretical knowledge is further organized, in different unit, around the operational steps.

2.0 OBJECTIVES

At the end of this unit you should be able to

- identify and formulate a research problem in environmental science
- construct instrument for data collection
- identify sampling techniques that will be most appropriate for your study
- analyse data collected in the field

3.0 MAIN BODY

The following sections of this unit provide a quick glance at the whole process to acquaint you with the various tasks you need to undertake your study

3.1 The Research Process

Step I: formulating a research problem is the first and most important step in the research process. A research problem identifies your destination: it should tell your research supervisor and your readers what you intend to research. The more specific and clear you are the better, as everything that follows in the research process-study designs, measurement procedures, sampling strategy, frame of analysis and the style of writing of your dissertation or report-is greatly influenced by the way in which you formulate your research problem. Hence, you should give it considerable and careful thought at this stage.

It is extremely important to evaluate the research problem in the light of the financial resources at your disposal, the time available, and your research supervisor’s expertise and knowledge in the field of study. It is equally important to identify any gaps in your knowledge of relevant disciplines, such as statistics, required for analysis. Also, ask yourself whether you have sufficient knowledge about computers and software if you plan to use them (Ranjit, 1999).

Step II: Conceptualizing a Research Design

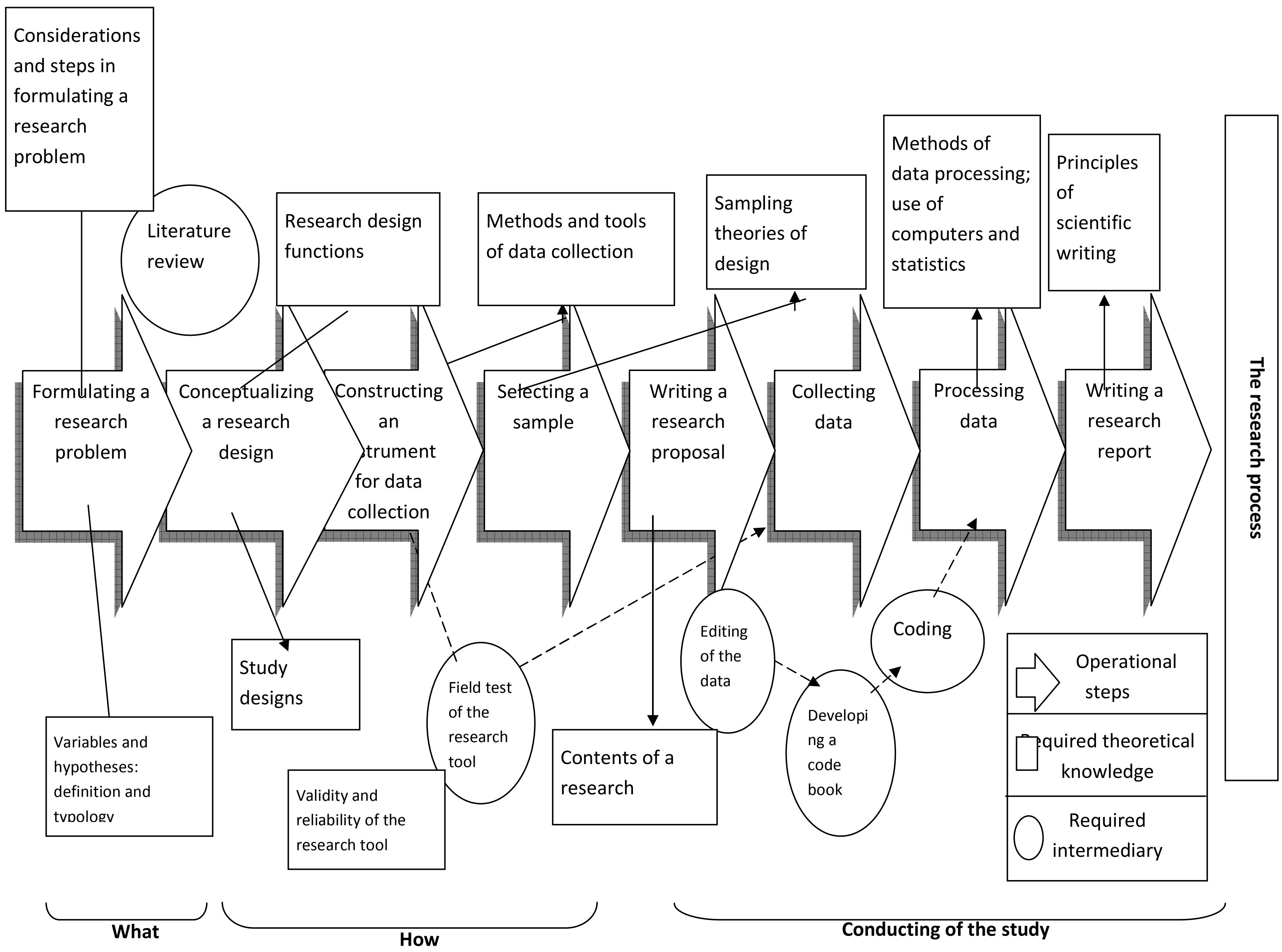
An extremely important feature of research is the use of scientific methods. Research involves systematic, controlled, valid and rigorous establishment of associations and causation that permit the accurate prediction of outcomes under a given set of conditions. It also involves identifying gaps in knowledge, verification of what is already known and identification of past errors and limitations. The validity of what you find largely rest on how it was found. The main function of a research design is to explain how you will find answers to your research questions. The research design should include the following the study per se and the logical arrangements that you propose to undertake, the measurement procedures, the sampling strategy, the frame of analysis and the time-frame. For any investigation, the selection of an appropriate research design is crucial in enabling you to arrive at valid findings, comparisons and conclusions. Ranjit (1999) argued that a faulty design results in misleading findings which therefore result in wasting human and financial resources. In scientific circles, the strength of an empirical investigation is primarily evaluated in the light of the research design adopted. When selecting a research design, it is important to ensure that it is valid, workable and manageable.

There is an enormous variety of study designs and you need to be acquainted with some of the most common ones. Select or develop the design that is most suited to your study. You must have strong reasons for selecting a particular design; you must be able to justify your selection; and you should be aware of its strengths, weaknesses and limitations. In addition, you will need to explain the logical details needed to implement the suggested design.

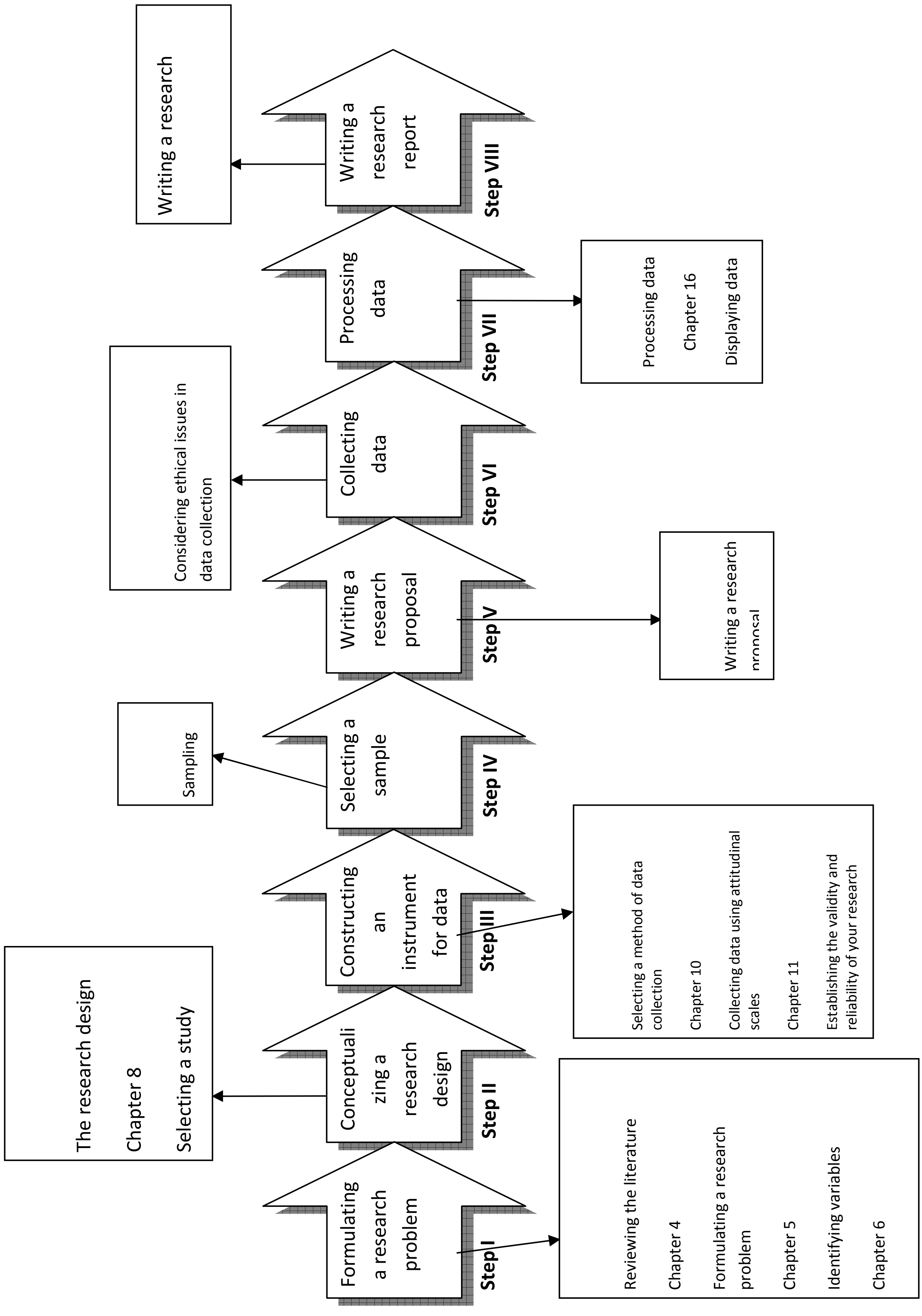
Step III: Constructing an Instrument for Data Collection

Anything that becomes a means of collecting information for your study is called a ‘research tool’ or a ‘research instrument’ .for example, observation forms, interview schedules, questionnaires, and interview guides are all classified as research tools.

