Fundamentals of research methodology and data collection

Book · April 2016

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FOREWORD

Fundamental of Research Methodology and Data Collection is an excellent book that has a collection of basic concepts and terminologies in research method. It is filled with good ideas and tips on how to write very good articles that are fit for publication in reputable journals. The author has tried to identify problems encountered by young researchers and also proffered solutions to those problems. She has given detailed tips on how to asses and determine a good article meant for publication in quality journals. This will no doubt equip young researchers with technical knowhow that will engender faster growth in academics. Referencing which is a vital part of any research work was fully covered with various styles carefully and painstakingly discussed. Basic concepts on inference which is very vital in most research endeavours were also captured for non-specialists. Detailed write-up on sampling techniques and sample size determination were well written and demonstrated in an excellent manner. The rudiments about data collection including various methods with the merits and demerits were fully covered in this book. This book is not only recommended to anybody engaged in writing Reports, Projects, Dissertations, Thesis and articles for publication in academic journals. It is also recommended to staff and students of all tertiary institutions especially those that want to learn how to become their best in research.

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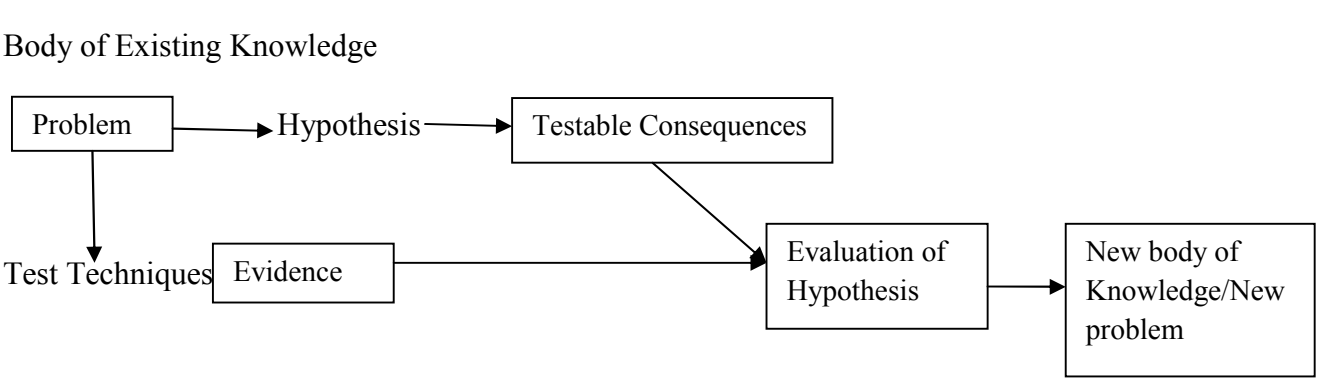
CHAPTER ONE

RESEARCH METHODOLOGY

1.1 Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. (Irny and Rose, 2005) A methodology does not set out to provide solutions - it is, therefore, not the same thing as a method. Instead, it offers the theoretical underpinning for understanding which method, set of methods or best practices which can be applied to specific case, for example, to calculate a specific result.

1.2 Research: The process of research came into being due to man's quest to be at tune with his environment and also understand nature. To achieve this, man uses the tools of experience and reasoning available to him. Man also makes use of experience and authoritative sources beyond his immediate circle. Experience and authority are rich and major sources of hypothesis, which are based mainly on common sense knowledge and haphazard events, therefore it can be unjustified for drawing conclusions on events. Hence research hypothesis formulation using experience and authority is judged to be unscientific. Research anchors on scientific reasoning; which could be inductive and deductive or both. Research is a combination of both experience and reasoning and can be said to be the most appropriate way of discovering the truth, precisely in the natural Sciences.

Research flow chart



The need to research came due to the following reason

1. To acquire a degree
2. To get respectability

3. To face a challenge
4. To solve a problem
5. To get Intellectual Joy
6. To Serve Society by increasing Standard of living for Science and technology and by showing right path to society in case of social and behavioural Sciences.

Qualities of Good Research

A good research method should lead to

i Originality/ Novelty

ii Contribution to knowledge

iii Significance

iv Technical soundness

v. Critical assessment of existing work

Igbokwe,(2009)

1.3 Research methodology: This is a set of systematic technique used in research. This simply means a guide to research and how it is conducted. It describes and analysis methods, throws more light on their limitations and resources, clarify their pre- suppositions and consequences, relating their potentialities to the twilight zone at the frontiers of knowledge.

Advantages of Research Methodology: The following are the advantages of research methodology:

1. Advancement of wealth of human being
2. Provision of tools for carrying out the research
3. Develops a critical and scientific attitude, disciplined thinking to observations
4. Enrichment of the research process and provision of chance for in-depth study and understanding of the subject
5. Helps to inculcate the ability to evaluate and use research results with reasonable confidence and in decision making
6. Inculcates the ability to learn to read and think critically.

1.4 PHILOSOPHIES AND RESEARCH METHODOLOGIES

1 Survey: This is used to obtain data about practices, situation views at one point in time through questionnaire or interviews

2. Case Study: this involves an attempt to describe relationships which exist in reality

3. Simulations: This involves copying the behaviour of a system and is used in situations where it is difficult to solve problems analytically. It typically involves the introduction of random variables. It has a problem of making the data collected sufficient enough to resemble reality.

4. Subjective/argumentative research: This is used for generating new theories and ideas which can subsequently be tested. It is subject to research bias. It is unstructured and subjective form of research.

5. Action research: This is the most useful form of research. It involves application in which the researcher attempts to develop results or obtain solutions of practical value to the people with whom the researcher is working and at the same time developing theoretical knowledge.

1.5 Types of Research

There are several criteria for the classification of research types these include method of research and goal of research. Research can also be classified by the research method used**.** However, many research projects use methods from more than one class.

i. **Action Research**: This type of research is mostly essential in applied research where it requires implanting recommended changes to a process, bearing in mind to solve a problem and to carry out research to determine the effectiveness of identified changes. It aims at solving an identified problem based on recommendations made to a process

ii. **Creative Research:** Creative research involves the development of new theories; new procedures and new inventions and is used to some extent in all fields, in contrast to experimental research, creative research is much less structured and cannot always be preplanned. This type of research includes both practical and theoretical research.

iii. **Descriptive Research:** This type of research is also called a "case –study research". It involves studying a specific situation to ascertain whether any general theories may arise out of it whether an existing theory are borne out by specific situations. e.g in anthropological studies etc

iv. **Experimental Research:** The cornerstone of science is experimental and creative research. Experimental research is primarily concerned with cause and effect. Here

the variables of interest are identified (i.e. the dependent and independent variables) and the researcher seeks to determine the effect of changes in the independent variables on the dependent variable.

v. **Ex-post facto Research:** This is Research "from after the fact" and this type of research typically occurs using data generated from experimental research. While in experimental research, the effect is determined from the cause, here the cause is deduced from the effect.

vi. **Expository Research:** This is research based purely on existing information and normally leads to "review –type reports". It involves reading widely on a field, comparing and contrasting, analyzing and synthesizing all points of view and developing new insights.

vii. **Historical Research**: Studies on the past to determine cause-effect patterns. This type of research is often geared towards using past events to examine current situation and to predict future situation. e.g stock market forecasting. Data is gathered from primary sources (records made at the time of past events) and secondary sources (records made after the event). (Lodico et al,2010)

1.6 The Purposes of Research

Research serves many purposes. Three of the most common and useful purposes, however, are exploration, description, and explanation. Many studies can and often do have more than one of these purposes, however each have different implications for other aspects of research design.

How to Design a Research Project

Undertaking a research project can be a bit difficult for a beginner who have never done one before or who is embarking on an entirely new subject or research method. Where should he start, and what are the proper steps involved? This section will serve as a guide to the process.

One important idea in a research project is the unit of analysis. The unit of analysis is the major entity that is being analyzed in a study. It is the 'what' or 'who' that is being studied. Units of analysis are essentially the things that are examined in order to create summary descriptions of them and explain differences among them.

Some studies include more than one unit of analysis. In these instances, the researcher must anticipate what conclusions he or she wishes to make with regard to each unit of analysis. For instance, if a researcher is examining students' expenditure in the tertiary institution, the unit of analysis is individuals (tertiary institution students). Again, if a researcher is examining what kinds of college students are most successful in their careers, but also wants to examine what kinds of colleges produce the most successful graduate students, he or she is working with two separate units of analysis: individuals (college students) and organizations (colleges).

1.7 Relationship between Methodology and Method

Methodology is the general research strategy that outlines the way in which a research project is to be undertaken and, among other things, identifies the methods to be used in it. These **Methods**, described in the methodology, define the means or modes of data collection or, sometimes, how a specific result is to be calculated. **Methodology** does not define specific methods, even though much attention is given to the nature and kinds of processes to be followed in a particular procedure or to attain an objective.(Howell,2013) Any description of a means of calculation of a specific result is always a description of a method, and never a description of a methodology (Katsicas,2009,). It is thus important to avoid using **methodology** as a synonym for **method** or **body of methods**. Doing this shifts it away from its true epistemological meaning and reduces it to being the procedure itself, the set of tools or the instruments that should have been its outcome. A methodology is the design process for carrying out research or the development of a procedure and is not in itself an instrument, or method, or procedure for doing things.

Methodology and **method** are not interchangeable but, in recent years, there has been a tendency to use **methodology** as a "pretentious substitute for the word **method**". Using **methodology** as a synonym for **method** or **set of methods**, leads to confusion and misinterpretation, and undermines the proper analysis that should go into designing the research.

