RESEARCH METHODOLOGY IN ARTS, SCIENCE AND HUMANITIES

Surbhi Jain

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Dr Surbhi Jain is the head of Academics at Regenesys Institute of Management. She has a PhD (management) and an MBA (Marketing and HR).

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She believes in encouraging young individuals to see the beauty and potential that is within them and encouraging deep love and respect for others and the environment.

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PREFACE

The subject of research has received a considerable level of attention for a long time. Studies that have been conducted on the subject have focused on analyzing the most important approaches and methodologies that can be used to conduct research. It is also important to indicate that researchers on the subject have been concerned with the specific methods and approaches that can be used to effectively conduct research in specific subjects. For example, studies on research in the sciences have concentrated on the issues of research that are specific to the sciences. Similarly, research studies on how to conduct research studies in the arts have concentrated on the specific issues that are related to the arts. Therefore, it appears that studies about conducting research studies that have been conducted so far are specific to academic domains.

The importance of research cannot be overemphasized. On the one hand, all the academic disciplines that are taught at institutions of higher learning usually have an element of research as part of their syllabi. Students are usually required to undertake specific research projects as a way of completing the coursework in any degree course. Therefore, students in all institutions of higher learning are supposed to prove that they have mastered the relevant research skills related to their courses of study by completing a formal research project. On the other hand, academics rely on research to not only verify new information but also develop new solutions to intricate problems within their fields. Thus, university teachers, for example, rely on research to produce new knowledge in their areas of specialty, address complex issues that have direct relevance to the lives of people in the society and test new knowledge to determine its veracity. For these reasons, the subject of research is important for students, academics, and professional researchers. Whereas the activities of learners related to research help to show that they have mastered the process of completing a formal research in their areas of study, those of academics and other professional researchers help to discover new frontiers of knowledge, provide key information about issues and help to generate new forms of knowledge in their areas of interest. Therefore, it is the fact that research has many uses within the academia and industrial settings that it is treated with importance.

Research methods are a subset of the broad subject of research. Simply put, research methods collectively refer to all the tools, techniques, and procedures that are used to conduct research. Given that research is a highly complex project, researchers are supposed to utilize specific methods and approaches when conducting it. Also, given that research studies can be carried out in all the academic disciplines that are currently in existence, it can, therefore, be deduced that there are many methodologies that can be used to conduct research studies. The multiplicity of research methods means that researchers have to settle on specific collection of techniques that suit their research topics. Therefore, the methods, approaches, and procedures that researchers use when conducting a research are collectively referred to as research methods.

Many research methods are available for researchers in all academic disciplines and traditions. In general, the methods that are used to conduct research vary with the academic disciplines that are available. It is proper for researchers of any class of disciplines to follow procedures that are in line with the provisions of the specific discipline. For example, students of the natural sciences such as Physics and Chemistry normally conduct their research by following strict protocol that characterizes academic research for the sciences. Similarly, students of the arts are usually supposed to follow specific procedures and methods when conducting research in their studies. In the same vein, professional researchers in the natural sciences use methods and procedures to carry out research in their disciplines. Also, researchers in the arts such as linguists and social scientists rely on the techniques and methodologies of conducting research in the social sciences and linguistics for them to complete their research projects.

This book, Research Methodology in Arts, Science, and Humanities is based on the need to provide a detailed explanation of the methods that are used to complete research projects in the arts, humanities, and sciences. It should be noted that these three classes of academic disciplines differ from each other in terms of the methods and procedures that are used to conduct research studies in them. The aim of this book is to provide a brief and concise description of the specific methodologies that are used to conduct research in these three types of disciplines.

This book is ideal for students of the three classes of academic disciplines who are at various stages of their academic endeavors. Students at the beginner's level will find the material about the specific methods that are used to conduct research helpful for their endeavors. The students will find the material that is presented in the book useful for guiding them on how to complete research studies in their disciplines. Students at advanced stages of studies will still find the content of this book useful for reference purposes. Students at advanced

stages of their studies may find the information that is contained in this book useful when they conduct research studies. Also, the learners may use the information as a form of reference when they are completing assignments at their academic levels which are related to the subject of research methodologies. Thus, learners do not have to cover all the material that is presented in the book in any given order but only need to focus on the topics that address their specific needs. Besides, the book is divided into three parts that are in line with the three categories of academic disciplines on which the content is based. Hence, learners can easily get the material that they need for their specific purposes as opposed to having to read the entire book.

Apart from students who are doing research as part of their studies, teachers of research methodology in various disciplines will find the material that is presented in this book invaluable. The fact that the book contains detailed descriptions of the methods that are used to conduct research in arts, sciences, and humanities means that a broad range of teachers can use the book as an invaluable reference resource. Teachers at all levels can find the information that is contained in the book useful for their teaching. Besides, teachers can easily recommend the book to their students as one of the key learning resources for the courses that are related to research methods.

PART I:
RESEARCH METHODOLOGIES IN THE ARTS

1
CHAPTER

INTRODUCTION

'There's no discovery without a search and there's no rediscovery without a research. Every discovery man ever made has always been concealed. It takes searchers and researchers to unveil them, that's what make an insightful leader.'