The construction of a research tool is the first ‘practical’ step in carrying out a study. You will need to decide how you are going to collect data for your research in environmental science.


The research process
Considerations and steps in formulating a research problem
Literature review
Research design functions
Methods and tools of data collection
Sampling theories of design
Methods of data processing; use of computers and statistics
Principles of scientific writing
Formulating a research problem
Conceptualizing a research design
Constructing an strument for data collection
Selecting a sample
Writing a research proposal
Collecting data
Processing data
Writing a research report
Variables and hypotheses: definition and typology
Study designs
Validity and reliability of the research tool
Field test of the research tool
Contents of a research
Editing of the data
Developi ng a code book
Coding
Operational steps
quired theoretical knowledge
Required intermediary
What
How
Conducting of the study

Source: Ranjit, 1999



Source: Adapted from Ranjit (1999).

the proposed study and then construct a research instrument for data collection. If you are planning to collect data specifically for your study (primary data), you need to either construct a research instrument or select an already constructed one. If you are using secondary data (information already collected for other purposes), develop a form to extract the required data. In order to determine what information is required, go through the same process as described for many data above.

Field testing a research tool is an integral part of instrument construction. As a rule, the field test should not be carried out on the sample of your study but on a similar environment.

If you are planning to use a computer for data analysis, you may wish provide space for coding the data on the research instrument.

Step IV: Selecting a Sample

The accuracy of your estimates largely depends upon the way you select your sample. The basic objective of any sampling design is to minimize, within the limitation of cost, the gap between the values obtained from your sample and those prevalent in the environment

The underlying premise in sampling is that, if a relatively small number of units is scientifically selected, it can provide, with a sufficiently high degree of probability, a fair true reflection of the sampled environment that is being studied.

Sampling theory is guided by two principles:

1. The avoidance of bias in the selection of a sample, and
2. The attainment of maximum precision for a given outlay of resources.

There are three categories of sampling design

1. Random probability sampling designs:
2. Non-random probability sampling designs; and
3. ‘Mixed’ sampling design.

There are several sampling strategies within the first two categories. You need to be acquainted with these sampling designs to select the one most appropriate for your study. You need to know the strengths and weaknesses of each and the situations in which they can or cannot be applied in order to select the most appropriate design. The type of sampling strategy you use also determines your ability to generalize from the sample to the entire environment and the type of analysis or statistical tests you can perform on the data.

Step V: Writing a Research Proposal

Now, step-by-step, you have done all the preparatory work. Next put everything together in a way that provides adequate information, for your research supervisor and others, about your research study. This overall plan tells a reader about your research problem and how you are planning to investigate, and is called a research proposal. Broadly, a research proposal’s main function is to detail the operational plan for obtaining answers to your research questions. In doing so it ensures and reassures the readers of the validity of the methodology to obtain answers accurately and objectively,

Universities and other institutions may have differing requirements regarding the style and content of a research proposal, but the majority of institutions would require most of what is set out here. Requirements may also vary within an institution, from discipline to discipline or from supervisor to supervisor. However, the guidelines set out in this course material provide a framework, which will be acceptable to most.

A research proposal must tell you, your research supervisor and a reviewer the following information about your study;

- What you are proposing to do;
- How you plan to proceed; and
- Why you selected the proposed strategy.

Therefore it should contain the following information about your study:

- A statement of the objectives of the study;
- A list of hypotheses, if you are testing any;
- The study design you are proposing to use;
- The setting for your study
- The research instrument(s) you are planning to use
- Information on sampling size and sampling design;
- Information on data processing procedures;
- An outline of the proposed chapters for the report;

- The study's problems and limitations; and
- The proposed time-frame.

Now that you have a general idea, writing a research proposal shall be taken in a more explanatory way in our subsequent unit (see unit …)

Step VI: Collecting Data

Having formulated a research problem, developed a study design, constructed a research instrument and selected a sample, you then collect the data from which you will draw inferences and conclusions for your study.

Many methods could be used to gather the required information. As a part of the research design, you decide upon the procedure you wanted to adopt to collect your data. At this stage you actually collect the data.

Step VII: Processing Data

The way you analyze the information you collected largely depends upon two things:

1. The type of information-descriptive, quantitative, qualitative and
2. The way you want to write your dissertation/report.

There are two broad categories of report: quantitative and qualitative. As mentioned earlier, the distinction is more academic than real in most studies.

If your study is purely descriptive, you can write your dissertation/report on the basis of your field notes, manually analyze the contents of your notes (content analysis), or use a computer program.

If you want quantitative analysis, it is also necessary to decide upon the type of analysis required (i.e., frequency distribution, cross-tabulation, or other statistical procedures, such as regression analysis, factor analysis, analysis of variance) and how it should be presented. Also identify the variables to be subjected to those statistical procedures.

Step VIII: Writing a Research Report

\writing the report is the last and, for many, the most difficult step of the research process. This report informs the world of what you have done what have you discovered and what conclusions you have drawn from your findings. If you are clear about the whole process, you will also be clear about the way you want to write your report. Your report should be written in an academic style and be divided into different chapters and/or sections based upon the main themes of your study.

This survey has been designed to elicit information about the training needs of academic staff who are involved in programme and course material design and development; tutorial facilitation; assessment; research and evaluation at… Specifically, it seeks to identify the gaps, possible causes, and profer training solutions that will enhance individual performance leading to achieving sustainable good practices. Kindly give us a minutes of your time to complete this survey as accurately as possible. Data collected with this survey will be kept strictly confidential. Thank very much for your time.

4.0 CONCLUSION

It is clear from this unit that there are some operational steps you need to take in order to conduct any research in environmental science. You have also learnt the required theoretical knowledge capable of enhancing your research operations. So, you now know, for instance the formulation of research problem, study designs, measurement procedures, sampling strategy, frame of analysis and the style of writing your original essay. You are now familiar with the construction of research tools which is the first practical step in carrying out an environmental study.

5.0 SUMMARY

In this unit, we have learnt the step-by-step of carrying out a research in environmental science. At this stage, we might go through the steps again. What is very important is for you to be consistent and thorough in applying each step. It is also very important to note the interrelation in all the steps with one another. In addition, each step has a unique role to play in the research process. Testing of a research tool in the field is an integral part of the research process. Therefore, as a rule the pilot survey should not be carried out on the sample of your study but on a similar environment.

6.0 TUTOR MARKED ASSIGNMENTS

1. Discuss how data is processed.

2. Draw a detailed diagram showing the research processes.

7.0 REFERENCES

Ranjit, Kumar (1999) Research Methodology: A Step-by-Step Guide for Beginners, Sage Publication, New Delhi.

Wax, R.(1983) The Ambiquity of Fieldwork. In R. Emerson (ed.) Contemporary Field Research, Boston and Toronto: Little Brown and Co.

UNIT 5 THE ROLE OF DATA ANALYSIS IN RESEARCH

CONTENTS

1.0 INTRODUCTION

The analysis of numerical data can therefore play many important roles in research. It can be used to make sense of large amounts of data, to explore data as a means of generating hypotheses and understanding environmental processes, to infer processes in a large environment from only a small sample of data, to assess the significance of findings, to help in model building, and in general to provide evidence for hypotheses about spatial processes. It is generally not sufficient to make statements about environmental processes without providing supporting evidence from the analysis of data.

2.0 OBJECTIVES

By the end of this unit you should be able to

-determine the techniques to be used in data analysis

-identify the types or level of data commonly encountered in environmental research

-be familiar with the number of sample and type of data being analysed

-be able to link the data analysed to the environment

-identify problem that might be encountered during the analysis and the modification of areal unit.

3.0 MAIN BODY

3.1 The Choice of Technique

This is not an easy question to answer as there are a bewildering number of techniques available, many of which can be applied to the same data. There are two properties of data collection. One of these properties is the number of samples; the other is the type or level of the data.