CHAPTER TWO

RESEARCH PAPER WRITING TIPS

At present research paper writing is a significant part of all academic curriculum and the students must write a research paper during their educational period. Here, the main aim of writing a research paper is for improving the skill to make use of collected information to support your point of view on a particular topic. As a researcher you want to have a solid grip in the fundamental ideas and terms used in the respective field that you are writing. It is simple to write a good research paper if you understand the writing. It is also simple to write a good research paper if you understand the writing pattern of a research. One of the important things to do before setting out to write your paper is to make your time schedule. Research paper writing includes many tasks such as thesis writing, collection of needed information, preparation of draft, etc, as such; it should take more time. You need to split the time allowed for your research paper to various processes. If the target period for your research paper is three months, then schedule the first ten to fifteen days for managing your thesis statement, the next fifteen days for collecting the useful resources to hold up your thesis and the following days for your writing and editing process.

Choosing of a right topic is the next important thing to follow a research paper writer. You should select a topic which is interesting to you to make the entire research process straightforward. And confirm that you know something related to the topic for developing your point of view on that topic. This will help you to save your time from a deep research. Collect needed information to support your thesis using various resources available. Make use of great books related to the topic, academic publications, magazines and internet resources such as educational websites and blogs of educational institutions and government authorities.

Move to your writing processes with the collected resource. Go through your point of view on the topic and use the appropriate resources to support it. Try at most to give a variation to your research writing to give a better attraction to the final paper. If it is not clearly maintained, the allocation of collected information will make bad effect in your entire research writing. Your attitude towards the research writing process is the key factor which determines the final result of your research. If you pay good attention, surely you will get a great result too.

In writing research papers, it is important to prevent some very common errors by avoiding these research papers writing blunders enumerate below;

2.1 LETTING YOUR DEADLINE SLIP

One never means to do it, but somehow deadlines often creep up out of nowhere. For big research papers, try to make a timeline in your planner. Schedule dates that you would like to have certain tasks completed (such as your outline and first draft) and maintain your progress. For instance, as earlier stated, if you are targeting three months for your research paper, then schedule the first ten to fifteen days for managing your thesis statement, the next fifteen days for collecting the useful resources to hold up your thesis and the following days for your writing and editing process. Making strides ahead of time will keep the stress and late- nights to a minimum as the turn- in date draws nearer.

2.2 BEING AFRAID TO ASK FOR HELP

Everyone struggles with research paper writing from time to time. As a student, your professors, supervisors, and librarians want you to succeed and, more than likely, they will all be eager to help you or give advice where they can. Don't hesitate to contact your professor/supervisor if you are not sure of how to get started or how to progress with your paper; they are there to help you. Schedule a meeting and bring along some of the work you have done so far. You may be able to divide some of your research tasks into small chunks which can be tackled whenever you have a little spare time. For example, if you take photocopies of materials you need to read, be sure not to wait until the last minute to ask for help with things you should have ordinarily begun long ago. As a researcher, it is always advisable to hook-up with a research assistant or a consultant. You cannot know it all, there must be an area you would need an expertise advice to achieve the desired quality required.

2.3 MAKING YOUR TOPIC TOO BROAD

Once you start developing ideas for your research paper, try to narrow your focus down even further. Papers that lack focus only skin the surface of a number of concepts, but never go into the details. Challenge yourself to pick one very specific thesis and research as much as possible

to inspire you to flush out your ideas as best as you can. The thesis should serve two purposes, it should guide you while you write and guide the readers when they read. The thesis should have a strong argument based on a debatable claim". Researchers need to review some existing literature in their interest area in order to be focused on the interest topic, this review will expose you to what others have been able to do in the same or similar area as such; could help you to modify your topic and make it a peculiar one.

2.4 SKIMPING ON THE SOURCES

Providing credible sources and a lot of examples is a great way to let your audience/professor know that you have actually performed thorough research and really understood the topic.

2.5 GETTING UNORGANIZED

Doing great research may not assure you a great research paper if you cannot keep your materials organized enough to call upon them later. You can even highlight the most important parts of the source, make personal notes on the margins, and automatically create your bibliography – all right on your computer. It is also possible to become unorganized within your very paper. It is important to ask yourself the following questions to keep your focus:

- Did I use my outline?
- Is there anything that I missed?
- Is there sense to my arguments?
- Did I put everything in my own words?
- Do my paragraphs connect and flow from one to the other?
- Does my conclusion tie the entire paper together?

2.6 BEING SNEAKY

Changing the margins? Adjusting the line spacing? Altering the font size ever so slightly? Resist the temptation to do this. When a template is given or when your professor sets a page length it is not because they enjoy reading that specific page length in particular. It is because your professor knows that page requirement is the amount of space that it will take to develop your topic to the appropriate amount and earn the good grade you deserve. Following these advices will assure that you do not need to try any of those tricks.

2.7 ADDING "FLUFF"

Sometimes meeting that page length requirement can be difficult when you feel as though you have run out of things to say. Professors know fluff when they see it. They know you have chosen to ramble on to fill the page requirement rather than do more research. Your introduction and your conclusion should not generally exceed one page unless your paper is extremely long. If you hit a wall, consider asking your professor for advice on where else you might go with this topic or suggestions for further reading.

2.8 NOT HAVING A FRIEND READ IT OVER

Sometimes when you have spent so many hours and days on a project, your exhausted eyes can start to miss things. This concept may not make sense to anyone else, though it is necessary. Have someone else do a read through of your paper, even if it is a quick one, to make sure that your paragraphs are coherent and you have not made any obvious mistakes. Also, consider visiting your school's writing center for further help if they offer one. The more reviews, the better. Sometimes there are centers that offer such services, register with them to get these necessary services. Remember these sayings: nothing good comes easy, penny wise pound foolish. Do not be too stingy with money; use it to obtain the necessary services it is meant for to avoid making avoidable mistakes.

2.9 TRUSTING THE COMPUTER TO SPELL – CHECK

Just because you have managed to avoid those red squiggles while typing your research paper does not mean your paper is error – free. Your computer will not always let you know when you have used the wrong form of a word such as "you're" or "their" but your professor certainly will. Carefully read over your entire paper when you have finished to be sure you have avoided simple spelling and grammatical errors. Professors hate reading silly mistakes as much as you hate making them.

2.10 FORGETTING FINISHING TOUCHES

Often for big projects such as a research paper, professor will have very specific guidelines as to how they would like it submitted to them. Make sure your name, class, and date are on it and do not forget the staple! If your professor requested a cover page, binder, etc., do not forget to get

everything assembled ahead of time. You do not want to lose points on presentation after working so hard on the research.

When it comes down to it, you know you are fully capable of writing a research paper worthy of an "A." What you need to do is avoid these common mistakes and give yourself enough time to complete the assignment to the best of your ability. These back to school tips will help you learn how to write a research paper and feel confident doing so. (James,2013)

CHAPTER THREE

TIPS FOR DETERMINING THE QUALITY OF YOUR RESEARCH PAPER

Assignments are given to students to help them have a broader perspective of the topic they need to research. The quality of the content matters a lot. Students fail to determine the quality of their research paper before submitting the same. The research paper needs to have a good introduction followed by thesis statement, body paragraphs and a conclusion.

Students need to understand the distinction between the local errors and the global errors. Local errors are those pertaining to syntax, structuring of the sentence and the punctuation. The global errors consist of those that are capable of affecting the large organization on a large scale. Ensure that your paper is devoid of both kinds of errors.

3.1 Tips for determining the quality of your research paper:

1. The first thing that you need to do is to review your introduction. The introduction has to be effective enough to keep the readers focused in the content. One needs to maintain the length of the introduction. It should not be more than a page unless you have a very long paper or in a case where you need to combine introduction together with the literature review. Ensure to lead the introduction to the thesis.

2. Thesis has to be clear and precise. As earlier mentioned, the thesis should serve two purposes, they should guide you while you write and guide the readers when they read. The thesis should have a strong argument based on a debatable claim. The points in the thesis should make your argument strong enough and convince the readers too.

3. The body paragraphs should follow your thesis statement. Do not introduce the same points as specified in the thesis.

4. Review the paragraphs again. Check all the points in detail. Ensure that you have sub points and examples for all the points that you incorporate in your body paragraphs.

5. Ensure that you have an excellent conclusion. Summarize your argument by highlighting the important points in the conclusion.

6. Review the quotes mentioned in the paper. Citation styles are important; this will be seen in later part of this write-up. Cite sources wherever needed. This is important for avoiding plagiarism.

7. Grammatical errors have to be seen and rectified. Small and simple errors can reduce your score. These are how you can determine the quality of your research paper and improve on it wherever/whenever the needed arises.

3.2 BACK TO SCHOOL TIPS: HOW TO WRITE A RESEARCH PAPER

After every vacation, one is always busy getting back into the swing of things, but while you have been away, you may have forgotten some vital information about how to write a research paper. There may also be some key components of writing papers with which you have always struggled. Here are some back to school tips to keep in mind while starting your first research paper this school year to help create your best work.

3.3 BRAINSTORM

The best way to write a great research paper is to choose a topic in which you are genuinely interested in. Many professors allow you to choose your own topic, and if not, you can generally choose your own direction to take it. Often, students will choose a topic that seems easy as opposed to one they find interesting. Unfortunately, you will find that you quickly run out of steam researching those "easy" topics. Choose something you are truly passionate about, narrow it down from a broad idea, and get to researching! Check out these ideas on where to look when brainstorming research topics from the post, from the smart students' conference blog.