—Benjamin Suulola

CONTENTS

This chapter provides a basic introduction to the subject of research. The aim of the chapter is to introduce the reader to the subject of academic research and present additional basic information on a broad range of issues related to research. Therefore, the chapter of the book serves the most important purposes of the entire book. On the one hand, this chapter of the book helps the already knowledgeable reader to remember the basic building blocks of the subject of research. On the other hand, the material that is contained in this chapter of the book provides a reliable form of introduction to the more advanced topics that are contained in the subsequent chapters of the book. The detailed and advanced nature of some aspects of the information that are presented in this book can be invaluable to the reader who has very little knowledge about the subject of academic research. The chapter contains information about the meaning of research, the definition of research methodology, the importance of research and other information that relevant to the subject of research methodology. The essence of the material is to provide a form of solid introduction to the more advanced and complex topics that follow. Also, the chapter contains a detailed description of the reasons as to why academics and students in general conduct research studies and a brief introduction of the various methods of research that are available for students, academics, and anyone else who is interested in the subject of academic research. By detailing all these forms of broad and very critical information related to research, the chapter helps to provide an important link between general knowledge about research and the more technical information on the methodologies that are used for arts, sciences, and humanities-based research studies, which forms the essence of the book.

1.1. DEFINITION OF THE CONCEPT OF RESEARCH

There are many definitions of the concept of research that have been developed over the course of time (Creswell, 2007). It is important to indicate at this stage that there is little variation in describing what truly constitutes research that emerges from the various definitions that have been developed. In general, it can be pointed out that academics agree that research can be defined as a process by which individuals systematically make inquiry about phenomena (Creswell, 2007). In other words, research is regarded as a process by which individuals can find answers to specific academic and industrial questions. Also, research is considered a process that is used to generate new knowledge and address pertinent theoretical

and practical issues. In simple terms, research can be defined as a complex academic endeavor that is systematically conceptualized, planned, and undertaken to achieve specific objectives or develop new information (Imam, 2015). This short definition of research has several implications that are worth mentioning at this stage. For example, it should be mentioned here that this definition implies that research is a process that entails many steps that are undertaken by those who conduct it. For example, any research process requires that the researcher first selects the issue that they need to investigate. The decision on the issue upon which the research is supposed to be based is important because it is directly related to the quality of the research. If a researcher chooses an issue about which a lot of research has been conducted, it is likely that the researcher may get a lot of published sources in the process. In turn, the researcher may find it easier to complete the work that it would be the case if they choose a subject that has not been adequately addressed by other researchers. However, a researcher who chooses a research subject about which a lot of work has already been done may not easily get a specific issue to address in the research. In other words, it may be difficult for the researcher who chooses a popular subject to frame a research question that is regarded as relevant and meaningful. Therefore, it is important for a researcher to strike a balance between the ease of accessing information on the topic of the research and the relevance of the research topic that the researcher is interested in. The making of the decision on the topic that the researcher wishes to address in a research study entails the first step of the research process.

Apart from selecting the most appropriate topic for the research, the designing of the entire research study is another important activity that forms the entire research process. For any research process to be complete, the researcher has to carefully choose a design for the study. Research design is a detailed description of the steps that a researcher is supposed to take to achieve the specific aims and objectives of the research (Imam, 2015). Thus, for a research process to be complete, the researcher has to develop a design that is the most appropriate one for the study that is to be undertaken. A researcher may have to choose from the various research designs that are available, based on the nature of the study. However, a researcher may have to tweak a few aspects of the research design templates that are available to address specific needs of the study that is to be conducted. Regardless of the number of various things that the researcher has to take into consideration when developing the design for any study, what should be borne in mind is that the researcher is free to adopt various aspects of different research

designs to the specific study, as long as doing so can help the researcher to achieve specific aims of the study (Figure 1.1).

Figure 1.1: Research is usually undertaken to provide answers for specific questions.

(Source: Pexels)

Additionally, the conceptualization of research as s complex process in which a researcher conducts a series of related activities is seen in the way the researcher treats research data and presents the findings to the audience. A researcher always has a particular audience in mind when conducting a research study. The audience of the research study is usually made up of people and institutions who are interested in the findings of the research. The audience usually follows the research proceedings and use the findings to make specific steps or actions related to their activities. For any research endeavor, the researcher usually has to collect data to complete the study and then present the findings to the audience. The type of data that is usually collected and the methods that are used to treat it are usually determined by the nature of the research. The final findings of the research are then presented to the audience in the form of a research report or any other form that is appropriate to the needs of the audience.

Another important implication of the definition of research that has been presented in this section of the book relates to the main reasons as to why research is conducted. There are many objectives as to why a research study can be conducted. For example, a research can be conducted to verify whether two phenomena are related to each other and, if that is the case, the nature of the relationship (Creswell, 2007). In technical terms, relationship between two phenomena is usually expected to be causal or non-causal. For

a causal relationship, one factor usually causes the other. The factor that causes the other usually occurs before the other one which is regarded as the consequence or result of the causative factor. It may be necessary to conduct a study to determine whether one factor or variable is the cause of another one. There are many examples of studies that are conducted to determine causal relationship. For example, in social studies, a research may seek to establish whether high levels of poverty in a specific city are the cause of relatively high rates of divorce in the region. In such a case, it should be noted that the findings of the research will not explain the nature of the relationship but only focus on answering the basic question of whether high rates of divorce among couples in the city can be attributed to relatively high levels of poverty in the city. Moreover, it is normal for studies that seek to test causality not to engage in explaining the complicated nature of the relationship. Therefore, it may be necessary for other forms of studies to be conducted to explain the reasons as to why the two factors have a causal relationship.

Another aim as to why research is conducted is related to exploring an issue to gain further information about it. In general, knowledge about issues is dynamic and constantly changing. Researchers, practitioners, and other individuals who are interested in specific matters in the society are always keen on learning about new developments in their professions (Kothari, 2004). Normally, it takes the effort of researchers for new knowledge or information about an issue to be developed. It is usually the work of researchers to reexamine issues and discover new insights about them. In practice, this form of research in which the researchers are only interested in developing further knowledge about an issue that is already known is referred to as exploratory research. A good example of exploratory research may take the form of a study to determine the factors that contribute to the failure of startups in a given country. In such a case, the researchers may only be interested in contributing to the already existing knowledge about the reasons as to why many startup companies in the region are failing.