The number of samples refers to the number of ‘framework’ for which you have sampled data. For instance, you might have data on a sample of soil in the southern part of Nigeria and want to examine whether this value is significantly different from the northern average. You have sampled data from only one part of the country (the northern average is considered a ‘fixed’ value in this context). However, if you have soil data from two regions of the country and want to determine if there is a significant difference between them, then you have two samples. Equivalently, you might want to compare farming practices in four different topographic regions; in which case you have four samples.

Three types or levels of data are commonly encountered: nominal, ordinal, and ratio, with ordinal data being further classified into two categories, weakly ordered and strongly ordered. Nominal and ordinal data are discrete (the data can take only certain values), whereas ratio data are continuous. Nominal data contain the least information in that they are simply categories without any ordering. Examples are the division of climate into tropical or temperate, or the division of land use into arable, pasture, forest and moorland. The data consist of counts of observations in each of these categories. Data that are ranked either individually or in groups are referred to as ordinal. Weakly ordered ordinal data consist of ranked categories such as the common responses asked on a questionnaire: strongly agree; agree; neutral: disagree: strongly disagree. Strongly ordered ordinal data consist of a ranking of individual data points. An example being when cities are ranked according to some attributes such as mean temperature or rainfall. Nominal and ordinal data are categorical and do not have metric properties, which clearly limits the types of analyses that can be performed on them. For instance, it does not make sense to calculate a mean land use that might be somewhat between pasture and forest! Nor does it make sense to calculate a mean response to a questionnaire statement. The problem is that in calculating a mean from such data it has to be assumed that the perceived divisions between all the categories are equal when there is no guarantee that this is so (Coshall. 1989). Ratio level data provide the most information since they are continuous and have metric properties. Examples include heights of mountains, stream velocities, clay content of soils and so on, and the statistical techniques that can be applied to these data are referred to as parametric statistics. Data can always be transformed from ratio to ordinal to nominal but never the other way.

Knowledge of both the number of samples and the type of data being analyzed can thus be a useful guide to an appropriate statistical technique. If the aim of the analysis, for example, is to compare two samples of strongly ordered ordinal data, then a Mann-Whitney U-test would be appropriate. If the aim is to compare one samples of normal data with a fixed value. Then a one- sample chi-square test is appropriate.

3.2 How environmental is my analysis?

In conducting data analysis within an environment, it is sometimes easy to lose sight of the geography of the problem and to concentrate simply on the analysis. Whilst the analysis is clearly important in improving our understanding of spatial processes, it is just a means to an end and the analysis should be linked to the environment at every opportunity. For this reason, statistical packages that provide linked windows where data can be analyzed and brushed in one window and then automatically displayed on map in another window are very attractive. Being able to map data and results in increasingly interesting ways and to undertake numerical analysis are also attractive features of geographical information systems (GIS). Currently the analytical functionality of most GIS is rather crude and not particularly user-friendly, but this is changing and fairly soon most types of spatial analysis within geography will be possible within a GIS.

Spatial analysis also facilitates access to large spatial databases such as boundary files, road and river networks, digital elevation models and remotely sensed images.

The display of data or results on a map utilizes the characteristic of spatial data that makes them special; the data have spatial location. It is possible to distinguish two types of analytical research using spatial data on the basis of this property. The first, which I will term weakly geographical, uses data for different locations but effectively throws the interesting spatial component away and utilizes the data as if they are simply lists of numbers that could be reshuffled without affecting the outcome of the analysis. Performing an ordinary least-squares regression analysis on spatial data is an example of a weakly geographical analysis. Unless the residuals of the regression are mapped, the analysis would produce exactly the same results no matter what the spatial arrangement of the data. The data become merely numbers which have been stripped of all their spatial information. Spatial analysis which is strongly geographical, on the other hand, explicitly uses the information on the spatial location of the data points. Examples of strongly geographical techniques include the calculation of spatial means and standard distances as spatial equivalents to the more usual mean and standard distances (Ranjit, 1999), and the calculation of directional means and directional variances where the data represent movement in various directions (Watson, 1987; Wax, 1983).

One strongly geographical analytical technique involves the measurement of spatial autocorrelation, which refers to the spatial patterning of data. Where the value of data for one spatial unit is similar to those in its neighbouring units and said to exhibit positive spatial autocorrelation (most data exhibit positive spatial autocorrelation); on the other hand where the value of data in one unit tends to be dissimilar to the values in neighbouring units which are said to exhibit negative spatial autocorrelation. A feature of other types of strongly geographical analysis, is that its measurement is sensitive to the definition of 'neighbouring unit'. Clearly many definitions could be used, ranging from a rather restrictively nominal contiguity criterion to a continuous distance-decay-based definition. However, this should not necessarily be considered a negative feature of spatial analysis; rather, the challenge is to examine how sensitive the calculation of spatial autocorrelation is to the definition of neighboring unit and perhaps report spatial autocorrelation values for a large range of definitions. In this way, more interesting and complex issues in the way data are related in space might be illuminated.

Other strongly geographical techniques include various types of point pattern analysis (Boots and Getis, 1988), where the interest is to examine whether or not points in space are clustered. There are many ways of undertaking point pattern analysis; a common one is nearest neighbour analysis, where average distances between points are measured and compared with expected values under a random distribution.

A final example of strongly geographical analysis is the movement towards producing local or ‘mappable’ statistics. Typically, in analyses such as regression, for example, and even spatial autocorrelation, whole-map statistics are produced. In the case of regression the whole-map statistics include the parameter estimates and the goodness-of-fit statistics. In both cases, these are clearly ‘average’ values that are assumed to apply equally to all parts of a region. However, it could be that the estimated regression model replicates data in some parts of the region more accurately than in others. Similarly, the general relationships between data points depicted in a spatial autocorrelation statistics is an average over the region which could mask important geographic variations in the relationships between data over space. For this reason, the realization is growing that whole-map statistics are limited and that wherever possible we should attempt to provide local or mappable statistics (Haggerstrand, 1975). Developments such as the expansion method (Drury, 1990) and spatial association statistics (Burgess, 1984) reflect this trend and also provide greater links to geography and mapping.

3.3 What problems might I encounter?

It is perhaps true that all analysis can be criticized in some way and certainly the analysis of spatial data is no exception to this statement. There are many options available at various stages of a research project and often more than one option may be appropriate in a given situation. It is therefore necessary to make decisions and this lays the researcher open to criticism such as Why didn't you do this…..? For instance, it is possible to debate the type of data collected, the way the data were collected, the number of samples taken, the analytical method used, the assumptions embedded in the use of the method, the interpretation of result, etc. But before being paralyzed into inaction, the appropriate question to ask yourself is whether or not the analysis is useful: that is, has it provided either insight or evidence that you would not otherwise have? Clearly you do not want to commit gross errors that invalidate your analysis but the goal of producing a piece of analysis that cannot be criticized in some way is probably unattainable. More realistically, aim to undertake an analysis that is useful and which avoids the major pitfalls associated with spatial data.

3.4 The modification of areal unit problem

This problem occurs with aggregate spatial data; data which are reported for zones rather than individuals. The problem is that the results of the analysis can be sensitive to the way in which the zones are defined. For example, an analysis of the relationship between rainfall and crop yields using data from a specific zone may well produce a different set of results from an analysis performed with exactly the same data aggregated to the level of the zone. This is clearly worrying, especially if the results are sufficiently different to alter the conclusions reached regarding the nature of the relationships being examined. The modifiable areal unit problem can be separated into two components. The first, described above, is sensitivity to scale and the numbers of spatial units into which a region is partitioned. The other is sensitivity to the way in which space is partitioned even when scale is held constant.

3.5 The identification of spurious relationships

Care must be taken in data analysis to avoid mistakenly attributing any importance to a spurious relationships. Such a problem can arise when complex relationship between two or more variables might be very different from that which is suggested by the statistical analysis. A common example where spurious relationships can occur is in the interpretation of a matrix of correlation coefficients between several interrelated variable. Each correlation coefficient measures the strength of a simple linear relationship between a pair of variables and can give a very misleading impression of the underlying causal relationship, which may involve several other variables. For example, suppose data are collected on crop yield, altitude and rainfall within a region and it is found that the correlation coefficient between crop yield and altitude is positive. It might be incorrect to infer that the causal mechanism producing this statistical result is one where the crop under investigation has an affinity for high-altitude locations.

This might be so, but it might also be the case that within this region rainfall tends to increase as altitude increases and that crop yield increase with rainfall. The calculation of a simple correlation coefficient can therefore suggest a relationship which is spurious. A more accurate picture of the determinants of crop yield would be obtained by a multiple regression, where each parameter indicates the relationship between the dependent variable and one independent variable, everything else being equal. A regression analysis, for example, might indicate that the relationship between crop yield and altitude is negative even though the correlation coefficient suggests it is positive. In much the same way, a simple scatter plot can give a false impression of the nature of the relationship between two variables. Partial regression or leverage plots, which depict the relationship between two variables, everything else being equal, are much more reliable.