3.4 ESTABLISH GOALS

This massive paper may seem daunting when it is first assigned but this is your chance to get a head start on things and establish goals. Pace yourself and allow time to do justice to your paper. Outlines are a great way to stay organized. A fifteen page paper spread out over a few weeks is no sweat if you set realistic goals and timeframes for yourself. (Planning to leave everything for the last minute is not a plan; you will hate yourself for it later)

3.5 PUT HONESTY FIRST

While developing your research paper, try not to forget that the craftier you become, the more experienced your professors get, too. They have seen it all by now, so do not try to outsmart them by taking short – cuts and not doing honest, well – developed research. Choosing credible sources for your research paper is the only way to succeed. There are many ways for professors to check whether or not your work is your own and the consequences could involve you failing the assignment, the class, or in extreme cases even being expelled from your university. It's never worth it.

3.6 DOUBLE CHECK CITATIONS

With the variety of ever- changing writing styles, it can be hard to get your works Cited or bibliography page in order. It is always better to ask your professor for guidance than to fall victim to unconscious plagiarism, which can still get you into trouble, if you are not careful individuals also have a tendency to repeat information without remembering or giving credit to where they got it from originally. This is why it is important to keep your sources and notes well organized.

3.7 DO NOT SET YOURSELF UP TO FAIL

Simply because your professor assigns you what seems to be an impossibly long research paper does not mean that you are doomed to fail. Your professors want you to succeed and are usually quite eager to help. Do not be afraid to take on something extraordinary just because it may require some hard work.

Staying on top of your research papers always makes life easier. With these five back – to – school research paper tips, you will quickly be on your way to a stress- free research with results you will be happy with.

3.8 HOW TO FIND RESEARCH PAPER TOPICS FROM EVERYDAY LIFE

Now, you imagine writing a fascinating, rewarding, and valuable research paper and getting a good result? Then it is crucial that you start with brainstorming interesting research paper ideas and getting a good research paper topic for the work.

Unfortunately, searching everywhere for already made research paper topics; twenty – four hours a day do not solve the problem. All efforts to find plans for research paper online, in the libraries, and from manuals appears to be in vain, for they are filled with battered, run – of – the – mill research paper topics, or even the ones that are impossible to research.

However, you will be able to derive a great research paper topic from anything you do throughout a day. Continue reading, and you will find out how to find the best research paper topic the way you like with ample information on its account.

Let us track your day- to – day activities and find out whether there are several ideas for research papers you are able to come up with. Assume, it is Monday, 8.am. After your noisy alarm wakes you up, having a start and goes back into the harsh reality, you tuned on the radio hoping the voice of the radio DJ will raise your spirits and tune you permanently for the day. This very voice says that in five seconds you will be offered a regular astrological forecast. Whether skeptically or whole- heartedly, you learn what is going to happen to you today.

Purse for a while; skeptically or whole – heartedly and tell yourself that it is high time for you to decide on your opinion of astrology when it comes to a research paper topic in science that could sound like: Is Astrology a Pseudoscience? This can serve as your first research paper concept of the day.

Again, you are now rushing towards the university also it strikes you that almost all buildings you are passing by are office blocks with costly equipment that should be protected by built –in security gadgets. What exactly are Built- In Security Features in New Constructions? What can they do? –This may be the heading of excellent research paper topic in Architecture.

Going further, you are in the university, a cradle of every day stress that drives you mad. Why don't you take a minimum of one advantage of the strain and turn this nagging daily problem right into a good research paper topic? You may realize the reasons for stress and investigate the issue on a scientific level.

Moreover, you can give a hint to your teachers; regarding how to alleviate tension within the classroom inside your research paper and they will appreciate your efforts and evaluate your paper at its true value.

Usually, after classes you go to a local cafeteria together with your friends where you can chat, this will give you the opportunity to bite at any given time. Is that bite harmful? Or Are Junk food synonymous with unhealthy foods? It can be a splendid research paper topic that might be based on your personal experience, feelings of other consumers, and numerous poll results, because the country is filled with fast food chains, one of them is the Shoprite.

Incidentally, how did Shoprite chain spread around the globe? Try to find out and write an investigation paper about the Shoprite's bread success story. It might be a nice investigation for any business research paper.

As a matter of fact, daily you go to an area shop to purchase food, in which the cashier asks you politely whether you will pay in cash or with a credit card. Things are now changing, in the past nobody may even think of each one of these electronic devices, however we cannot do without credit cards. Why? What Factors are adding to the Expended Utilization of Credit Cards? What Might Influence their Decline?

After shopping you fill the refrigerator with stuffs humming your favorite song, but a weird thought comes into your mind: How did our ancestors manage with food perseveration when there were no fridges? There should have been some option to frost! That is a very nice topic

After the day's hassles, at night, you take a seat in a comfortable chair watching Television, probably the most favorite activity that can take approximately 170 minutes from Twenty four hours, according to a consumer survey. Have you cared to pay attention to this burning problem which needs immediate research? Try to investigate television activities because the phenomenon from the modern world tries to look out for what it really gives and not just how it influences our consciousness.

In the first seconds of watching television, you are most likely to trap a peek at annoying advertisements; as such they take fifteen minutes out of an average television hour. Then you think: Oh, Gosh! Not again! Television is not an Entertainment Medium, it is an Advertising Medium. From there you get one other good research paper topic in Sociology that will be likely to react to everyone's feelings about advertisements.

Furthermore, before going to bed you want to take a bath, your younger brother/ sister appears. You fell within the marathon towards the bathroom and wind up extremely mad near the closed door. But rather than grumbling, you can thank your sibling for making one good research paper topic enter into your mind: Do First – Born Children Vary from Those Who are Born Late? Do you know the Possible Reasons and also the Significant Characteristics of these Variations?

You can now forget about your bath session and peacefully go to sleep, since the mission during the day is complete: you have had enough research paper topic ideas.

As you can tell, it was not difficult. You will be able to find good research paper topics without putting and excessive amount of effort into the search. The best idea is that you simply need to stretch your hand and drive them in order to make sure to recognize good research paper topics as they come around you.

Incoming search terms: The following are possible research paper ideas that may present as you go by the day; food research paper topics, excellent research paper topics, Research Paper Topic Ideas, conference paper based on personal experience, college research paper topic ideas, research paper topics about college students, research paper topics about work, research paper topic on ideas for food.

For many Ph.D. candidates, this is their ultimate goal, without much questions asked. Yet, when you get the ball rolling, it quickly picks up its own momentum; it quickly starts to feel as if your goal may get away from you.

Stepping back and considering this scenario more broadly, this is the precise moment we typically look around and call out for some form of assistance. Run away dog posters allow neighbors to help in searching for the missing dog. When you are lost in the woods, a flare signals to authorities where you can be found. So, when it comes to something as important as your Ph.D., why hesitate to seek out expert assistance if you feel you need it? Expert assistance can come in many forms such as; guidance in writing, review of related literature, method of analysis to be used, data collection/collation, analysis and proper interpretation of the analysis result , overall proof reading etc.

Many dissertation clients can attest to the fact that they actually sorted the assistance of one consultant directly or indirectly. Therefore it is normal, acceptable and should be encouraged in order to carry out a quality research work with a maximum degree of originality/novelty. A number of consulting firms exist for such services; one of such is Merc Data consulting, which can be accessed through their website at http://www.mercdataconsulting.org.

In addition, researchers may even benefit more as their papers are being published on time to meet up with their demands. They can equally get assistance on how to embark on research or how to write a good research paper of acceptable standard to avoid the stress of frequent article rejection and demoralization that accompanies it. This assistance also extends to aiding in sending papers out for publication in reputable journals with great impacts, organizing seminars/workshops for clients. The seminars and workshops plays very important role to researchers in the following ways:

- It empower them to take personal responsibility by developing a road map that gets them through the dissertation process
- It helps them learn to select and work effectively with faculty and their comments
- By identifying some common roadblocks which students have been seen to struggle with over the years, these stumbling blocks are then used to coach as stepping stones to success
- Participants walk away with a user-friendly workbook that provides expert guidance on how to get through each chapter of their dissertation

Do you want to get your dissertation completed this year? Then you are lucky! We invite you to join Merc Data Consulting at http://www.mercdataconsulting.org for easy and prompt assistance.

Benefits

Merc Data consulting will provide expert guidance to clients, co-create a plan/expertly guide individual clients to co-create a plan that positions each client to complete their dissertation within one year. More specifically, our day together will encompass the following steps:

Introductions and Coming Together

- Introduce and hand-select the best groupings of researchers and candidates based upon the phase of the research and dissertation process each one is in. In this phase, clients will learn together, understanding the importance of where they are in the research and dissertation process before moving on to creating their road map to completion.

Learning about What Good Looks like

- Clarify what the end result must look like in order for researchers and candidates to move to the next phase in their research and dissertation process. At this point in the process, candidates transform into masters of their current phase such that they have no lingering questions around as regards to "Well, what do I do next?"

Preparing to Successfully Move Forward

- Increase participants' sense of efficiency in completing the research and dissertation process. Having already established a mutually understood foundation to stand upon

together, candidates will now collaboratively create/co-create individualized plans that they can easily follow through on all the way to graduation.

Writing a dissertation can be a grueling process, but consulting services helps you through it, by exposing you to the best practices on staying motivated while working to complete your dissertation and provide invaluable tips based on years of dissertation consulting experience.

CHAPTER FOUR

REFERENCING

There are various styles of referencing; we will look at the American Psychological Association (APA). This style can be looked at based on the following guidelines.