From the foregoing, it is clear that the definition of research methodology that has been presented in this section of the book implies that research is a complicated process during which the researchers have to carry out specific activities to address the matching needs of the stakeholders. For any research process to be complete, the researcher has to choose the most appropriate research framework, carefully collect data, process the data to answer specific questions and then present the findings in the form of a report (Figure 1.2).

Figure 1.2: Research may be undertaken to provide additional information about a theoretical concept or idea.

(Source: Unsplash)

Moreover, research may be undertaken to determine the extent to which a specific event occurs within the society. Determining the level of frequency of an event in the society may be important because it may provide the much-needed information to form the basis for action (Imam, 2015). For example, in the case of medical research, trained medical researchers usually take the time to assess the prevalence of a condition within a given population before they label the condition and develop the most appropriate action to address it. If it is determined that the condition is serious enough, the researchers and other decision makers may take the necessary action to address it as soon as possible. Even in the case of studies that are conducted to establish whether causality exists between two factors, the findings of the studies may be used as a basis for making decisions. The authorities may have to decide on the best course of action to take based on the findings whether there is a causal relationship between key issues (Pickering, 2008). Thus, in all these cases, it can be seen that the entire decision-making process is wholly dependent on the findings of the study to determine the prevalence of the situation or condition within the given population.

1.2. POSITIVISM AND RELATIVISM IN RESEARCH

The activities that form the entire research process have a strong theoretical basis on philosophy. The philosophical foundation of research is important

because it provides knowledge about the assumptions that are made by the researchers when they are conducting a study. Moreover, the philosophical basis of research provides a framework that researchers use to complete their research studies. Hence, it observed that understanding the theoretical basis of the research process is important because it helps the researcher to clearly understand what his or her role is in the entire research process (Swanborn, 2009). The philosophical foundation of research is summed up by the concepts of positivism and relativism. In simple terms, positivism, and relativism are two philosophical approaches that are used to shape the way research studies are conducted. The essence of these two phenomena is that they provide a theoretical framework that can be used to guide researchers to conduct their study in a way that is appropriate to their specific needs (Pickering, 2008). Thus, if a researcher decides to use the positivist approach when conducting a specific study, the researcher may be required to follow the specific requirements of the approach which, as it would be expected, cover all the activities that are usually undertaken in the course of conducting a research. Similarly, if a researcher chooses to use the relativist approach to conduct a research study, the researcher will be required to strictly adhere to all the provisions of the approach when doing all the activities that collectively form the entire research study (Figure 1.3).

Figure 1.3: The essence of positivism is that the world exists in a specific form and that it is possible to gain a universal form of knowledge about nature.

(Source: Unsplash)

There are fundamental differences between positivism and relativism as far as the process of conducting research is concerned. One of the main differences between these two philosophical approaches to research lies in the way the entire research process is carried out. If the research process can be viewed as a decision-making process, then using the positivist approach will require that the researcher who is undertaking the process focuses on using the inductive process or others that rely on scientific methods. The use of the inductive process is fundamental in research studies that are conducted using the positivist approach (Singh, 2010). On the other hand, when one chooses the relativist method, it may be necessary for the researcher to focus his or her attention on a subjective process that is based on data. In other words, whereas research that is conducted using the positivist approach rests on the rules of rational thinking, that which is conducted using the relativist approach is hinged on the need for the researcher to be subjective in the process (Betz, 2010). It should be remembered that the fact that positivist research is usually based on rational thinking while relativist research is based on subjective thinking does not mean that one approach to research is superior to the others. In practice, the choice of the approach that is used in a research largely depends on the nature of the research that is to be conducted.

Another important difference between positivist and relativist approaches to research lies in the roles of the researchers and the research studies. The essence of research that is undertaken using the positivist approach is that the researcher is regarded as an independent or neutral observer (Imam, 2015). The researcher is not supposed to be a participant in the processes that he or she is undertaking. There are numerous examples of how the neutrality of the researcher, as recommended as part of the application of positivism in research is seen. For example, in scientific experiments, the researcher is an independent observer because he or she cannot be regarded as part of the phenomenon that is under investigation. In such a case, the researcher is independent of the specimen and can only alter the specimen in his or her capacity as the person who is conducting the experiment but not as part of the phenomenon that is being studied.

On the other hand, when a study is conducted using the relativist approach, the researcher may be part of the research. What this statement means is that unlike the positivist approach to research, the relativist one allows the researcher to be a participant in the process. A good example of how a researcher can be participant in the process of conducting a research is seen when one considers the role of a teacher who is conducting a study

on some phenomenon in the school in which the teacher works. If, for example, the teacher in question is examining on the effectiveness of the teaching methods that are used by the teachers in the school, the teacher who is doing the research is also part of the process because he or she may have to examine the methods that he or she uses in the classroom. Thus, the teacher is not a neutral observer of the research process but rather an active participant of the events and processes that are under investigation as part of the research study.

As it has been stated here, there is also a clear difference between positivism and relativism as far as the role or purpose of the research study is concerned. In the case of studies that are conducted using the positivist approach, it is held that the main purpose of the study is to discover or show universal laws that have been in existence since time immemorial (Swanborn, 2009). The purpose of research as indicated under the positivist approach arises from the assumption that nature is a phenomenon that has been in existence for as long as it can be remembered. Moreover, the need for research to help uncover the fundamental laws of the universe, as indicated under the positivist approach, is based on the philosophical assumption that there is nothing new about nature that can be said to have developed in the recent past but that rather, every aspect of nature has been in existence for as long as it can be remembered. Thus, under this approach, the main purpose of research studies is to help uncover the underlying universal laws of nature. In other words, this philosophy holds that it is possible for people to understand the world in a clear and universally uniform manner (Figure 1.4).