4.0 CONCLUSION

The unit gave you an overview of the large number of techniques available for data analysis. It has the two principal properties of data collection: the number of samples and the type or level of the data. The unit has identified three types of level of data commonly encountered namely nominal, ordinal and ratio data. You now know that the knowledge of both the number of samples and type of data being analysed can be a useful guide to an appropriate statistical technique. It is thus possible to map spatial data such as roads, rivers, etc. Geographical analytical technique involves measurement of spatial autocorrelations. This allows the value of data for one spatial unit to be similar to those in its neighbor unit and as such exhibit positive spatial autocorrelation. You can now be careful of not allowing spurious relationship between two or more data.

5.0 SUMMARY

The analysis of numerical data can be an extremely valuable constituent of environmental research. It drives data collection and data presentation and it provides a powerful framework within which our understanding of environmental processes can be tested and developed. This unit has described how the analysis of numerical data can be useful; in summarizing large amounts of data through descriptive statistics; how relatively new, and primarily visual, exploratory techniques can be useful in both formulating hypotheses and examining results; how we can infer aspects of a population from a sample; and how model building and calibration can be used as a test of how well we understand the real world.

One of the more confusing aspects of data analysis is deciding on what technique to use in a given situation. Whilst experience is useful here, discussing your problem with a user-friendly statistician is highly recommended. This unit also discusses how to narrow down the choice of technique fairly easily. It is noted that environmental data have certain properties which lend themselves to different types of analysis and many of these are highly visual, which often makes their presentation in research projects more appealing.

There are pitfalls, however, and cares has to be taken to eliminate problems that could invalidate the conclusion reached. These include the modifiable areal unit problem, spatial non stationary, spatial dependence, non-standard distribution and the identification of spurious relationships. However, these problems are also challenges and should not deter students from incorporating data analysis as a central theme of their projects because the analysis of numerical data can provide a pivotal contribution to research.

6.0 TUTOR MARKED ASSIGNMENT

1. Explain the basis for making environmental analysis

2. What problems are you likely to be confronted while embarking on data analysis

7.0 REFERENCES

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UNIT 6 THE NEED FOR RESEARCH PROPOSAL

CONTENTS

6.0 Tutor Marked Assignment

7.0 References

1.0 INTRODUCTION

For students in Environmental Studies and Resource Management, National Open University of Nigeria (NOUN), it is a requirement to write a research proposal before a thesis or dissertation research is undertaken. For the purpose of external funding, the research proposal is a necessary document to convince-funding sources, sponsors, and academic bodies that the project is worthy of their attention let alone their money. In the case of an academic institution, such as NOUN, the research proposal is essential to convince the appropriate committees or your supervisor of the, value of the project as it may contribute to a body of knowledge.

The proposal is a study plan that is to be followed in the course of the research effort. It should be thought of as a device to be used as a guide in the development of research process. To the extent that the proposal is a plan, it establishes an order to one’s research effort. It gives a continuity to the various steps and stages of the work to be done.

The proposal helps the researcher to organize his efforts in terms of time to be spent and resources to commit to the project. After all, a project may sound and seem reasonable enough to do except when it worked out in detail and one discovers that the time or expenses are beyond one's resources. The proposal forces one to consider these two issues.

The process of writing a proposal actually forces the author to think through various steps of the research process. That is, the proposal writing process forces a direction of thought that shapes the project and the procedures for carrying it out. To put it another way, the proposal preparation process is a thinking-through process.

In more formal terms the proposal is a series of statements which are designed as guide to the hypothesis testing process which embodies the specific purpose of the study effort.'

Finally, the research proposal serves as the basis for the writing of the first three chapters o£ the final research report. The final report will logically include an Introduction, Review of Literature and a Methodology. The proposal once written and used can easily be converted to chapters in the research report.

2.0 OBJECTIVES

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

- Justify the reasons for research proposal
- Generate ideas that will eventually lead to research proposal
- Identify important methods and procedures that will direct you on the administration of the study.

3.0 MAIN BODY

3.1 Generating Ideas

When a proposal is in the process of being prepared, it is obvious that a topic has been selected and its refinement is well under way. However, many researchers, grant writers and especially students may be looking for ideas that will eventually lead to the preparation of a research proposal. More often than not the writer has an idea but it lacks substance, clarity, conceptualization and everything else that makes it more than an idea. There are plenty of ideas floating around 'that is in this stage. The quality of these ideas is terribly important and should not be overlooked as a factor of value in the research process and will be dealt with shortly. At this point how does one move an idea from its simplicity as a thought to a set of workable concepts within a theoretical framework

Begin by writing down thoughts about your idea. Note- taking is and should be a highly regarded scientific activity. Note-taking is a means of playing with thoughts, and fragments of ideas. It is a process by which one fits together ideas and pieces of ideas as if one were working out a jig say puzzle. The note-taking stage should take on the dimensions of an obsession. The writing of notes should be, at this stage, impulsive and obsessive. Don't worry about the randomness of this process for in time a pattern will begin to form and the bits and pieces will fall into place. Don't rush the note-taking process for it is an idea-hunting method and takes time.

Talk to as many people as you can who are knowledgeable in the area of your idea. Such personal contact will frequently lead you to new or additional material. Such persons are frequently very willing to spend time with you but others will be much less willing to give off their time and this posture should be respected, because experts or specialists are busy with their own work. Yet, there are those who are kind enough to discuss their ideas with you. In this regard, do not limit yourself to experts. Discuss your idea with anyone who is willing to listen. The author of this course material has found the most valuable ideas expressed by experts and non-experts in the field of environmental studies, resource analysis and management.

3.2 Read widely: It goes without saying that you must read a great deal before you can be satisfied that your idea is shared by others. Other writers have developed material in your idea area and can contribute to yours. Continue to do general reading that you are normally inclined to consume, for your idea has a way of popping up in the oddest places. Actually you are, at this stage, in the process of holding your idea close to the front of your mind and any material that passes before you is automatically perused for its relatedness to the pedantic idea. This is why it is equally important not to limit yourself to the pedantic journals because ideas are found everywhere if your radar, so to speak, is turned on.

There are popular or mass consumption of journals, newspapers and magazines that may very well add useful facets and information to your idea. The presentation of information is not neatly organized by the literary world into important and non-important scientific material. This is especially true of original and futuristic ideas. Very often environmental science presentations express the newest ideas. Again, my suggestion is to read' widely and talk to a diverse group of people to give needed substance to your idea.

In the development of your idea, be sure to allow for a substantial lapse of time from its origination to the time when you start writing your research proposal. It is important not to hurry this development because it needs time to mature or wither. It is possible that others will have covered the idea so thoroughly that your own interest is weakened and perhaps lost. But more importantly, you must have the time to examine the nuances of all the material that is added to your idea. Actually, as your idea formulates and takes creditable shape, the maturing will have occurred. At this point you will have 'moved from informal idea hunting toward s more formal review of literature.

3.3 Don't Be Afraid To Be Creative

The problems that" confront most students professionals and non-professionals seem endless in number. Many of these problems, perhaps most, are a consequence of higher expectations for one's life. The more we expect the more complexities and dissatisfactions are encountered. The solutions to these problems are difficult to come by as multi-faceted complexities inundate the problem situation. Frequently, researchers will build their research plans on the shoulders of previous research efforts. This approach is traditional and very sound scientifically speaking. It is a building block procedure that starts with a foundation of well validated knowledge. Careful searching of the literature is an absolute necessity in the preparation of any study and solution to problems. What needs to be emphasized here is a few words of encouragement to students for their research proposal to be more creative in approaching an environmental problem.

As you look for material do not limit yourself to other people's ideas. Nor should you limit yourself by thinking you must accept the totality of someone else's idea or theory. You can extract an idea or theory and build on it with your own thinking. Remember, your own ideas have just as much potential as the next fellow's, and may be more. Don't rely on the most authoritative persons in a field you should certainly study their writings and their research but your own creativity may equal and possibly purpose even the most impeding of authorities. Don't be afraid to dismantle someone else's theory and take that which best fits your conceptualization. Everyone has had the experience, upon hearing about a new idea, of saying "I thought of that a long time ago." Everyone has had ideas that were criticized for being too ridiculous, too far out, only to discover with the passage of time that someone else has developed the same idea and accumulated fame and fortune in the process. Not all of our ideas have achieved such dramatic ends, but the point that ideas have validity without formal institutional backing is true for most of us.

The real limit to whatever ingenious notions and ideas we may develop is our own imagination. We need to stretch our thinking in order to develop new possibilities. In the process of studying and pondering literature in a particular area of interest in environmental science, the logic of the author is always subject to interpretation.

Why didn't the author consider a different line of thinking? Inquiry and instrumentation in Environmental Science are serious matters and should be done boldly whether applied to innovation or ponderous theoretical matter. Critical assessment of long held beliefs is the first; step to new interpretation of the scientific truths. The knowledgeable authorities occupy the institutional front row only because others have abandoned the effort. The promoters of solar energy have long been considered slightly less than ridiculous for thinking that this kind of energy could be economically produced. We now know that solar energy is an idea whose time has come. Any and all ideas about alternative sources of energy are seriously being considered and explored. The creative spirit still lives. Don't be afraid to exercise it even within the pedantic halls of higher learning.