American Psychological Association (APA): The American Psychological Association (APA) style is a widely used author-date system of referencing or bibliographic citation. This chapter covers basic explanations and examples for the most common types of citations used by students. It is based on the Publication Manual of the American Psychological Association (6th edition) which is available at all UWS libraries. If you are unable to find the referencing example you require in this chapter, more detailed information and examples can be found in the above publication. The APA Style Guide to Electronic References can be used for examples that are not available in the Publication Manual. Current information can also be obtained via the Internet from the official APA Style website http://www.apastyle.org which includes tutorial, a blog and frequently asked questions. Corrected sample papers from the Publication Manual can also be found on the APA website. (APA Referencing Style Guide)

4.1 Various Referencing styles

Referencing of Conference papers: Conference papers can be referenced in both text and in the reference sections as follows

In text citation: Inside the text the citation follows the style as shown below:

(Shobhadevi & Bidarakoppa, 1994) or Shobhadevi and Bidarakoppa (1994) published their ... In this case the authors followed with a coma and date of publication are enclosed in a bracket or the authors followed with a date enclosed in a bracket as shown above.

In reference list: At the end of the study comes the reference section; which follows the style below:

Shobhadevi, Y. J., & Bidarakoppa, G. S. (1994). Possession phenomena: As a coping behaviour. In G. Davidson (Ed.), Applying psychology: Lessons from Asia-Oceania (pp. 83-95). Carlton, Vic., Australia: Australian Psychological Society.

Here the authors are listed followed by the date of publication which is enclosed in bracket. The title of the article and the edition follows immediately after the date. The Journal name

Referencing Book by one author: In referencing a book written by one author, the citation follows the styles as shown in both text and reference sections below:

In text citation: The citations done inside the text follows the style given below:

(King, 2000) or King (2000) compares Frame with "..." (p. 34).

In reference list: At the reference section, the style below is used:

King, M. (2000). Wrestling with the angel: A life of Janet Frame. Auckland, New Zealand: Viking.

Here the author's surname and initial comes before the date which is enclosed in a bracket, followed by the book title, place of publication and the publisher .

Books by three to five authors: If the authors of the book are from three to five**,** the citation is done in the text as follows:

In text citation: Inside the text, the referencing follows the styles as shown below:

First in text citation: (Krause, Bochner, & Duchesne, 2006) or Krause, Bochner, and Duchesne (2006) recommend "..." (p. 32).

Here the first time the citation is done in the text, all authors are cited.

In subsequent citations: According to Krause et al. (2006)

When the citation is done subsequently only the first authors name is listed followed by et al. (short for et alii - Latin for 'and others'). Do not italicize et al.

In reference list: In the reference section, list all the authors and the date enclosed in a bracket as shown below:

Krause, K.-L., Bochner, S., & Duchesne, S. (2006). Educational psychology for learning and teaching (2nd ed.). South Melbourne, VIC., Australia: Thomson.

In this case, the authors surname and initial comes before the date which is enclosed in bracket, followed by the title of the book and edition, place of publication and the publisher.

Journal article with continuous pagination: For journal articles with continuous pagination, the citation styles for both inside the text and at the reference section follow the guide given below:

In text citation: The citation inside the text follow either the style of author, date all enclosed inside a bracket thus: (Ferguson, 2014) or the author and the date alone inside the bracket as shown: Ferguson (2014) delves...

In reference list: The citation at the reference section follows the style of author and date enclosed inside a bracket. This is followed by the title of the article, the journal name and volume in italics, and the page number normal. The Uniform Resource Locator (URL) is given at the end. This is as shown below.

Ferguson, C. J. (2014). A way forward for video game violence research. American Psychologist, 69, 307-309. http://dx.doi.org/10.1037/a0036357

Journal article; electronic version with DIO: Some journal articles published electronically have the digital object identifier. In such case the citation follows the style given below both in the text and at the reference section.

In text citation: In the text, the citation style follows either Shepherd et al. (2007) or Shepherd et al. (2007) highlight the... In this case et al. is used in the first citation.

In reference list: The citation follows the style given below at the reference section:

Shepherd, R., Barnett, J., Cooper, H., Coyle, A., Moran-Ellis, J., Senior, V., & Walton, C. (2007). Towards an understanding of British public attitudes concerning human cloning. Social Science & Medicine, 65(2), 377-392. http://dx.doi.org/10.1016/j.socscimed.2007.03.018

Here, all the authors are listed followed by the date enclosed in a bracket. This is followed by the article title, the Journal name, the volume and the issue, then the pages and the DOI link. The journal name and volume are in italics, the issue enclosed in a bracket closely follows the volume and are separated by coma before the page numbers which are not in italics. The DIO link comes last.

In 2012, APA published a supplement to the official APA Style Manual, where they announced a change to the way the DOI was to be presented, from **doi:10.XXXXXX** (as is recommended by Cross Ref in the sixth edition of the Publication Manual) to **http://dx.doi.org/10.XXXXXXX**. This is to ensure that DOIs are resolved into working links. However, both are acceptable during this transition period, therefore, when a DOI is available, include it in the reference.

Journal article without DOI: On the other hand, some journals do not have DOI, in such case the citations, both in the text or at the reference section follows the style given below:

In text citation: Inside the text, the citation also follows either of these styles: In their research, (Harrison & Papa, 2005) established ...or: In their research, Harrison and Papa (2005) established....

In reference list: As earlier stated, at the reference section, all the authors are listed followed by the date enclosed in a bracket. This is followed by the article title, the Journal name, the volume and the issue, then the pages and the source. The journal name and volume are in italics, the issue enclosed in a bracket closely follows the volume and as usual are separated by coma before the page numbers which are not in italics. The source which could be from the database, the webpage or the URL is given. Below is an example:

Harrison, B., & Papa, R. (2005). The development of an indigenous knowledge program in a New Zealand Maori-language immersion school. Anthropology and Education Quarterly, 36(1), 57-72. Retrieved from Academic Research Library database.

While giving the name of the database, as in the example above, do not include the database URL. If the article was not retrieved from a library database, include the webpage name or URL.

Journal article in internet only (online publishing): Some journals publish both in printed version and online version. For those publishing online alone, the style is as given below:

In text citation: Inside the text in case if there is no date, the citation follows either of the styles below: (Snell & Hodgetts, n.d.) or Snell and Hodgetts (n.d.) identified "..." (para.3). If there are no page numbers, cite the paragraph number in text as shown.

In reference list: At the reference section, follow the guide given below:

Snell, D., & Hodgetts, D. (n.d.). The psychology of heavy metal communities and white supremacy. Te Kura Kete Aronui, 1. Retrieved from http://www.waikato.ac.nz/wfass/tkka

Note that (n.d.) stands for no date.

Journal article cited in a secondary source: Sometimes authors cite references from a secondary source. In such cases, the referencing in both the text and reference section follows the guide below:

In text citation: Inside the text, the guide below applies:

(Lilieholm & Romney, 2000, as cited in Suntikul, Butler, & Airey, 2010) or Lilieholm and Romney (2000, as cited in Suntikul, Butler, & Airey, 2010) argue that... Here the secondary source containing the primary source and the primary source itself are enclosed in a bracket or only the date of the primary source and the secondary source containing the primary source are enclosed in a bracket.

In reference list: At the reference section, only the secondary source is cited, the style as shown on the guide below:

Suntikul, W., Butler, R., & Airey, D. (2010). Implications of political change on national park operations: Doi moi and tourism to Vietnam's national parks. Journal of Ecotourism, 9(3), 201-218. http://dx.doi.org/10.1080/14724040903144360

Magazine in electronic form: Sometime fact can be extracted from a magazine, in such case the referencing both in the text and the reference list follows the style below:

In text citation: The citation inside the text follows the style of author and date all enclosed in a bracket or author outside the bracket with only the date in the bracket. This is shown below:

(Robison, 2008) or Robison (2008) considers...

In reference list: At the reference section, the citation is done as shown below:

Robison, J. (2008, January). On the waka wave. North and South, 262, 80-87. Retrieved from Australia/New Zealand Reference Centre database.

Here the author is cited as usual, and the date which also includes the month is all enclosed in a bracket. The article title not in italic comes immediately after the date, followed by the name of the magazine, the volume and the pages all in italics. The name of the database without including the database URL is also given. If there are eight or more authors, list the first six, then an ellipsis (...) and finish with the last author.

Newspaper in printed form: In referencing information obtained from a newspaper publication which comes in printed version, the reference in both text and reference section follows the guide below:

In text citation: Inside the text, the citation as usual follows the style given below:

(Cumming, 2003) or Cumming (2003) reports...

In reference list: At the reference section, the citation is follows the style as shown below:

Cumming, G. (2003, April 5). Cough that shook the world. New Zealand Herald, p. B4. Here the author is outside a bracket while the date which also includes the month and the day is enclosed in a bracket. The article title which is not in italics follows immediately. This is followed by the Newspaper name in italics and the page before the page number. This is used for newspapers only, not magazines or journals. Use p for 1 page, pp. more than one page. If page numbers are discontinuous, separate page numbers with a comma. e.g. pp. A1, A4-5.

Newspaper in electronic version: If the newspaper is in electronic form the citation in both the text and reference section follow the style given below:

In text citation: Inside the text, the citation as in printed version follows the style shown below:

(Cumming, 2003) or Cumming (2003) reports...

In reference list: At the reference section, the citation follows similar style as in printed version except that the URL is given because it is in electronic form. The style is as shown below:

Cumming, G. (2003, April 5). Cough that shook the world. New Zealand Herald. Retrieved from http://www.nzherald.co.nz. The URL of the homepage of the newspaper is used as a direct link to an online article in a news paper. This is because website is not a persistent link.