Figure 1.4: At the heart of relativist, research is the assumption that there are many ways of interpreting phenomena.

(Source: Pexels).

Regarding relativist research, the essence of the study is usually regarded as revealing the many and various interpretations of phenomena that exist in the world. In other words, research that is conducted using the relativist approach is usually based on the need of realizing the many ways in which people in the society can interpret any given phenomena (Creswell, 2007). The underlying philosophy of this approach, which is referred to as idealism, holds that the natural world and any other issue in the world can be interpreted in many different ways. Therefore, researchers are not bound to stick to one form of interpretation of phenomena but are free to discover as many interpretations of phenomena as they exist in the world.

Therefore, it can be seen that there are many differences between positivism and relativism and that the differences have practical implications on the way the research process is conducted. Researchers are aware of the differences and use them when carrying out specific activities of the research process.

1.3. COMMON TYPES OF RESEARCH

There are many different types of research that are in existence. The large number of types of research studies arises from the fact that there are different approaches and methods that can be used to conduct research studies. In other words, as much there are many different methodologies that can be used to address the questions that researchers have to deal with, it is possible for the researchers to use any of the different types or formats of research that are in existence. The following is a brief description of some of the most common forms of research studies that students and other individuals who are doing research studies may choose from.

One of the most common forms of research is the quantitative or qualitative research. There is a very clear difference between quantitative and qualitative research; however, these two forms of research are regarded as related to each other because whenever a researcher has to conduct a research, he or she has to choose either of the two. In other words, research studies only contain aspects that make them qualitative or quantitative. However, in other cases, researchers may choose to incorporate the elements of both forms of research in a study (Chand, 2003). The need to include the aspects of the two forms of research may arise from the complex nature of the study that is under consideration. Thus, it is always left upon the researcher to decide whether to include the qualitative and quantitative aspects of research in the study or to simply choose one type of research.

Needless to say, the essence of quantitative research is that the researcher deliberately focuses on measuring content that is quantitative in nature. A researcher who chooses to conduct a quantitative study should be certain that the issues that he or she is set to examine can be accurately measured in discrete ways.

On the other hand, qualitative research is defined by the way the entire research is focused on evaluating a phenomenon using non-measurable criteria. A good example of the divide between qualitative and quantitative research is as follows. If a researcher chooses to conduct a survey to determine the rate of prevalence of a condition, such as poverty, in a region, the researcher may measure the actual prevalence by enumerating the households that can be categorized as poor and expressing this number as a percentage of the total households in the region. Suffice to say that the number of households that are regarded as poor can be measured in numerical terms. Therefore, such a research is clearly quantitative in nature.

On the other hand, if a researcher chooses to analyze poverty in the said region but chooses to study the effect of poverty on the lives of people in the region by focusing on a family, then the researcher would have to use the qualitative approach. The resulting study would be qualitative in nature because it would entail examining non-quantitative aspects such as the extent to which poverty is affecting interpersonal relationships among family members, how individuals in the family that would be used as a case study view poverty and other values that cannot be expressed in the form of numbers.

The second category of research includes empirical and conceptual forms of research. Empirical type of research is usually conducted without making reference to existing theoretical systems (Imam, 2015). In general, research is usually conducted in such a way that a researcher considers the various theoretical models that are in existence. In empirical studies, the researcher simply seeks to achieve the objectives of the study by collecting and measuring data. The process of collecting and measuring the data is usually carried out with the aim of testing a hypothesis. On the other hand, conceptual research is usually conducted to provide further information about a theory of concept. For example, a study may be conducted to provide further information about a specific theory of a discipline. In such a case, the researcher is not interested in testing any hypothesis but rather in providing further information about the theoretical concept. The third type of research is referred to as applied research. To understand the essence

of applied research, it is important to consider the opposite of this type of research, which is called fundamental research. Primarily, fundamental or basic research is any study that is carried out with the aim of collecting knowledge which is then used to fill the gaps that exist in the knowledge that already exists (Swanborn, 2009). On many occasions, research may carry out a study because they have realized that some information is missing about a certain issue. For example, in the example that has been provided in this chapter about a study to determine whether there is a correlative relationship between poverty and high rates of divorce in a given city, the researchers may be motivated to conduct the study because they feel that there is a need to enumerate on the theoretical models that explain the social phenomena. In such a case, the researchers may use the findings of the study to either support or refute the theoretical explanation of the issue that is already in existence. In such a case, it can be clearly seen that the research study is basic in that it does not seek to solve any issue but rather to make a theoretical contribution to the repertoire of knowledge related to the issue that already exists.

If, separately, researchers conduct the study with the aim of providing solutions to the problem of high rates of divorce in the region, then the researchers can be said to have carried out a form of research that is called applied research. The study, in such a case, will be applied in the sense that its findings will be used to provide solutions to the problems that are being experienced in the society. Thus, the aim of the research will not be to provide additional knowledge about the relationship between poverty and divorce but rather to help explain what can be done to address the situation.

In practice, the type of research that a researcher chooses is directly tied to the issues that the researcher would like to evaluate. If a researcher only seeks to examine the characteristics of a complex scientific phenomena, for example, the researcher may have to use quantitative research. On a different note, a researcher may be required to use qualitative research to examine an issue if the opinion of the researcher is very important in helping the audience to understand the complicated nature of the issue. Similarly, a researcher may choose applied form of research to address certain issues that cause problems in the society. It may be necessary for the researcher to choose applied research as the preferred form of research because the goal of conducting the study may be tied to providing solutions to the issue that is affecting the society.