3.4 Writing Style

Writing a research proposal is an exercise in providing detail that will answer the questions of any reader or reviewer. Normally there should be a good deal of detail that satisfies the expert or reviewer and yet not so much detail that the person unfamiliar with the topic gets lost in a maze of discussion. The right balance of detail should help the reader quickly grasp the nature of the problem and your approach to it. The beat advice is to write close to your proposal outline (at least the first draft). Write clearly and simply. But some detail is always needed unless you are writing a one or two page abstract. Good proposal writing is a delicate balance of presenting your intentions in dealing with your research problem. You should describe the research proposal in enough detail that the supervisor or reviewer is satisfied that the problem is worth investigation and that you have the capacity to carry it out to a satisfactory conclusion. It should be remembered that it is impossible to anticipate every minor detail.

When writing even the first draft of your proposal, take care to see that there is a logical flow from one section to another. After all, the proposal, like the research that flows from it, is like a chain of reasoning that moves smoothly from one concern to another without confusing interruptions. One good example of this flow is implicit in the introduction section of the research proposal outline. The "area of concern" is followed by "problem statement", followed by "purpose", followed by "major research question", followed by "minor research questions" and so on. This Sequence of topics begins with a very general statement and continues to narrow down to .very specific detailed material. A good| proposal will reflect this kind of reasoning with each section reflecting the previous section and carrying it one step further in a consistent manner. Too often the beginning writer of proposals will complain of this apparent overlapping and see it as duplication. The proposal is a chain of logic built carefully and slowly so that after the final page is read a clear, complete picture will be comprehended by the supervisor, reviewer and entire readership.

When doubt is raised in your mind regarding your material, it is best to stop and re-write that portion. It is good practice to write your proposal word for word as if it were the final draft. Obviously, at this point you are working from an outline as well as notes so that the final draft feeling is with you as you strive for the final draft look of your proposal.

3.5 Others Can Help You

How can others help you in writing your proposal? Always have others' read over your material in order to identify gaps, flaws and oversights of various kinds, weaknesses in organization of work and writing style are frequently most easily detected by those unfamiliar with the proposal and thereby giving the most skillful proposal writer himself after a span of time has the writer a different perspective. Even you the writer can benefit from a critical reading by a second party. More often than not, a reader unfamiliar with your work will give you some of the most helpful suggestions.

One of the most common failures on the part of first time proposal writers is lack of clarity regarding the central purpose of the endeavour. Very often first time writers will overlook the obvious in favour of the esoteric and complex. In regard to complexity, it is most important to define in text writing uncommon terms in an honest effort to communicate. Some authors write obscurely for reasons of ego building and self-reassurance of the proposal's importance. Here, I instruct you to write clearly and write simply.

Good writing, especially research proposal writing, should involve the use of punctuation, spacing, underlining, drawing, charts, tables, frequent use of subheadings in order to attract your reader’s full attention. When possible, list items in order of importance or in terms of logical sequence. This is a part of outlining which gives order and structure to your work. After all, this is not poetry or the great American novel you are writing. The purpose of this section is to present the methods by which the proposed study will be carried out. The greater the detail and care taken in the preparation of this section the more efficiently and easily the research will be completed. All steps will go according to the plan if the plan is carefully and meticulously organized. If the previous two sections of the proposal were announced as important to the proposal this section should be considered even more important.

3.6 Method and /or Procedure

Why is this section important and useful to the researcher? The "Method" or "Procedures" section (many researchers use the title heading "Procedures" or "Methods" in the place of "Methodology") is a specific set of procedures that direct the researcher in the administration of the project. Almost all of the material in this section of the proposal should be transferred to the "Methodology" chapter in the final research report. Science is based on .replication, that is, the capacity to validate a piece of research by using the same methods of study. In the presentation of any research findings, the methodology is, in fact, the authority base for the research. When the researcher reveals his methods through publication he challenges his critics to question, to doubt or to reject his findings. In effect, the findings (the content) are only as good as method used to produce the findings. Those researchers who refuse or avoid revealing their method or sources of information sacrifice their credibility because 'if the methods for producing results cannot be made available for close scrutiny then such results are assumed to lack validity. Again, the methods or source is as important as the actual results making one inexorably tied to the other. It is for these reasons that a complete and comprehensive methodology section be included in the research proposal. Too many students write far too little about their research methods in the proposal as well as the final research report. Sponsors of environmental research are skeptical of data when little or no information regarding methods is given in the report document and the same is equally true of the proposal. The writer runs far less risk of criticism in writing too much in the methods section of the proposal as compared to the other sections of the proposal. Science and research (research is the action arm of science) are founded on systematic methodology. Therefore, the right to replicate any research is a 'right available to all who are so inclined to attempt replication'. In a very real sense, the methods section is similar to a recipe (from a cookbook, anyone can get the same results using the same recipe if procedures are systematically and carefully followed).

The logical arrangement of subject headings in this section of the research proposal tends to follow the logic of the research process. The section opens with a restatement of the major hypothesis (or hypotheses) or question. Next, the appropriate research design followed by a description of the population to-be studied is inserted, This is followed by a discussion of instruments for measuring variables and a pretest exercise, the collection of information and the necessary procedures involved in the collection of data, methods of data processing and finally data analysis design to produce and answer the charge embodied in the hypotheses or research questions. Let us begin with the restatement of the major research hypothesis or question.

3.7 Restatement of the Major Research Hypothesis or Question

The restatement of your hypothesis or question at this point in the proposal is necessary to your reader or reviewer that all the methods discussed in this section are focused on answering the test set up by the hypothesis or question. This statement should be absolutely clear in the minds of everyone concerned. The reader and writer will be making continual reference to the major hypothesis or question because all hinges on that statement or question. That is, no other statement or question is more important.

4.0 CONCLUSION

The unit has provided insight to research proposal writing. It has given full understanding on the relevance of research proposal in environmental science. It shows, for instance, that the research proposal is a study plan that is to be followed in the course of the research effort .It helps you to organize your effort regarding your resources. You would recall that the selection of topic requires ideas and more often than not, as a student, you may have an idea that lacks clarity, substance, conceptualization or even floating. At this point you need not panic but make consultations with experts and non-experts in the field of environmental science or who are knowledgeable in related fields.

5.0 SUMMARY

We have learnt quite a number of concepts in research proposal writing. Do not forget that it is very important for you to read very widely before you commence the discussion of your idea or topic and subsequently the research proposal. The proposal writing process forces a direction if thoughts that shapes the research. Build your research plans on background of previous research efforts. Here you can see the power of literature review as an absolute necessity in the preparation of any study. As a student, you need to be courageous and creative in approaching an environmental problem.

6.0 TUTOR MARKED ASSIGNMENTS

1. Why is methodology important in environmental research?

2. Give reasons why you must involve others in your research proposal

7.0 REFERENCES

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UNIT 7 RESEARCH DESIGN

CONTENTS

1.0 INTRODUCTION

What do we mean by "research design" and why is it so important to discuss in the research proposal? A good research design will identify the control of those primary variables under investigation and the variables are expected to produce the experimental effect. Research design means the ordering and the arrangement of observations for the purpose of identifying variables that cause, influence, relate, associate and/or affect in some way other variables. Research design is a structuring of systematic observation to investigate the influence of one variable or a group of variables on a given situation, condition and/or other variables. The goal of research design is to establish a predictable influence (cause- effect or independent- dependent nexus) between well defined and specific variables (Polansky, 1974, 38-39).

2.0 OBJECTIVES

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

-Define research design

-Discuss types of research designs

-Explain types of research design and procedure

3.0 MAIN BODY

3.1 Types of Research Design

Before examining the many different kinds of research designs, it is important to consider the differences between studies based on secondary sources and primary sources. The former is sometimes referred to as “library” research. In planning a research project the source of the data shapes the character of the work to be done. Much research is carried out using secondary or library data. This is the kind of research that is written almost entirely as a review of literature. The principal difference between library and other types of research is that the numbers of cases used to support a hypothesis and non- library research are taken from direct observation while library research is based on collecting and organizing pieces of research that support or reject a given hypothesis. Library research is obviously far more qualitative than non- library statuses. Among the different types of library studies we would classify the philosophical analysis, the case study, historical studies, and some exploratory studies. Scholars and researchers use the library approach when attempting to write articles for publication based on secondary sources. Of course, many formally published studies are based on primary –direct observation data. More will be said about these qualitative studies later in this section.

Research designs may be classified into two-major types: Survey and Experimental designs. Survey designs do not have control group comparison nor is there any independent or "cause" variable. Experimental designs always have an independent or cause variable present and a control group. Some designs have no control group comparison at all. These are referred to as quasi- experimental designs.

In order to more explicitly illustrate types of designs, each design is schematically laid out to show the dimensions of time, independent variable and observations.

3.1.1 Survey Designs

The survey designs are observations taken at one or more points in time. There is no reference to a control group or independent variable.

3.1.2 Cross-Sectional Surveys

Descriptive — one time only observation

Exploratory — one time only observation

Explanatory — one time only observation

All three cross-sectioned designs are observation at one time only. The descriptive design is used for community surveys such as Environmental Impact Assessment (EIA) and need assessment projects. The exploratory design is used to accumulate data in order to formulate more precise hypotheses and research questions. Explanatory designs attempt to make assertions about the population being studied (Babbie, 1973:58). The researcher may want, to explain the relationship of one variable to a second variable and would use an explanatory design. This process requires at least a bivariate analysis, if not a multivariate analysis of the survey data.