Newspaper without author: Some articles in a newspaper do not have authors, in such case, the citations both in the text and reference section follow the style shown below:

In text citation: Inside the text, the title of the article is used in place of the author with a date separated by coma all enclosed in a bracket as shown below:

("Drivers Reject Fuel Prices", 2003). Here, the title is abbreviated; double quotation marks are used. Each letter of word is capitalized.

In reference list: At the reference section, the citation follows the style below:

Drivers reject fuel prices driven by war threat. (2003, March 7). Timaru Herald, p.1. Here, because there is no author, the article title comes first. The date which includes the month and the day are enclosed in a bracket. This is followed by the newspaper title in italics and the page number.

However, it is important to note that before submitting a work to a publisher, check the journal referencing guidelines provided by the publisher as this may vary from one publisher to the other.

CHAPTER FIVE

TESTS OF HYPOTHESIS

A statistical hypothesis is a scientific hypothesis that is testable on the basis of observing a process that is modeled through a set of random variables. It is a method of statistical inference used for testing a statistical hypothesis.

A test result is said to be statistically significant if it has been predicted as unlikely to have occurred by sampling error alone, according to a threshold probability known as the significance level. Hypothesis tests are used in determining what outcomes of a study would lead to a acceptance or rejection of the null hypothesis for a pre-specified level of significance. In the Neyman-Pearson framework the process of distinguishing between the null hypothesis and the alternative hypothesis is aided by identifying two conceptual types of errors known as the type 1 and the type 2, and by specifying parametric limits on for instance; how much type 1 error will be permitted.

5.1 TYPE I TYPE II ERRORS

In making decisions on the basis of a sample, two errors are possible.

Example.1:

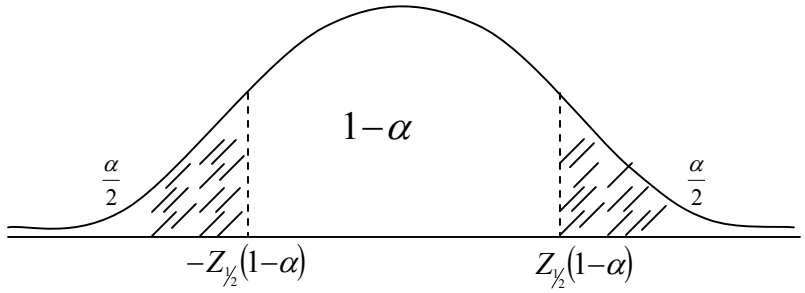
We may reject H_0 when it is true, i.e. when we ought to have accept it. When this happens, we say that one has committed a type I error. Secondly, we may accept H_0 when actually H_0 is false. This again is called type II error. A test of hypothesis is considered good if both errors of judgments are minimized. This is not always possible. However in any particular situation, it is better to minimize the more serious error.

Example 2:

Suppose we have the null hypothesis that a particular drug is not poisonous, i.e. $H_{0:}$ drug is not poisonous. Type I error: Reject H_0 when it is true. This means that we assume the drug to be poisonous.

Type II error: Accept H_0 when H_0 is false. Here we try to minimize type II error and allow type I error to dominate.

In testing a given hypothesis, the maximum probability with which we would be willing to risk, a type I error is called the **level of significance** and it is often denoted by α. We summarize this level of significance in the diagram below. The curve below is meant for tests, involving normal curve.



If H_0 is true, then we can be 100(1-α)% confident that Z lies within $-Z_{½}(1-\alpha)$, $Z_{½}(1-\alpha)$.

However, if on choosing a single sample at random, it is found that Z is outside the unshaded range, we would conclude that such an event would happen with probability of only α - the shaded regions – if H_0 is true. The total shaded region 'α' represents the probability of our being wrong in rejecting H_0, i.e. the probability of committing type I error. Thus we may say that H_0 is rejected at a 0.05 level of significance or that Z is significance at 0.05 level. The set of values of Z outside the unshaded part constitute what is called the critical region or significance region or region of rejection of H_0. While the set of Z inside is called the region of acceptance of H_0 or the confidence region or the region of non-significance.

The points separating the acceptance region from critical region is called the critical point of the test.

Thus the following decision rule can be formulated:

1) Reject H_0 at 'α' level of significance if Z lies outside $\pm Z_{½}(1-\alpha)$.
2) Accept H_0 otherwise.

One-tailed and two-tailed tests: If in a test of H_0, the critical region exist on both tails of the curve of the sampling distribution as in the above figure, we call it two-tailed test. On the other hand, if the test involves critical region appearing only on one side of the curve, we call it one-tailed test. In two –tailed test, the area of the critical regions on each side of the distribution is equal to ½ of the level of significant of the test.

An alternative framework for statistical hypothesis testing is to specify a set of statistical models, one for each candidate hypothesis, and then use model selection techniques to choose the most appropriate model. The most common selection techniques are based on either Akaike information criterion or Bayes factor.

Statistical hypothesis testing is sometimes called **confirmatory data analysis**. It can be contrasted with exploratory data analysis, which may not have pre-specified hypotheses

A **hypothesis** is a proposed explanation for a phenomenon. For a hypothesis to be a scientific hypothesis, the scientific method requires that one can test it. Scientists generally base scientific hypotheses on previous observations that cannot satisfactorily be explained with the available scientific theories. Even though the words "hypothesis" and "theory" are often used synonymously, a scientific hypothesis is not the same as a scientific theory. A working hypothesis is a provisionally accepted hypothesis proposed for further research.

The **Akaike Information Criterion** (**AIC**): This is a measure of the relative quality of a statistical model for a given set of data. That is, given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other models. Hence, AIC provides a means for model selection.

AIC is founded on information theory; it offers a relative estimate of the information lost when a given model is used to represent the process that generates the data. In doing so, it deals with the trade-off between the goodness of fit of the model and the complexity of the model. It does not provide a test of a model in the sense of testing a null hypothesis; i.e. AIC can tell nothing about the quality of the model in an absolute sense. If the entire candidate models fit poorly, AIC will not give any warning of that.

A **statistical model** embodies a set of assumptions concerning the generation of the observed data, and similar data from a larger population. A model represents, often in considerably idealized form, the data-generating process. The model assumptions describe a set of probability distributions, some of which are assumed to adequately approximate the distribution from which a particular data set is sampled.

A model is usually specified by mathematical equations that relate one or more random variables and possibly other non-random variables. As such, "a model is a formal representation of a theory" (Herman Adèr quoting Kenneth Bollen).

All statistical hypothesis tests and all statistical estimators are derived from statistical models. More generally, statistical models are part of the foundation of statistical inference.

Statistics, like all mathematical disciplines, does not infer valid conclusions from nothing. Inferring interesting conclusions about real statistical populations usually requires some background assumptions. Those assumptions must be made carefully, because incorrect assumptions can generate wildly inaccurate conclusions.

Here are some examples of statistical assumptions.

- Independence of observations from each other (this assumption is an especially common error).
- Independence of observational error from potential confounding effects.
- Exact or approximate normality of observations.
- Linearity of graded responses to quantitative stimuli, e.g. in linear regression.

There are two approaches to statistical inference they are the **model-based inference** and the **design-based inference.** Both approaches rely on some statistical model to represent the data-generating process. In the model-based approach, the model is taken to be initially unknown, and one of the goals is to select an appropriate model for inference. In the design-based approach, the model is taken to be known, and one of the goals is to ensure that the sample data are selected randomly enough for inference.

Statistical assumptions can be put into two classes, depending upon which approach the inference is used.

- Model-based assumptions. These include the following three types:
    1. Distributional assumptions. Where a statistical model involves terms relating to random errors, assumptions may be made about the probability distribution of

these errors. In some cases, the distributional assumption relates to the observations themselves.

2 Structural assumptions. Statistical relationships between variables are often modeled by equating one variable to a function of another (or several others), plus a random error. Models often involve making a structural assumption about the form of the functional relationship, e.g. as in linear regression. This can be generalized to models involving relationships between underlying unobserved latent variables.

3 Cross-variation assumptions. These assumptions involve the joint probability distributions of either the observations themselves or the random errors in a model. Simple models may include the assumption that observations or errors are statistically independent.

- Design-based assumptions. These relate to the way observations have been gathered, and often involve an assumption of randomization during sampling.

5.2 TEST OF SIGNIFICANCE

As far as statistical analysis is concerned, the confidence interval completely summarizes all the information about the parameter of interest. It enables us to make probability statement about the unknown parameter. Apart from giving the most likely values of the parameter, the interval can in a similar way, be used to check whether the sample data contradicts some known results or not. The following example illustrates this:

Example
Do you think that the ages of the ten boys above are likely to come from a population of students whose mean age is 17?
Solution
Because there is no information on δ, we estimate from the sample. We had to set up a 95%, and 99% confidence intervals for the population mean where δ is estimated from the sample, i.e. (17.5, 18.7) and (17.3, 18.9) respectively, we can conclude that the value 17 falls outside 99% interval, and therefore it is an unlikely value of the population mean. Thus, we can say that the sample is not likely to have come from a population of student whose mean age is 17.

CHAPTER SIX

METHODS OF SAMPLING

Sampling is concerned with the selection of a subset of individuals from within a defined population to estimate characteristics of the entire population. Each individual variable measures one or more properties (such as weight, location, color) of observable bodies distinguished as independent objects or individuals. In survey sampling, weights can be applied to the data to adjust for the sample design; this is particularly seen in stratified sampling. Results from probability theory and statistical theory are employed to guide practice. In all fields of research, sampling is widely used for gathering information about a population.