1.4. COMMON TYPES OF RESEARCH DESIGNS

Research design refers to the overall framework that researchers rely on to carry out their research studies (Imam, 2015). Typically, a research design contains details about the specific objectives of the study and the methods that shall be used to meet the objectives. Additionally, any good design of a research should show the kind of data that the researcher intends to use and how the researcher will collect, collate, process, and analyze the data. Therefore, a research design provides a comprehensive structure of the methods and techniques that are supposed to be used for a specific research study to be completed.

There are as many types of research designs as there are approaches to research. One of the most common forms of research designs is the correlation type. Correlative studies are based on the need for the researcher to establish whether there is a correlative relationship between two variables and the kind of correlation relationship that exists between the two variables that are under investigation (Creswell, 2007). It follows that all studies that use the correlation design are based on the need to establish the nature of the relationship that exists among variables. If the researcher thinks that two variables may have a causal relationship, then the researcher may have to test this hypothesis to determine whether truly the existence of one factor is the cause of the other or otherwise. It should be noted that there are many ways in which variables may be related to one another. For example, if an increase in one variable usually leads to a corresponding increase in another, then the correlative relationship between the variables may be described as positive. Otherwise, if the relationship between two variables is in such a manner that an increase in one variable leads to a decrease in the other, then the correlative relationship between the variables is described as negative.

Apart from correlation design, another common form of research design that is in use is what is referred to as comparative design. As the name suggests, comparative research design is used for studies in which the researcher seeks to compare and contrast two phenomena. If, for example, a researcher seeks to compare the cultural impacts of the 1st World War and the 2nd World War on a given population in a region, then the researcher may have to use this form of research design. The comparative form of research design may be appropriate for conducting such a study because it provides the most appropriate framework for the researcher to identify similarities and differences between two issues. The researcher may use the framework to effectively identify the various areas in which the two issues had a similar

effect on the culture of the people who were affected by them at the time. Also, a researcher who is carrying out such a study may have the chance to examine the various ways in which the two issues had different effects on the lives of individuals who were affected by them at the time. It needs to be mentioned at this point that this form of research approach is commonly used in the social sciences. It is easy for a researcher to use this approach to conduct a research about a social phenomenon than it is for a researcher to use it to carry out a scientific study.

The third commonly used research design is the experimental form of design. The essence of experimental design of research is that the researcher creates a situation in which variables are tightly controlled and subjected to an ideal environment for testing. This form of research design is commonly used in scientific studies. In such studies, the researcher deliberately chooses specific phenomena that needs to be examined, creates an ideal environment in the form of a laboratory and then subjects the issues to a series of tests to determine whether the results that are indicated in the hypothesis can be actualized under the laboratory conditions. The researcher then uses the findings of the study to make a conclusion about the general environment. The act or extrapolating the findings of experimental studies to the society, in general, is referred to as generalization (Kumar, 2010). Thus, based on the findings that would have been obtained from the sample or specimen, the researcher is able to make conclusions about the general population. Therefore, it can be seen that experimental research design is ideal for scientific studies that usually involve the drawing of a sample, drafting of a hypothesis and testing the hypothesis by applying specific conditions to the specimen that is used in the study.

The findings are then used to draw conclusions about the sample that is used in the research. Later, the researcher has to extrapolate the findings about the sample on the entire population. For example, if a researcher is testing the efficacy of a drug within a specific patient population such as children, the researcher may make a finding about the sample that is used in the drug testing experiment (Khan, 2011). Once the researcher has made a conclusion about the sample, the researcher may then use the findings to predict the possible level of efficacy of the drug on the entire population, which in such a case is composed of all the children in the population (Figure 1.5).

Figure 1.5: Experimental research is usually carried out in the form of exposing a specimen to controlled laboratory conditions to test specific hypothesis.

(Source: Pexels).

This chapter has presented introductory material about the subject of research in general. Information about the definition of the concept of research has been presented. It has been seen that research can be defined as a complex process by which individuals examine issues with the aim of providing answers to specific questions. It has also been shown that research studies are usually detailed and well-planned endeavors that require the input of a considerable amount of resources. It has also been shown that research studies are conducted for the purpose of achieving specific objectives. Some of the objectives of research studies may be related to explaining the relationship between two phenomena, describing specific events or simply providing general additional information about theoretical concepts. Moreover, it has been pointed out that there are many types of research designs from which a researcher may choose. A good researcher usually considers the nature of the study, the type of data to be used and other factors when choosing the research design to utilize for the study. The next chapter will present basic introductory information about research methodology in the arts.

2
CHAPTER

ARTS-BASED RESEARCH: THE BASICS

CONTENTS

This chapter contains basic information about a form of research that is referred to as Arts-Based Research (Arts-Based Research). In the chapter, detailed information about the definition of Arts-Based Research, the major characteristics of Arts-Based Research and the main philosophical principles that form the basis for the practice of Arts-Based Research are presented. In addition, other additional information related to Arts-Based Research is presented in this chapter of the book. Some of the additional information that is related to research in the arts that is presented in this chapter of the book includes the various types of research in the arts that are in use and some of the most common benefits of research in the arts to individuals and the community. The main aim of the chapter is to introduce the reader to basic material about Arts-Based Research as a way of laying the ground for more detailed and in-depth material related to the methodologies that are used to conduct research in the arts.

2.1. DEFINITION OF ARTS-BASED RESEARCH

It is important to point out at this stage that there are very few definitions of Arts-Based Research that have been developed over the course of time. This observation means that there are very little disagreements regarding the definition of the concept of research in the arts among scholars, practitioners, and other stakeholders. There are various reasons as to why the definition of the issue of research in the arts is clear. On the one hand, there are marked differences between research in the arts and other forms of research such as research in the sciences and research in the humanities. The differences make is easy for academics to develop definitions for research in the arts that are specific and applicable (Smith, 2009). Therefore, the fact that it is very easy to delineate Arts-Based Research from many other forms of research, mainly scientific and social science research means that academics, students, and other interested parties can easily identify the main characteristics that can be used to define Arts-Based Research.