3.1.3 Longitudinal Surveys

Some surveys allow for the analysis of data at different points in time. A descriptive or explanatory survey may be carried out at a second and third time or more in order to see changes over time.

These are not experimental because no causal factor is assumed to be operating in the survey situation. Longitudinal designs are trend, cohort and panel.

T_1 T_2 T_3

Trend

Each set of observations is a different sample.

Cohort $\boxed{T_1}$ $\boxed{T_2}$ $\boxed{T_3}$

Each set of observations is a different sample but from the same environment.

3.2 General Characteristics of Environmental Study

Why write a description of the environment to be studied? The reviewer or advisor of your proposal cannot judge the relevance of your project without knowing at least the general characteristics of the environment in the study. It is quite likely that the physical environment will be so unique that the project is not feasible given the limits of the proposal writer’s monetary means. For example, as a student in Environmental Studies and Resource Management Programme, you want to study biodiversity in the moon, you soon realize that your limited resources will not allow you achieve this ambition. One of the first questions to be answered by a researcher is “do I have enough funds to cover the broad spectrum of the problem?” It would be more interesting if one could study beings from outer space but such a study is impossible in as much as no one can seem to identify any such creatures. If one were to do a study of power structures with a focus on medium size cities as the units of study one would be expected to spend a great deal of time describing in detail each city to be surveyed and analyzed. If one were concerned with matching cases from two different geographical locations knowing the characteristics would be absolutely necessary in order to pair-match cases from each location.

Some amount of information is necessary to know early on in the planning and proposal writing stage of the project. If one is to study the soil forming process, one would presumably want to examine soil from initial weathering process. It is therefore important that a detailed description of your study environment be presented in the research proposal. If the unit of study is the physical environment then some general characteristics seem necessary to report. These common characteristics of value to the reader are vegetation, soil, climate, landform and geographic location.

3.3 Location or Setting in which the Study is Carried Out

Why is the location of the study important? Why should it be discussed in the research proposal? Not unlike that. previous subsection on describing the environment to be studied, the location greatly determines the feasibility of the entire project. If the location requires extensive travel then costs will have to be considered and may delay the project beyond realistic dates of completion. For example, a project may require special equipment such as a soundproof room equipped with a two way glass and playroom toys. This type of setting would be difficult to procure. Such a setting is rarely found on a college campus and permission may be difficult to obtain for its use. Another example of special setting problems is the need for special measuring devices. The construction of some devices may require special skill and funding and employing such skill takes time and money. There are more reasons for delay and possible postponement of the project. For these reasons the proposal writer should carefully describe the location or setting of the project. This includes geographic location as well as the nature of the setting. The uniqueness of the location or setting must be clearly laid out and detailed.

3.4 Calendar of Events During The Study

Why prepare a calendar of events? A calendar of events is a time schedule for carrying out the required tasks of the research project. It represents more of the detailed organization necessary for convincing your advisor or reviewer that the project is indeed feasible. The time schedule or calendar is another indication of how carefully and realistically the proposal has been developed. Very often a reviewer may have difficulty following the flow of your material and when he turns to the calendar of events, he will be able to find the clarification that he has been looking for all along. The calendar logically follows a sequence of events that parallel the research and in fact embodies the research process to a great extent.

Specific dates should be set for the completion of various tasks and phases of the project. Indicate these by placing them in a chronological order and the specific amount of time required to complete them. You should strive for a clear set of steps in a sequential arrangement. Is the description of these steps consistent with other materials discussed in other sections of the proposal? For example, is there sufficient time set aside for the collection of data? Is there a sufficiency of time allowed for the analysis of data? It may be advisable to consult with others regarding realistic periods of time for the completion of certain tasks. Different tasks require varying lengths of time to complete. The review of literature takes weeks or even months to examine, but it is done in a fairly casual manner, whereas the data collection phase or rather experimentation is very often carried out in a very intensive way requiring strict adherence to procedure. The time required to collect "data may be only a few days or several months depending on the nature of the problem. The planning of this kind of thing is best done by careful discussion with your advisor or some other knowledgeable person in the field of environmental research methodology.

Experience in the field of research activity suggests that a time table of research activity is probably much too ambitious and will fall way short of the established goals. This is especially true of the beginner and novice. The old hands in the field of research will suggest that a timetable be set up and once it is fixed, the researcher should double the amount of time presumably needed. If there ever • was an absolute, this cornea close to being one of them. Once the revised time schedule is established, the proposal writer should set his dates of completion for each task. Once this is done, the writer should observe how realistically each study phase can be completed. It is extremely important that the research be carried out according to this calendar of events as closely as possible.

Let it be said that if you are not an experienced researcher, all effort should be made to develop this calendar as realistically as possible. In the face of good or bad advice from other well meaning people, make your timetable, double your time requirements and work like hell to stick to it.

One last comment in regard to scheduling your research work when it involves travel and travel time. When and if your proposed project requires any substantial amount of traveling, be extra careful in planning such events. Details of plan are a most wise posture to take. Traveling takes not only time but money, and wasted travel effort is demoralizing and damages the entire research effort. Again in this regard as well as all other time scheduling, be conservative and realistic, for once the project is approved and under way it is extremely difficult to overcome problems of timing and the resulting time binds.

3.5 Sampling Design and Procedure

Sampling is a procedure used by scientists in order to generalize about a larger population. Researchers are always worrying about the problem of sampling primarily because of representativeness of that sample. But before examining the issue of probability the proposal writers should begin by defining his unit of study and/or unit of analysis. Next, the proposal writer should firmly establish the size of the sample and present the rationale for the number of cases selected. A very small sample meticulously selected is far better than a large sample carelessly gathered.

Sampling is important because a great deal of information can be gained from a very limited effort with a well-selected sample. But equally important are two other technical reasons for carefully outlining your proposed sample. First, from the point of view of external validity, it is important so that the researcher may know the environment to which the results of the study can be generalized. The reviewer or dissertation advisor will want to know the limits and the definition of the environment to which you wish to generalize and your exact methods and procedures for selecting a sample from that environment. In order to produce a scientific sample, one must draw that sample from the defined environment according to some systematic pattern so as to obtain a 'experimental' sample. Given an experimental sample, well known scientific procedures can be readily applied. An experimental sample is one in which every case or unit of study in the defined environment has an equal chance of appearing in the sample. Remember, all forms of experimental sampling involve random sampling at some stage in the selection process. The writer should make use of random sampling when the design of his study is survey or experimental where the assignment of cases to both the experimental and control groups should be systematic and random in assignment procedure. A second reason that experimental samples are top important is because without an experimental sample the researcher cannot form a sampling error estimates and thus have no way of judging the precision of scientific results. In many research projects the researcher is simply concerned with the total number of cases being affected by some environmental problem situation. Rather than selecting a probability sample from a very large environment affected by a given problem, the researcher takes a smaller environment of the same problem.

For these reasons, it is important for the proposal writer to describe the particular sampling procedure and the rationale for using that procedure. If one is selecting soil samples from a given neighborhood, he should describe the procedure for selecting the cases. Do not leave your advisor or reviewer guessing as to your intentions. If there is a follow-up sampling process, describe this to your reader. It is important and valuable to make reference to other studies that have used the particular sampling method you hope to employ. This will strengthen your proposal in the eyes of those reviewing your document.

Finally, if there are anticipated difficulties in the sampling phase of your research, it is always best to deal with these difficulties directly. Any experienced reviewer or advisor will spot these problems and confront you with the area of weakness.

3.6 Data Collection Instrument or Schedule

This subsection and the following one may be confusing to the reader because they both are concerned with data measurement and data collection. The data collection schedule is a repository and/or a device that contains the instruments that measure the variables necessary to test the research hypotheses and questions. A data collection schedule may very often contain several instruments. It is possible that a data collection schedule contains but one instrument. In this case it may be referred to as a "data collection instrument". The next subsection is concerned with "instruments" that measure variables.

Before beginning any further discussion, it should be pointed out that when one refers to a “questionnaire” one is referring to a data collection schedule that is completed or filled out by the respondents. A data collection schedule completed by the researcher as observer is referred to as a schedule”. It is common to hear the term “questionnaire” in both situations. However, the term questionnaire, when used, still refers to a schedule even when used as a mailed device.

The data collection schedule will more than likely contain more than one instrument. For example, the schedule will include edaphic information such as soil texture, structure, moisture, air, colour, and acidity among other variables. These kinds of variables are relatively easy to measure and present no problem in designing. The schedule will also include the instruments measuring your primary variables. These would be the dependent variable and the primary variable as well as the dependent variable and the independent variable. The researcher must control unwanted intervention.

The different kinds of variables should be listed in a straightforward manner so that the reader can see very quickly the variables being measured by your instruments. The listing of variables should be accompanied by continual [reference to: a draft of the data collection schedule that must be attached as an appendix item to the research proposal.