The sampling process comprises several stages:

- Defining the population of concern
- Specifying a sampling frame(sampling frame is a set of items/ a list or map containing all the units from which a sample is drawn)
- Specifying a sampling method for selecting items or events from the frame
- Determining the sample size
- Implementing the sampling plan
- Sampling and data collecting
- Data which can be selected

In statistics, a **simple random sample** is a subset of individuals (a sample) chosen from a larger set (a population). Each individual is chosen randomly and entirely by chance hence it is categorized as a probability sampling; such that each individual has the same probability of being chosen at any stage during the sampling process, and each subset of k individuals has the same probability of being chosen for the sample as any other subset of k individuals. This process and technique is known as **simple random sampling**, and should not be confused with systematic random sampling. A simple random sample is an unbiased surveying technique. Saul McLeod, (2014)

Simple random sampling is a basic type of sampling, since it can be a component of other more complex sampling methods. The principle of simple random sampling is that every elementary unit has the same probability of being chosen. For example, suppose N university students want to get a gate -pass for a show, but there is only $X < N$ gate passes for them, so they decide to have a fair way to choose who gets to go. Then, everybody is given a number in the range from 0 to N-1, and random numbers are generated, either electronically or from a table of random numbers (always contained at the back of every standard mathematical/statistical table). Numbers outside the range from 0 to N-1 are ignored, as are any numbers previously selected. The first X numbers would identify the lucky candidate to collect a gate pass.

In small populations and often in large ones, such sampling is typically done "**without replacement**", i.e., one deliberately avoids choosing any member of the population more than once. Although simple random sampling can be conducted with replacement instead, this is less common and would normally be described more fully as simple random sampling **with**

replacement. Sampling done without replacement is no longer independent, but still satisfies exchangeability, hence many results still hold.

Further, for a small sample from a large population, sampling without replacement is approximately the same as sampling with replacement, since the odds of choosing the same individual twice is low.

An unbiased random selection of individuals is important so that if a large number of samples were drawn, the average sample would accurately represent the population. However, this does not guarantee that a particular sample is a perfect representation of the population. Simple random sampling merely allows one to draw externally valid conclusions about the entire population based on the sample.

Conceptually, simple random sampling is the simplest of the probability sampling techniques. It requires a complete sampling frame, which may not be available or feasible to construct for large populations. Even if a complete frame is available, more efficient approaches may be possible if other useful information is available about the units in the population.

Advantages are that it is free of classification error, and it requires minimum advance knowledge of the population other than the frame. Its simplicity also makes it relatively easy to interpret data collected in this manner. For these reasons, simple random sampling best suits situations where not much information is available about the population and data collection can be efficiently conducted on randomly distributed items, or where the cost of sampling is small enough to make efficiency less important than simplicity. If these conditions do not hold, stratified sampling or cluster sampling may be a better choice.

Table of Random Numbers: A table of random number is specially prepared for obtaining random samples. To use this table all the units in the population are first of all numbered as follows;

01-99, if the number of units in the population is less than hundred.
001-999, if it is less than 1,000.
0001-9999, if it is less than 10,000 etc. The table is then used to pick the desired number of units.

Suppose it is required to take a random sample of 5 students from a school of 99 students. We first of all obtain the list of all the 99 students in the school. Since the number of students in the schools is less than 100, we shall number the students as follows 01, 02, 03, …, 99. We then take any two columns or rows of the random number table and run down the columns or cross the rows. Any time we come across a different number between 01 and 99 we write it down. The students whose numbers correspond to the first five different number obtained in this way form our random sample of size five.

Frame: A frame is the list of all the population units from which the sample units are identified. The units are called sampling units. In the above example of 5 students, the school list is the frame. Note the difference between samples units and sampling units. The former are the objects in a sample while the latter are the objects in the population. Common examples of frame are;

1) List of school, if a number of schools are being selected to form a sample.
2) List of all the students in a school if the number of students from the school is to be selected to form the sample.
3) List of all tax payers in an area, etc.

6.1 Systematic sampling is a statistical method involving the selection of elements from an ordered sampling frame. The most common form of systematic sampling is an equal-probability method. In this approach, progression through the list is treated circularly, with a return to the top once the end of the list is passed. The sampling starts by selecting an element from the list at random and then every k^{th} element in the frame is selected, where k, the sampling interval (sometimes known as the skip): this is calculated as:

$$k = \frac{N}{n}$$ Where n is the sample size, and N is the population size.

Using this procedure each element in the population has a known and equal probability of selection. This makes systematic sampling functionally similar to simple random sampling. It is however, much more efficient (if variance within systematic sample is more than variance of population).

Systematic sampling is to be applied only if the given population is logically homogeneous, because systematic sample units are uniformly distributed over the population. The researcher must ensure that the chosen sampling interval does not hide a pattern. Any pattern would threaten randomness.

Example: Suppose a supermarket wants to study buying habits of their customers, then using systematic sampling they can choose every 10th or 15th customer entering the supermarket and conduct the study on this sample.

This is random sampling with a system. From the sampling frame, a starting point is chosen at random, and choices thereafter are at regular intervals. For example, suppose you want to sample 8 houses from a street of 120 houses. 120/8=15, so every 15th house is chosen after a random starting point between 1 and 15. If the random starting point is 11, then the houses selected are 11, 26, 41, 56, 71, 86, 101, and 116. As an aside, if every 15th house was a "corner house" then this corner pattern could destroy the randomness of the population.

If, as more frequently, the population is not evenly divisible (suppose you want to sample 8 houses out of 125, where 125/8=15.625), should you take every 15th house or every 16th house? If you take every 16th house, 8*16=128, so there is a risk that the last house chosen does not exist. On the other hand, if you take every 15th house, 8 multiplied by 15 equals 120, so the last five houses will never be selected. The random starting point should instead be selected as a non integer between 0 and 15.625 (inclusive on one endpoint only) to ensure that every house has equal chance of being selected; the interval should now be non integral (15.625); and each non

integer selected should be rounded up to the next integer. If the random starting point is 3.6, then the houses selected are 4, 20, 35, 50, 66, 82, 98, and 113, where there are 3 cyclic intervals of 15 and 4 intervals of 16.

To illustrate the danger of systematic skip concealing a pattern, suppose we were to sample a planned neighborhood where each street has ten houses on each block. This places houses No. 1, 10, 11, 20, 21, 30... on block corners; corner blocks may be less valuable, since more of their area is taken up by street front etc. that is unavailable for building purposes. If we then sample every 10th household, our sample will either be made up only of corner houses (if we start at 1 or 10) or have no corner houses (any other start); either way, it will not be representative.

Systematic sampling may also be used with non-equal selection probabilities. In this case, rather than simply counting through elements of the population and selecting every k^{th} unit, we allocate each element a space along a number line according to its selection probability. We then generate a random start from a uniform distribution between 0 and 1, and move along the number line in steps of 1.

Example: We have a population of 5 units (A to E). We want to give unit A a 20% probability of selection, unit B a 40% probability, and so on up to unit E a 100%. Assuming we maintain alphabetical order, we allocate each unit to the following interval:

A: 0 to 0.2
B: 0.2 to 0.6 (= 0.2 + 0.4)
C: 0.6 to 1.2 (= 0.6 + 0.6)
D: 1.2 to 2.0 (= 1.2 + 0.8)
E: 2.0 to 3.0 (= 2.0 + 1.0)

If our random start was 0.156, we would first select the unit whose interval contains this number (i.e. A). Next, we would select the interval containing 1.156 (element C), then 2.156 (element E). If instead our random start was 0.350, we would select from points 0.350 (B), 1.350 (D), and 2.350 (E).

6.2 Distinction between a systematic random sample and a simple random sample

Consider a school with 1000 students, divided equally into boys and girls, and suppose that a researcher wants to select 100 of them for further study. All their names might be put in a bucket and then 100 names might be pulled out. Not only does each person have an equal chance of being selected, we can also easily calculate the probability P of a given person being chosen, since we know the sample size (n) and the population (N):

1. In the case that any given person can only be selected once (i.e., after selection a person is removed from the selection pool):

$$P = 1 - \frac{N-1}{N} \cdot \frac{N-2}{N-1} \cdot \cdots \cdot \frac{N-n}{N-(n-1)}$$

$$\overset{\text{Canceling}}{=} 1 - \frac{N-n}{N}$$

$$= \frac{n}{N}$$

$$= \frac{100}{1000}$$

$$= 10\%$$

2. In the case that any selected person is returned to the selection pool (i.e., can be picked more than once):

$$P = 1 - \left(1 - \frac{1}{N}\right)^n = 1 - \left(\frac{999}{1000}\right)^{100} = 0.0952\ldots \approx 9.5\%$$

This means that every student in the school has in any case approximately a 1 in 10 chance of being selected using this method. Further, all combinations of 100 students have the same probability of selection.

If a systematic pattern is introduced into random sampling, it is referred to as "systematic (random) sampling". An example would be if the students in the school had numbers attached to their names ranging from 0001 to 1000, and we chose a random starting point, e.g. 0533, and then picked every 10th name thereafter to give us our sample of 100 (starting over with 0003 after reaching 0993). In this sense, this technique is similar to cluster sampling, since the choice of the first unit will determine the remainder. This is no longer simple random sampling, because some combinations of 100 students have a larger selection probability than others – for instance, {3, 13, 23, ..., 993} has a 1/10 chance of selection, while {1, 2, 3, ..., 100} cannot be selected under this method.