On the other hand, it is easy to define Arts-Based Research because the practice has been in existence for a long time. Artists have been actively practicing the unique form of research that is now commonly referred to as research in the arts for many decades. The longevity of the time during which Arts-Based Research has been in existence has led to the development of a rich collection of terms that are specific to the practice. For example, there is a rich repertoire of lexicons that is used to guide the process by which researchers conduct research studies in the arts (Sullivan, 2010). The

terms are unique because they describe specific phenomena, processes, and approaches that are unique to research studies that are conducted in the arts. Also, the existence of a rich lexicon of terms that are unique to research I the arts means that researchers in the discipline can stick to using particular terms when describing some of the most common aspects of research which are related to basic processes such as collecting and processing data. The existence of well-defined lexicology that is related to the practice is an example of the effect that the long history of existence has had on the practice. In other words, the long history of Arts-Based Research has resulted in the full development of the branch of knowledge. Therefore, it is based on three main reasons that are argued that there has been very minimal controversy regarding how the concept of Arts-Based Research should be defined.

In general, Arts-Based Research is defined as an approach to the process of research in which the persons who are conducting the research deliberately rely on the processes and techniques of the various art forms that are in existence to address the demands of the research process (Given, 2008). Research in the arts is regarded as an approach to conducting research in which the researcher relies on specific methodologies which are unique to the arts as opposed to the other academic disciplines, to complete the study. The uniqueness of the methodologies is exhibited in the way data is collected, research questions and objectives are developed, and other aspects of the research are managed. What these observations mean is that as part of the process of conducting research in the arts, researchers are supposed to be careful enough to use specific methods, approaches, and techniques to carry out all the processes that normally form the research cycle. In practice, a researcher who is conducting a form of research in the arts needs to use specific tools and methods to cover all the activities that are usually carried out as part of a research study. For example, in the course of conducting a research study in the arts, researchers are usually required to collect the data that they intend to utilize using specific methods and practices.

Apart from the data-collection process, the data analysis and even result presentation activities are also supposed to be conducted using specific methods when one is carrying out a research study in the arts subjects (Pickering, 2008). Moreover, the process of analyzing the data to address the objectives of the research is also supposed to be conducted in a way that is unique to the arts in the case of a study that falls within the category of Arts-Based Research. Therefore, it can be seen that the essence of research in arts is that any researcher who does this kind of study is supposed to use

specific methods, tools, and approaches to carry out all the activities that are normally conducted as part of a research study (Figure 2.1).

Figure 2.1: In scientific research, unlike the arts, the researcher is regarded as an external observer who is completely detached from the phenomena that are under investigation.

(Source: Pexels).

Apart from the existence of specific methods and tools that researchers are used to conducting research in the arts, another important issue that arises from the definition of research in the arts that has been presented in this section of the book is that the entire process is multidisciplinary in practice. The multidisciplinary nature of research in arts is seen in the way researchers who are using the approach are supposed to borrow concepts, theories, and processes from multiple disciplines in the course of conducting their studies. For example, it is common for researchers who use this approach to borrow specific methods, tools, and approaches from the sciences, humanities, and other disciplines.

It is generally acceptable for researchers using this approach to research to use skills from multiple disciplines because of the nature of the research process. Some of the tools that are used to complete research studies in the arts may have their origin in the humanities. For example, some of the commonly-used approaches to conducting a form of research in the arts that is based on using the knowledge that is generated from the study to help transform the community is unique to a form of research in the humanities that is referred to as action research. The underlying principle of action research is that the researcher is not a unique observer during the research

process but rather an active participant in the process or issue that is being examined (Leavy, 2015). As it is the case in action research, in a unique form of Arts-Based Research, the researcher is focused on using the findings of the study to change the status of the lives of individuals in the community. In such a case, the researcher may actually be a member of the community upon which the study is based. In other cases, a researcher may borrow methods or aspects of techniques from scientific research to complete a research in the arts.

The methods that are borrowed from the sciences may be related to how to analyze data, if the data is quantitative in nature, or how to handle any other technical aspect of the research process. Therefore, it is clear that there are many occasions in which the researchers who are conducting Arts-Based Research studies use methods that originated from other forms of research. Hence, the multidisciplinary nature of research in the arts is one of its hallmarks because it differentiates it from other forms of research (Figure 2.2).

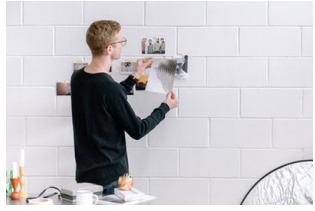

Figure 2.2: In research in the arts, the researcher is usually regarded as an active participant in the processes that are under investigation.

(Source: Unsplash)

It is important to note that critical questions have been raised relating to the issue of the relationship between research in the arts and qualitative research in general. It has been argued that Arts-Based Research can best be regarded as an example or subset of qualitative research, given its salient features, tools, and processes (McNiff, 2008). The argument that research in arts is a subset of qualitative research has been informed by the observation that research in the arts mainly uses tools that are borrowed from qualitative research practices (Sullivan, 2010). For example, the kind of data that is used in research in the arts is similar to that which is used in qualitative research studies. As it is in practice, qualitative research may entail examining a single case study or collecting and examining non-numerical

data. Interestingly, in research in the arts, researchers normally concentrate on using non-numerical data to achieve the objectives of the research. In both cases, researchers normally emphasize on using data that cannot be expressed in numerical terms. Thus, if one considers the kind of data that is used in both research in the arts and generally in qualitative studies, one may easily conclude that research in the arts collectively form a kind of research that is part of the qualitative approach to research.