It is wise if each listed variable is identified by level of measurement. It may be necessary to return to a statistics textbook in order to review the data classification chapter. Some writers will recall this system, but |others will not. Basically all data are divided into three categories that actually fall along a continuum from very crude measurement or "nominal" measures to "ordinal" and then "interval", the most precise level of measurement. Each variable should be identified as to level of measurement by examining the number of categories making up each variable. Again, it is suggested that the proposal writer review his statistics text for help in this subject area. The identification of level of measurement will be invaluable late: on when the researcher begins the analysis of data.

When the schedule is being planned, it should be laid out in such a manner as to be attractive and easy to code when the data are finally collected. The schedule should be on good quality paper and printed if cost does not prohibit such luxury. The use of colored paper makes the format so much more inviting and after all, you do want to encourage your respondents to actively complete your instruments. It is also advisable to provide wide margins for each page of the schedule in order that the coding of data is made convenient and visible.

Finally, it should be said that it is wise to carefully examine the reasons for including each variable in the schedule. Do not include a variable if there is no apparent good reason. Very often students will say that “it might be nice to include…” or “there is still room on the schedule…" These reasons are not sufficient to warrant inclusion of any variable. Include only those variables that you plan to use and analyze.

3.7 Instrumentation and Tools for Measuring Variables.

Environmental research as well as other kinds of research instruments are designed to measure variables.

Detailed discussion of the instruments to be used in a study shows the proposal reviewer that the writer has a sophisticated appreciation for the detail of research methodology. The proposal must reflect this quality. The researcher must design or select from previous studies an instrument or set of instruments for measuring each variable included in the data collection schedule. This process is also known as operationally defining variables. The researcher is trying to determine if the definition through operationalizing the measurement of a variable validly measures that variable. Most important in this regard is the step between conceptualization of a variable and its practical measurement. Is the measurement true to the theoretical meaning embodied in the variable as a concept? The question is a difficult one to answer and other text material on theory and measurement might be helpful. One of the best and most practical approaches to handling this problem is the pretest. Always discuss in your proposal the extent of validity and reliability as shown by any pretesting of your variables. Pretesting is the simplest method to strengthen the meaning of your measurements and their conceptual intent.

For most researchers there are two choices available in regard to instrument design. One is to borrow the necessary tools from as they are needed. There are many well-designed instruments available and they should be used if they fit your problem. Too often students will give up the search and fall back on their own skills to design instruments. The search may lead you back to your literature where much discussion was focused on measuring variables. It is wise and economical to use instruments that have already been designed. For one thing, these instruments have probably been tested for reliability and validity and that needs only to be mentioned in your methodology section of your proposal. Most environmental variables have their validity and reliability based on use and need not be tested. Many scales have subsections that measure single dimensions that can be lifted out of the original scale and placed in your own data collection schedule. It goes without further mention that all authors of scales or other instruments should be given full credit for their work.

The format of the several instruments to be included in your schedule should follow a logic. For example, some instruments are single dimensional such as the environmental variables mentioned earlier. These may be grouped together while the multiple statement scales may be set off one from another in subsections. This gives proper attention to each instrument or scale. Most collection schedules have some open-ended items. This kind of instrument is valuable for a number of reasons, for it gives the researcher the opportunity to freely express a point of view. Such items should be placed at the very end of the schedule.

The range of different kinds of instrument is very great and all are available for your use to measure variables, that is, a schedule need not be made up of only one type of instrument. The range of tools is for your use. Among the list of different instruments are the following: sound detector, scales, GPS, survey chain/tape, check lists, open-ended questions, direct observation, tape recordings, and hand-written journals.

4.0 CONCLUSION

This unit has exposed you to what research design is all about. It has brought to the fore some reasons for producing a good research design even at the level of proposal. As you have known, research design is the systematic structuring of observations for the purpose of identifying variables that cause, influence, associate or affect other variables. The unit has highlighted some general characteristics of environmental studies. It explains very clearly that the location or setting of a study determines the feasibility of the entire project. At this point, you have learnt that detailed discussions of the instruments to be used in the study and will appreciate the details of research methodology.

5.0 SUMMARY

We have learnt research design and types of research design available for environmental studies. The unit has dealt with such issues as types of research designs, the location or setting of study, calendar of events during the study as well as sampling design and procedure which can serve as important technical subsections of the study. This is more relevant because of the need to understand the environmental conditions to which results of the study can be generalized. Data collection instrument has been mentioned as a repository necessary to test the research hypothesis and questions.

6.0 TUTOR MARKED ASSIGNMENTS

1. Describe instrumentation as tool for measuring variables

7.0 REFERENCES/ FURTHER READING

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UNIT 8 VALIDITY AND RELIABILITY

CONTENTS

1.0 INTRODUCTION

In preparing the research proposal, the confidence one can place in the accuracy of the instruments used goes a long way toward winning acceptance for your proposal. The issues of validity and reliability are the twin pillars that prove research to be only mediocre or outstanding. It is highly recommended that whenever the methods used in research are tried and tested this fact should be documented for it greatly increases the strength of your proposal and eventually your research findings.

What do we mean by validity and reliability? Most students of research methodology and statistics are well-informed of the issues involved. If this is not the case, it is suggested that a review of validity and reliability be made. In the meantime, a brief remainder of their meanings may be helpful. Validity is concerned with the truth of a measure. That is, does this variable measure what it is supposed to measure? For example, does a wind vane measure wind direction? Does a thermometer measure temperature? Does rain guage measure the amount of rainfall? Are we measuring weather and climate or are we measuring something we think is weather and climate? Does the instrument measure what it claims to measure? These are hard questions with only vague answers.

Reliability is somewhat more readily understood. Reliability of an instrument is concerned with the consistency of its application. A rainguage may well be a measure of rainfall but is it a consistent measure of rainfall? If an instrument consistently measures rainfall incorrectly, one is unable to use the instrument. If we know that the rainguage is always short by, say, five millimetres, then it is not a valid instrument but it is reliable. The difficulty with testing instruments for these methodological dimensions only goes to underscore the strength of your instruments when validity and reliability are present. Then, too, an instrument may have reliability and not validity or the reverse condition. From an operational point of view, it is probably best if your instrument has at least demonstrated reliability. For an instrument to have some reliability it automatically has a small amount of validity built into it. Finally, it needs to be pointed out that most environmental data and other observable behavior has what is called “face” validity. This consists of well-defined understanding of what, let us say, temperature means. The scientific world literally demands that its environmentalist know and measure such variables as soil acidity, texture, structure, moisture and a whole host of features necessary in order to understand types of soil in a given environment.

2.0 OBJECTIVES

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

- Define and differentiate validity and reliability.
- Define the most important concepts and terms used in the study.

- Understand the actual procedure for the collection of data.
- Define data processing and procedures for data analysis.
- Identify things to do with proposal when the research is completed.

3.0 MAIN BODY

3.1 Pretesting the Data Collection Schedule

The pretest is also sometimes referred to as a “pilot test or pilot survey”. Even if a data collection schedule has valid and reliable instruments, it is always wise to plan to submit your schedule to some kind of pretest. A pretest is using the instruments on a very small size of the environment. This kind of pretest may consist of only five or six subjects. The value of this procedure can only be realized after using a set of instruments to a study of environment and finding errors and embarrassing omissions. A simple pretest will quickly assess for the researcher errors that can quickly be corrected. The comments of a pretest environment are sometimes invaluable in showing insight that only the researcher would overlook because he is much too close to his work. For these reasons, he should include a pretest or “test run” before the actual serious data collection gets under way. It need not be indicated in the proposal but on some occasions the sample used in the pretest can also be included as part of the actual data to be collected. This is possible when and if the pretest cases can be legitimately included in the sample and there are no serious errors in the instruments as designed.

3.2 Definition of the Most Important Terms and Concepts

Why define terms in the research proposal? Every researcher knows that a clear understanding of terms and concepts is necessary in order to communicate to other scientist and scholars. There must be a common understanding of what is being referred to during the presentation of findings. But the need to define has already been discussed in a previous subsection. That is, under the discussion of the data collection schedule and instrumentation, variables were listed and measured. The process of describing and measuring variables is in fact a process of defining terms and concepts. For example, if the concepts “climate change” were used as a measure of the environment, the definition of this concept would consists of the individual items making up the scale that measures “climate change”. Measuring a variable is synonymous with defining that variable.

During the development of your review of literature, there will be a great deal of reference made to technical terms and concepts. The understanding of these items is more important to the reviewer or advisor in order that he quickly grasp the full impact of your problem and your particular theoretical approach to it. It is for this reason that technical terms be clearly defined in this section of the proposal. It should be remembered that once the research has been completed and the final document is available to any and all eyes, the non-expert and the non-specialist may find good reason to read your work. This audience will need to have the technical terms defined for them in order that a full appreciation of your work can be experienced. Moreover, the greater the depth of the proposal writer’s involvement with his work, the less sensitive he is to the clarity of his own writing. He gets lost in his own fascination with the problem and fails to see that what is common and obvious to him is foreign and obscure to others. This does not mean that every term or concept should be defined in this subsection. You must be selective and this may require that a second reader can more objectively help make the judgment as to what should be defined here and what need not be defined in this section.