In statistics, **survey sampling** describes the process of selecting a sample of elements from a target population to conduct a survey. The term "survey" may refer to many different types or techniques of observation. In survey sampling it most often involves a questionnaire used to measure the characteristics and/or attitudes of people. Different ways of contacting members of a sample once they have been selected is the subject of survey data collection. The purpose of sampling is to reduce the cost and/or the amount of work that it would take to survey the entire target population. A survey that measures the entire target population is called a census or complete enumeration.

Survey samples can be broadly divided into two types: probability samples and non-probability samples. Probability-based samples implement a sampling plan with specified probabilities (perhaps adapted probabilities specified by an adaptive procedure). Probability-based sampling

allows design-based inference about the target population. The inferences are based on a known objective probability distribution that was specified in the study protocol. Inferences from probability-based surveys may still suffer from many types of bias. The following points should be noted concerning survey sampling:

- Surveys that are not based on probability sampling have greater difficulty measuring their bias or sampling error. Surveys based on non-probability samples often fail to represent the people in the target population.
- In academic and government survey research, probability sampling is a standard procedure. In developed countries; for instance in the USA, the Office of Management and Budget's "List of Standards for Statistical Surveys" states that federally funded surveys must be performed:
- Selecting samples using generally accepted statistical methods (e.g., probabilistic methods that can provide estimates of sampling error). Any use of non probability sampling methods (e.g., cut-off or model-based samples) must be justified statistically and be able to measure estimation error.
- Besides, random sampling and design-based inference are supplemented by other statistical methods, such as model-assisted sampling and model-based sampling.
- For example, many surveys have substantial amounts of non response. Even though the units are initially chosen with known probabilities, the non response mechanisms are unknown. For surveys with substantial non response, statisticians have proposed statistical models, with which data sets are analyzed.

The model-based approach is much the most commonly used in statistical inference; the design-based approach is used mainly with survey sampling. With the model-based approached, all the assumptions are effectively encoded in the model.

6.3 Stratified sampling is a method of sampling from a population. In statistical surveys, when subpopulations within an overall population vary, it is advantageous to sample each subpopulation (stratum) independently by stratifying them. **Stratification** is the process of dividing members of the population into homogeneous subgroups before sampling. The strata should be mutually exclusive: every element in the population must be assigned to only one stratum. The strata should also be collectively exhaustive: no population element can be excluded. Then simple random sampling or systematic sampling is applied within each stratum. This often improves the representativeness of the sample by reducing sampling error. It can produce a weighted mean that has less variability than the arithmetic mean of a simple random sample of the population.

In computational statistics, stratified sampling is a method of variance reduction when Monte Carlo methods are used to estimate population statistics from a known population

6.4 Strategies involved in Stratified sampling

1. Proportionate allocation uses a sampling fraction in each of the strata that is proportional to that of the total population. For instance, if the population X consists of m in the male

stratum and f in the female stratum (where m + f = X), then the relative size of the two samples (x_1 = m/X males, x_2 = f/X females) should reflect this proportion.
2. Optimum allocation (or disproportionate allocation) - Each stratum is proportionate to the standard deviation of the distribution of the variable. Larger samples are taken in the strata with the greatest variability to generate the least possible sampling variance.

Stratified sampling ensures that at least one observation is picked from each of the strata, even if probability of it being selected is far less than 1. Hence the statistical properties of the population may not be preserved if there are thin strata. A rule of thumb that is used to ensure this is that the population should consist of no more than six strata, but depending on special cases the rule can change - for example if there are 100 strata each with 1 million observations, it is perfectly fine to do a 10% stratified sampling on them.

A real-world example of using stratified sampling would be for a political survey. If the respondents needed to reflect the diversity of the population, the researcher would specifically seek to include participants of various minority groups such as race or religion, based on their proportionality to the total population as mentioned above. A stratified survey could thus claim to be more representative of the population than a survey of simple random sampling or systematic sampling. Below are some of the advantages and disadvantages of stratified sampling.

6.5 Advantages of Stratified sampling over other sampling methods

If population density varies greatly within a region, stratified sampling will ensure that estimates can be made with equal accuracy in different parts of the region, and that comparisons of sub-regions can be made with equal statistical power. For example, in Ontario a survey taken throughout the province might use a larger sampling fraction in the less populated north, since the disparity in population between north and south is so great that a sampling fraction based on the provincial sample as a whole might result in the collection of only a handful of data from the north.1

Randomized stratification can also be used to improve population representativeness in a study.

6.6 Disadvantages of Stratified Sampling

Stratified sampling is not useful when the population cannot be exhaustively partitioned into disjoint subgroups. It would be a misapplication of the technique to make subgroups' sample sizes proportional to the amount of data available from the subgroups, rather than scaling sample sizes to subgroup sizes (or to their variances, if known to vary significantly e.g. by means of an F Test). The problem of stratified sampling in the case of unknown class priors (ratio of subpopulations in the entire population) can have deleterious effect on the performance of any analysis on the dataset, e.g. classification. In that regard, minimax sampling ratio can be used to make the dataset robust with respect to uncertainty in the underlying data generating process.

Practical example

In general the size of the sample in each stratum is taken in proportion to the size of the stratum. This is called proportional allocation. Suppose that in a company, the following staff exists:

- male, full-time: 90
- male, part-time: 18
- female, full-time: 9
- female, part-time: 63
- Total: 180

If we are required to take a sample of 40 staff, stratified according to the above categories; the first step is to find the total number of staff (180) and calculate the percentage in each group.

- % male, full-time = 90 ÷ 180 = 50%
- % male, part-time = 18 ÷ 180 = 10%
- % female, full-time = 9 ÷ 180 = 5%
- % female, part-time = 63 ÷ 180 = 35%

This tells us that of our sample of 40,

- 50% should be male, full-time.
- 10% should be male, part-time.
- 5% should be female, full-time.
- 35% should be female, part-time.

- 50% of 40 is 20.
- 10% of 40 is 4.
- 5% of 40 is 2.
- 35% of 40 is 14.

Another easy way without having to calculate the percentage is to multiply each group size by the sample size and divide by the total population size (size of entire staff):

- male, full-time = 90 × (40 ÷ 180) = 20
- male, part-time = 18 × (40 ÷ 180) = 4
- female, full-time = 9 × (40 ÷ 180) = 2
- female, part-time = 63 × (40 ÷ 180) = 14

Cluster Sampling: In many situations the population units belong to some natural group. For instance, the school constitutes a natural grouping of school children if the population of school children is of interest while markets constitute a natural grouping in a study where interest is to know the prices of foodstuff.

These natural groups consisting of the units of interest are called **Clusters**. A sample of clusters may be selected from all available clusters of interest and all the units in the selected clusters are then studied – this is known as cluster sampling.

Multi-Stage Sampling: Suppose a study is carried out which will use the all the states in the country. The investigator may first randomly select six states (1^{st} stage), out of these six states, he randomly selects ten local government areas from each of the six states (second stage). This is two stage sampling. He may decide to have 3-stage by going to zones. Notice that each stage constitutes a cluster.

6.7 Some Non-Random Sampling Method

Any sampling procedure where chance devices are not used to select the required sample is said to be non-random.

Examples of non-random sampling scheme are:

1) Systematic Sampling
2) Quota Sampling
3) Haphazard Sampling

Systematic Sampling: This sampling procedure as earlier discussed is the one in which the sampling units are selected at fixed interval from the frame. Example, instead of selecting a random sample of ten students from a school, one may select a systematic sample in which every ninth name on the school list of 90 names is picked.

The main disadvantage of this is that one may end up having units that resemble each other because they coincide with some unexpected periodic variation in the frame. In practice, one can introduce randomness here by randomly deciding where on the list he will start picking systematically.

Quota Sampling: Here one attempts to represent different classes that may exist in a given population. It is commonly used in public opinion and market research surveys. In such surveys, the interviewers is required to ensure that specified number of units in various classes like age, sex, income group, geographical location are included in the sample. The big difference between this and stratified is the lack of well defined rule of selection in quota sampling. In stratified sampling, apart from random selection from each stratum, the units to be included in the sample are known before sampling. With quota sampling these units are not known in advance.

Haphazard Sampling: Here the selector thinks that he is making a random selection. A good example is the sort of selection in public places often made by:

1. Press agents
2. Business promoters

Who interview people anyhow, seeking their views about something that is of interest to them? No chance device is however used in this type of selection. You can think of many possible biases that can come into such haphazard selection.

CHAPTER SEVEN
DATA COLLECTION

In any study, an investigator may have a choice of collecting the relevant data himself or of relying entirely on existing data already collected by someone else. The former is called the **Primary Sources** while the latter is called **Secondary Sources** of data. For example, in a study of weights of first year students, an investigator may choose to observe some first year students in certain schools in the area of interest, he therefore uses a primary data. However, if schools keep records of weights of all entering students, the investigator can use such data if he likes, he is thus using secondary data.

Whether primary or secondary, data may be published or unpublished.

7.1 Unpublished Sources:

Data in their original form such as number of births, and deaths in a locality, names of taxable adults in an area, ages of school children in a country etc may exist in the files, log books, registers, etc of government or non-governmental departments. These departments include ministries, schools, churches, hospitals etc. To obtain data from these sources require a lot of effort, time and money.

7.2 Published Data:

The following are the main sources of published data:

a) Statistical abstracts, bulletin, and reports issued by government department. A data here may be primary or secondary.
b) Reports of government and non-government agencies.
c) Research reports and journals.
d) Daily newspapers, magazine, and periodicals.

The data here may or may be reliable; hence caution is required in using them.