Moreover, the role of the researcher in research in the arts is another reason as to why it is generally argued that research in the arts collectively form a subset of qualitative research. It is generally argued that in research in the arts, the researcher plays a critical role of influencing the way the entire study is conducted (Given, 2008). Similarly, in qualitative studies, the researcher is not regarded as an external observer but rather as an active participant who is directly involved in the way the phenomena that forms the subject of the study is treated in the course of the entire research. The way the researcher interacts with the whole research process is an important attribute because, in the sciences, the researcher is supposed to be an external observer. A researcher who is conducting a science-based research study does interact with data as intimately as it is the case for a researcher who is completing a research study in the arts. Therefore, the fact that the researcher is an active participant in both qualitative studies and research in the arts means that the two forms of studies share important features.

The role of the researcher in Arts-Based Research and qualitative research studies contrasts sharply with that which is witnessed in science-based research studies. For the research studies that are based on the arts, the researcher is usually regarded as an external observer whose main interest is in studying and analyzing the phenomena. In such a case, the researcher cannot be said to be an active participant in the research process as it is the case in Arts-Based Research studies.

From the foregoing discussion, it can be seen that research in the arts can be defined as a complex approach to research in which the researcher borrows a range of tools and methodologies from other disciplines and relies on the arts to complete the research. In other words, research in the arts is primarily a way of conducting research in which the researcher uses specific methods, tools, and techniques that belong to the arts to complete the study. Thus, research in the arts is defined by the approach and methodologies that are used by the researcher which are different from those which are used by researchers who conduct studies in other disciplines. For example,

there is a clear difference between research in the arts and research in the sciences. Scientific research uses methods, tools, and techniques that are unique to science and which are totally different from those which are used in the arts. Moreover, in the sciences, unlike what takes place in the arts, the researcher is regarded as an independent observer. In the arts, the researcher is expected to be an active participant in the entire research process. Thus, in the arts, unlike the sciences, it is impractical to separate the researcher from the research study.

2.2. RESEARCH IN THE ARTS: THE PROCESS

To understand the research process that is used to conduct studies in the arts, it is important to examine the key questions that are supposed to be addressed by researchers as part of the preliminary process of conducting studies. Primarily, researchers need to ask themselves several key questions as part of the research process in the arts. Moreover, the researchers need to ensure that they have accurate and detailed answers to the questions that they ask themselves before they focus their energies on implementing their research plans (Betz, 2010). Although the questions are common in research studies in many other disciplines, in the following analysis, they have been specifically modified to address the pertinent needs that researchers who conduct research studies in the arts normally face.

The first question, which also forms the first stage of the process of research in the arts, is related to the issue on which the researcher intends to conduct the study. Primarily, a researcher in the arts needs to address the question of the issue or subject that is supposed to be addressed in the proposed research. In other words, a researcher is supposed to have a clear and detailed answer to the following question: what am I researching on? In practice, a researcher can answer this question by looking at many possible sources of information as a form of inspiration for a research idea. A good researcher may get the germ of a research idea from careful observation of the creative processes that take place around them. For example, a researcher who happens to be a teacher may get an idea or a research subject by examining the activities of their students or by referring to the text that they use in their work.

Also, any professional who would like to carry out an arts-based research may get the idea for the research by evaluating their work. The professionals may discover a problem that needs to be solved and use it as a source of information for their planned research study (Pruzan, 2016). It is possible

for professional researchers in the arts to discover an issue in their work that needs to be examined further. The issue that needs to be examined further may be a theoretical or practical one. Regardless of the nature of the issue, the most important thing that needs to be remembered is that researchers may rely on their professional knowledge and practice to identify a research topic and, by so doing, answer the basic question that forms the basis of the entire research process in the arts.

In the same vein, researchers in the arts can collect research ideas from their interactions with others. For this reason, the question of the issue that the researchers should be examined can be answered by the way the researchers take the time to get the right ideas that need to be investigated in the form of a formal study. The interactions that yield research ideas may be with fellow professionals, students, in the case of teachers and community members in general.

The second question that needs to be addressed and which forms the second stage of the research process in the arts relates to the significance of the proposed research. After a researcher has adequately answered the first question of the issue that the researcher is supposed to address in the research, there is a need for the researcher to answer the question that is related to the reason for them to carry out a research. There are many reasons for conducting research studies in the arts; however, it is important for the researchers to ensure that they have clearly identified the social benefits that the findings of the research may have. It is not enough for a researcher in the arts to say that they intend to conduct a study simply because they are curious about the subject of the research (Gimbel, 2011). Given that at times, research in the arts takes place within the context of large institutions, which are governed by complex procedures and rules, researchers may have to justify their planned study by showing that its findings will be beneficial to other stakeholders (Smith, 2009).

Moreover, researchers may be required to demonstrate the potential benefits of a planned research study for them to acquire the funding that they need to complete the study. Regardless of the reason for researchers to show the potential benefits of their studies, it is important for them to also answer the question of why they plan to complete their research projects. It is for these reasons that researchers need to show that the findings of the study that they wish to carry out will address the needs of stakeholders. The stakeholders in any given research process may include the public, organizations that fund the study and the institutions that provide the

resources for the study to be completed.

At the third stage of the process, a researcher takes the time to carry out a detailed review of literature on the topic of study. The importance of literature review in the research process, in general, cannot be overemphasized. On the one hand, a researcher needs to carry out detailed review of literature to determine what other researchers say on the issue of the planned research study. If a researcher attempts to start doing a research without first evaluating the findings of published studies on the issue, the researcher may duplicate what has already been published. Also, if a researcher fails to complete a detailed review of literature, the researcher may produce research results which are not credible. Therefore, regardless of the academic orientation of the researcher of any given study, it is necessary for every researcher to critically evaluate literature related to the subject of the research study.