3.3 Administration of the Data Collection Schedule

By now you are familiar with the other subsections which have dealt with the data collection schedule and its design. Following that, a discussion on instrumentation was presented. This subsection is primarily concerned with the actual procedures for the collection of data. The proposal should reflect rather clearly how the administration of the collection schedule should proceed because this is the most critical period in the entire research process including the preparation of the research proposal. In one sense, all the stages of planning and carrying out the project have been within the direct control of the researcher. This is not so when the collection of data is under way. The research is especially vulnerable if the data are collected from personal interviews. Only well-trained interviewer can give the researcher any reassurance that the process will be accurately and correctly done within the time limits set forth in the proposal's calendar of events. Some research which relies on files as the source of data greatly reduces the potential anxiety of the researcher because such data can be more systematically organized for collection. If the data are to be collected from respondents by interview, it would be advisable to give the interviewer some training before sending them out to get your data.

The reviewer or research advisor will want to know the specifics of your plans for the collection of data and that will include explicit statements about the field controls you will employ. The environmental dynamics of the data collection situation, if ignored, may damage the study's validity.

3.4 Data Processing

What is meant by data processing? Data processing is concerned with the transfer of collected data to a coded form that is entered onto a data processing instrument which in turn is manipulated in such a way as to produce statistical and/or numerically arranged data. More and more research on and off the Study Centre is being done with the assistance of computer equipment. The capacity of this technology is so superior to the old manual methods of sort-count and record that there is no comparison in terms of efficiency and accuracy. Computer analysis provides the researcher with the capacity to manipulate data in many different ways and make possible highly sophisticated and precise understanding of data collected. It should be remembered that since great effort has been expended on the research project up to this point, it certainly deserves careful and generous treatment when it comes to the analysis of data.

There are computer centers on almost every university campus and consultants are available to give you assistance in preparing your data for processing and analysis. It is recommended in the planning of the data collection schedule that coding of the variables should be worked out. That is, the writer should return to his list of variables under the subsection "Data collection Schedule". Each variable should be assigned categories which can in turn be assigned numerical values, for example, rainfall -1 and temperature -2, etc. This arrangement of coded variables by category is referred to as "Coding Instructions". The coding instructions are necessary if the data are to be keyed into softwares such as Statistical Package for Social Sciences (SPSS), Excel, etc., and processed by computer. Again, the proposal should at least include coding of categories which can be done on the margins of the attached instruments or listed separately as an attachment to the proposal.

3.5 Procedures of Data Analysis

The research design subsection of the proposal focuses attention on the basic contrast and comparisons to be made in order to test the major and minor questions and hypotheses. The "Procedures of Data Analysis" subsection of the proposal makes somewhat more explicit the technical procedures necessary to carry out the charge expressed in the design subsection.

The proposal should show what groups are to be compared and what statistical tests and measures will be used to determine statistical significance. In the situation of the case study or environmental design, the researcher will want to indicate the specific use of non-statistical as well as statistical techniques. Non-statistical techniques will include the use of photographs, maps, drawings and illustrations. Statistical technique will include the use of statistical tables, frequency counts, and percentages for summarizing data and making simple comparisons possible. If the proposal writer is skilled in the use of bivariate and multivariate analysis (which the computer equipment can easily perform), then these statistical tests should be mentioned in this subsection of the proposal. Some of the more common data analysis designs would include chi square analysis, product moment correlation coefficient, and “t” tests, analysis of variance and Mann-Whitney u analysis.

3.6 Special Techniques

It has been mentioned earlier that each project will be unique and this writer respects that character of your work. It is likely that the uniqueness of your work is sufficient to warrant the preparation of a special section and eventually a special chapter in the final research document to describe this uniqueness. For example, for those researchers who find the need to develop and construct a special scale or instrument, the procedures involved should be outlines in a special section of the proposal. This development of an instrument is valuable not only to the researcher but also to potential users who read your final document. Another example of a special section is the extended environmental history. When a little known area is being investigated, the researcher may find it necessary to inform his reader of the historical background to the problem. He should prepare a detailed outline of this section to be included in the proposal. The complicated construction of equipment necessary to test and measure or otherwise use in a project might warrant detailed description in the final document. This, too, should be outlined in the proposal. Do not feel reluctant to make the effort to include special mention to unique features of your research, for this will almost always be viewed as competency on the part of the proposal writer by academic advisors.

3.7 Things to do with the Proposal when the Research is Completed

Let us assume that your proposal has been accepted and the research process has been followed through the data collection and processing phases. It is obvious that reference to the proposal has been casual if not intense at particular times. By this point into the research, the steps and stages have become familiar to you and use of the proposal declines as work on the project proceeds. The question is of what value is the proposal at this stages have become familiar to you and use of the declines as work on the project proceeds. The question is of what value is the proposal at this stage of events? The proposal remains valuable for one basic reason. All of the material that was written into the proposal is certainly a part of the overall project. When the analysis of data is under way, the writer can turn his thoughts to shaping the first three chapters of the research report. It is not necessary to wait until the data are completely processed or analyzed before the report writing phase can begin.

First, begin by taking a spare copy of the proposal and removing each section for separate use and examination. Next, reread the introduction with a view of changing it to “introduction” Chapter 1 of the report. It will be necessary to change tenses. It will also be necessary to remove those statements, question, and hypotheses that no longer fit with the reality of the actual research. Move to the second section, “Review of literature”. Follow the same procedure as you did in the first section. Start thinking and reading as if it were the second chapter of your final report. During the research work you will have undoubtedly discovered additional literature relevant to the project. In this event this new material should be added and integrated into the literature chapter. Again, the rewriting task will require changing tenses. Move to the methodology section and continue the process of rereading, change tenses, adding material and removing inappropriate parts. No researcher is so wise that all plans work perfectly. The methodology chapter must reflect the actual facts of the research experience. If a special section has been written about the unique aspects of “interviewer training” and has been placed under the subjection “Special Techniques” of the research proposal, the writer may want to pull this out of the methodology section and create an entirely new chapter in the research report.

With relatively little effort, the writer has converted the research proposal into four chapters of the final report, chapter 1. INTRODUCTION, chapter 2 REVIEW OF LITERATURE, chapter 3. METHODOLOGY. At this point, the writer is ready to organize the “findings” chapter around the major research questions and hypotheses.

4.0 CONCLUSION

The concepts of reliability and validity have been clearly discussed in this unit. The unit has established that whenever the methods used in research are tested, there should be documentation which will increase the strength of research findings. It is therefore your place to understand their meanings and differences in order to establish a consistent measure of variable in your study. The challenge of testing research instrument for this methodological dimension only goes to underscore the strength of instruments you had used in the study when validity and reliability are to be confirmed.

5.0 SUMMARY

In this unit, we have learnt that validity is concerned with the true measurement and not probability or guesses; whereas, reliability is concerned with the consistency of the application. A pretest of research instrument is one valuable procedure that identifies errors and ambiguity committed by the researcher. You should also remember that this unit has highlighted the actual procedures for the collection of data, processing techniques, and data analysis. Finally, the unit illustrates your familiarity with the steps and stages of the research and what you need to do with the proposal when the research is completed.

6.0 TUTOR MARKED ASSIGNMENTS

1. Carefully describe the things you will do with a research proposal when the research is over.

7.0 REFERENCES/FURTHER READING

Burgess, J. A.(1984) In the Field: An Introduction to Field Research, London: Routledge.

Coshall, J. (1989) The Application of Non-parametric Statistical Test in Geography, Concepts and Techniques in Modern Geography 50, Norwich: Environmental Publication.

Drury, S.A. (1990) A Guide to Remote Sensing: Interpreting Images of the Earth, Oxford University Press.

Hagerstrand, T. (1975) Space, Time and Human Conditions, In A. Karlqvist, L. Lundqvist and F. Snickars (eds) Dynamic Allocation of Urban Space, Farnborough: Saxon House

Martin, D. (1996) Geographic Information Systems: Socio-economic Applications, 2nd edn, London: Routledge.

Watson, G. (1987) Writing a Thesis: A Guide to Long Essays and Dissertations, London: Longman.

UNIT 9 FIELD TRIP

1. The Field Trip is expected to be organised by ESM Facilitators at respective Study Centres. It is expected that the Field Trip be done within the local environment where students can take advantage to study the environmental conditions in their neighbourhood.

2. Students are expected to submit s type-written field trip report of not less than 20 pages on A 4 sized paper: 12 fonts, Times New Roman, double spacing and spiral bound to the Study Centre Manager for assessment.

3. All scores on the field trip report must be submitted to the Study Centre Manager.

LOGISTICS:

- ✓ TRANSPORTATION
- ✓ FEEDING (optional)
- ✓ MEDICAL ATTENTION
- ✓ ACCOMODATION (optional)

INSTRUCTIONS FOR THE FACILITATORS

1. Facilitators should explore (conduct pilot survey) the local environment in order to identify study site(s) for students.
2. Facilitators should ensure that students have full grasp of the major environmental concepts in the study area.
3. Facilitators should relate facts and concepts found in course materials to what is found in the field.
4. Students should be free to ask questions while in the field; such questions must be appreciated by the facilitator who in turn will provide on-the-spot illustrations and explanations to the students.
5. Students are expected to submit a type-written report two weeks after the field trip for grading.