7.3 Necessary Guidelines for Collecting Reliable Data

The following consideration may be borne in mind when embarking on any data collection.

a) The cost of collecting the data
b) Practicality of proposed methods of collection.
a) If sampling is used, the samples must be a representative of the population. A representative sample gives equal chances to every member of the population to be included in the sample. Some of the sampling techniques will be treated later in the text.
b) The various errors and biases which may lead to wrong conclusion must be minimized, or if possible avoided.

Errors come into collection of data, for instance, when the wrong type of data not suitable for the problem under investigation is collected. Bias is introduced, for example, when the investigator either because of convenience or some other reason allows his personal feelings to override statistical principle.

e) Too much time should not be spent in collecting the data.

For the investigator who uses other people's data, it is still essential that he knows how the data was collected. Such knowledge and the above criteria should enable him to decide on the reliability of the data and its suitability for the problem under study. (Igwenagu, 2007)

7.4 METHODS OF COLLECTING DATA

The guidelines listed above come for consideration at various stages of an investigation. Before discussing these various stages, we need to distinguish between two types of investigations – the survey and the experimental types. We are very familiar with the term 'experiment' in Chemistry, Biology, Physics etc.

A survey is the observation of either the entire population (this is known as census), or the observation of the part of population (we call this sample survey). We can recognize the following three major differences between survey and experiment.

a) Experiments are mainly used to obtain data in the natural sciences, while surveys are used for the same purpose in social sciences and education.

b) In the experimental type, the investigator (experimenter) is very often able to control some factors which are not relevant to the problem under study in order to minimize bias in his conclusion. In surveys, the investigator cannot control any of the irrelevant factors.

c) The population of interest in experimental type is always infinite while that of surveys is usually finite.

7.5 SOME STAGES IN THE COLLECTION OF DATA

In trying to collect data, either through experiments or surveys, the following stages should be borne in mind.

1) Formulation of the problem
2) Planning the study
3) Design of the study

Formulation of the Problem

Before starting to collect data, the investigator must first of all determine the problem to be solved and specify its objectives.

As an illustration of problem statement, suppose a government Ministry of Education is thinking of regulating the spending habits of children in the boarding schools. Before making policy decisions, the government will first need to know the following facts;

i) The normal needs for which pocket money will be required.
ii) The present range of the amount of pocket money among the students.
iii) How the students spend their pocket money.
iv) Such other facts as age, sex, location of school, parental income, etc.

If all the above facts are not well known we might decide to find out more about them. A problem for study can then be formulated thus:

Problem: To find out the present level of pocket money among boarding school children, how such money is spent, and the influences of such factors are age, sex, seniority in school, location of school and parental income on the amount of pocket money and the spending habits of the students.

With the problem clearly stated, we can now consider the next stage.

Planning the Study: The investigator's next stage is to plan the study. He has to plan how best to solve his problem. In fact his plan will include

a) The coverage
b) Search for available information
c) Recording of the data and
d) Pilot survey

Coverage: Areas to be covered and types of object to be observed are determined. If the population of interest is infinite, then a sample may be used. If it is finite, the investigator will decide whether to use sample still or the whole population. Of course, there are obvious advantages for using a sample instead. For instance, cost of collecting data is reduced, time spent will also be reduced. Greater accuracy in the data is ensured. Since a few observations are involved, results from well planned samples are as useful and informative as those from the whole population.

Search for Available Information: This information may exist in the form of written reports which may be published or unpublished. It enables the investigator to know what is available and what remains to be done. It also helps him to learn from mistakes or constraints of the previous investigator in similar studies.

Recording of the Data: The investigator at this stage will have to decide how the data are to be recorded, i.e. whether to use the questionnaires type or direct observation type.

A questionnaire consists of questions and answers. It is usually used when studying human being and their social activities. The questions and answers may be written or oral. When oral answers are given, such answers which constitute the data must necessarily be recorded by the interviewer who is sometimes called the enumerator. Written questions can be sent by mail or accompanied by the interviewer. Both methods have their merits and demerits. The merits of mailed questionnaire include the following:

i) The respondent can take time to fill the questionnaires without the undue pestering by the interviewer.
ii) He is more likely to co-operate in questions of confidential nature.
iii) It is less expensive.

On the other hand, mailed questionnaire has got its disadvantage. Some of which are:

i) The percentage of non-response can be very high
ii) The questions can get lost.

In the case of using interviewer to collect data directly, greater returns are assured, especially if the enumerator is the persuasive type.

The interviewer has the opportunity of explaining difficult questions. On the other hand, direct observation is very expensive and requires more time to carry out. In the direct observation the investigator observes directly either the whole population or part of it. This is commonly used for experiments in the areas of sciences, agriculture, medicine etc. It is worthwhile top mention here that there are obvious disadvantages in observing the whole population:

i) More time is required
ii) More money is also needed.
iii) A large number of interviewers and respondents are involved resulting in an increase in the problem of definition, interpretation of the concept.
iv) Incompleteness may arise as a result of lack of interest shown by some members of the population.
v) Some remote areas may not be accessible.

Pilot Survey: In some cases the investigator may discover that the available information is so scanty that embarking on the study might result in a waste of money and efforts without necessarily achieving the objectives. It becomes desirable then to carry out the preliminary study before the main study. Such a study is called **Pilot Survey or Study** and it is normally done on a much smaller scale than the one in view.
A pilot study has the following objectives.

1) It helps to estimate the cost of the main survey.
2) It helps to taste and establish procedures to be used in the main study.
3) It helps to discover the difficulties and short-comings of the questionnaires.
4) It may lead to new ideas not originally included in the formulation of the problem.
5) It may help to discover the type of variation existing among the units of the population of interest.

The variation may enable the investigator to determine the type of sampling method and the sample size to use. If we pretest our questionnaire, on a few respondents, any unsuspected obscurities and difficulties in the questions are likely to be discovered and rectified.

Designing the Study: After the planning and possibly a pilot survey, the following final touches are then carried out:

a) The size of the experiment or sample is obtained, if sampling is to be used, this is the number of observation to be made.
b) The sampling and experimental procedures to be used are determined. Discussion on some sampling techniques will be given later.
c) The questionnaire if needed is constructed.
A sample questionnaire will be provided later.
d) Recorders or interviewers are trained.
Experimental procedures will include the decision on:
i) The number and type of variable to be observed.
ii) How treatments if any area to be spread or assigned to observation units.
iii) The type of observation unit to be used.
Observation units are identifiable physical entities on which a variable(s) is measured.

Example: In the study of heights and weights of school children, the children themselves are the observation units while their heights and weights are variables of interest. To minimize biases and errors in the conclusion drawn from experiment, treatments are assigned to the observation

units in such as way that objects benefit equally from the treatment. Many examples of the procedure exist, for instance in Agriculture when comparing two or more crops or fertilizers; in medicine, when comparing the effect of two or more drugs. In the former, plots of lands are the observation units while crops and fertilizers are the treatments.

Similarly in the later, patients are the observation units while the drugs constitute the treatment.

7.6 DESIGN OF A GOOD QUESTIONNAIRE

The following terms are commonly used in questionnaire: a **respondent** is the person who answers question in a questionnaire. He can help to promote collection of data by co-operating with the interviewer or he can spoil the investigator's master-plan through his distorted answers, non-response, unnecessary enthusiasm to give answers that will please the interviewer.

An observation unit, which can be defined as an identifiable physical entity on which such observations as measurements or attributes can be made is called **enumeration unit**. One or more variables may be observed on a unit. For example, in the pocket money survey, the students will be the respondent, he is also the unit on which to observe such attributes as the amount of pocket money, his age etc.

However, in a study to find out the most popular brand of baby milk among babies of a specified age range, each baby is the observation unit. But the respondent must necessarily be someone else like his parent or guardian, since the baby cannot answer questions himself. Having selected the topics to be included in the survey, we must formulate questions to cover each topic. The number, order and type of questions constitute the main elements of design of a questionnaire.

The following are the guidelines for the designing of a good questionnaire:

i) **Number of Questions:** The number of questions depends on the number of topics or variable being studied. Ideally they should be as few as possible. Too many questions, resulting in a lengthy and voluminous questionnaire may discourage a respondent from given the type of co-operation that he might have given with fewer questions. Repetition of questions should be avoided.

ii) **Arrangement and Order of the Questions:** A well-arranged and well-ordered sequence of questions showing a logical and continuous flow of thought could be very helpful to the respondent.

iii) **Simplicity and Clarity:** Simple, clear and unambiguous questions are more likely to have more meaningful responses than complicated and ambiguous questions. For example, a study in which one of the topics of interest is the marital status of the respondent, questions like "Married or Single" is not clear or that is ambiguous. Divorcees and widowers are left out. As an alternative may be: are you unmarried, married, widowed, divorced or separated? Where difficult or ambiguous questions are unavoidable, explanatory notes should be given so that the entire respondent interprets the questions in the same way. For instance, in a study involving families, the term 'family' should be defined. Does it consist of man, his wife, his children or does it include maids and houseboy etc.

iv) **Open-ended and Closed-ended Questions:** Questions leading to definite answers are to be preferred to those that call for many possible answers which cannot be classified easily. The

former type is said to be closed-ended, while the latter is open-ended. A question framed in such a way as to demand only 'Yes', 'No' or 'don't know' is an example of a closed-ended question.

v) **Other points:**

a) Leading questions should be discouraged. These questions lead to the answers desired by the investigator himself and so introduce bias into the data. They are meant for lawyers in the law court.

b) Provoking questions should be avoided where possible. These are personal and confidential types of questions which intrude into the privacy of the would-be respondent unless they are absolutely necessary. (Igwenagu Opcit)

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