The next important issue that a researcher who is conducting a study in the arts needs to address as a part of the entire research process relates to the method that is to be used to complete the study. For any research process to be successful, it is necessary for the researchers who are involved to select the most appropriate methods to be used. There are many research methods that can be used to complete studies in any given discipline. For example, in the arts, researchers can choose from any arts-based methods to complete their research projects. Similarly, in other disciplines such as humanities and the arts, researchers have a collection of methods from which they can choose one that suits their research needs.

The choice of the methodology that is used to complete research studies is usually based on the kind of research that is to be completed and its specific needs. Within the context of the arts, a good researcher will not only stick to the methods that are appropriate for completing studies in the arts, but also choose a method that best addresses the unique needs of the research study. If a researcher in the arts wishes to complete a study about a specific painter, then the researcher may choose the case study method and apply it to the case because it best suits the needs of the planned study (Hayler, 2016). Similarly, if a researcher would like to complete a study, which is based on a communal issue, the researcher will be obliged to select a research method and design which meets the actual needs of the research study.

It is also at this stage that a good researcher usually develops a plan for undertaking the study. A good plan for the research usually acts as a roadmap, which the researcher follows when accomplishing specific tasks of the research. If a researcher prepares a good research plan, then the

researcher will easily ensure that they complete all the small tasks related to the research in time and the right sequence.

Also, it should be noted that as part of the process of addressing the issue of how the planned research is to be completed, a good researcher normally might choose mixed methods or a single method to complete the study. In the arts, a researcher may deliberately settle on a number of methods as the best way of achieving the goals of the research. In other words, a researcher is not bound to use a single method to complete a research study. Any good researcher will examine the issue on hand and make the right decision in relation to the most suitable method that can be used to conduct the research study.

After a researcher has settled on the right methodology, it is now important for the researcher to start collecting all the data needed in the research. The data collection process is one of the most critical aspects of any research undertaking. It is important for the researcher to collect the right information and use the best methods to collect the data that is required. If a researcher collects data that is not appropriate for the study, then the researcher may get findings, which are not credible. On the other hand, if a researcher uses wrong methods to collect the data that is needed for the study to be completed, then the researcher will face difficulties when they attempt to test the validity and reliability of the information. The data collection process enables a researcher to process the data and answer the research questions. It is based on these and many other activities that the researcher finally compiles the results of the research study. Thus, a researcher is supposed to take all preceding processes seriously to ensure that the whole research process is completed successfully.

2.3. VALUES OF RESEARCH IN THE ARTS

Many values emerge from the work that researchers do when they conduct studies in the arts. The following is a brief description of some of the most important values of research in the arts. In the first place, research in the arts is defined by the fact that the knowledge that is finally disseminated at the end of the research may arise from multiple sources. In practice, the concept of multiple sources, as used in research in the arts, refers to the work that the researcher finally generates, the actual piece of art that the researcher uses as a base for the study and any other issue or phenomena that the researcher uses to conduct the study (McNiff, 2008). It is usually the duty of the researcher to ensure that at the end of the entire study, the

researcher has successfully yielded knowledge that can be used for other purposes. Interestingly, in research studies that are based on the arts, the knowledge that is usually generated at the end of the study is usually derived from multiple sources. For example, the artists who are conducting a study may realize at the end of the study that useful knowledge has been directly generated from the work that the artist would have created as a result of the research. Also, an artist may realize that knowledge at the end of a research study arises from any other source. Thus, the multiplicity of possible sources of useful knowledge is an important value of research in the arts.

The second important value of research in the arts is that the researcher is supposed to be morally committed. The value of moral commitment in research in the arts is important for various reasons. In the first place, the reason as to why artists are supposed to be morally committed is that the arts are, by nature, studies that underscore the value of life in the society. The subjects that are categorized as arts are usually concerned with the human condition in the world (Sullivan, 2010). As such, the researchers who specialize in any of the arts subjects are, by effect, scholars who are concerned with the condition of the life of people in the society. Thus, the close link between human life and the arts is an important reason that makes it necessary for researchers in the arts to take a moral stance when doing their research studies. Another reason as to why artists who are conducting research need to take a moral stand when doing their studies is that research in the arts is usually defined by the need for the artists to participate in the studies. Researchers who conduct research in the arts are usually motivated by the need to be active participants in the process of the research. As a result of directly participating in the research, artists who do research studies are obliged to take a moral stand related to the issues that are addressed in their studies. Therefore, it can be seen that the need for researchers to take a moral stand in the course of doing their studies is one of the most important values of research in the arts.

Another key value of research in the arts relates to authenticity. Authenticity, within the context of research in the arts, refers to the extent to which the work of art and the research that is being undertaken are interconnected (Leavy, 2015). Interconnectedness between these two important aspects of research is regarded as a necessity in Arts-Based Research because of many reasons; however, the main reason is that interconnectedness of the two is similar to the values of plausibility in qualitative research. For the audience to regard a research study in the arts as an important source of information, there is a need for the work to show

elements of the input of the researcher and the value of the knowledge that arises from the work. It is always necessary for the researcher to ensure that there is a relationship between him or her and the work is very clear. Moreover, it is important for researchers in the arts to ensure that there is a clear connection between their work as researchers and the artwork as a way of showing rigor in the research work. Thus, authenticity is a critical value in research in the arts.

Another important value of research in the arts is that it is usually conducted with reference to the most important issues of research such as validity, acceptability, and quality. In general, the concept of quality in research is broad enough to cover all the different forms of research that are in existence. For example, the concept of quality in scientific research is usually addressed by the extent to which the research can be said to have adhered to the issue of validity and reliability. In general, validity, and reliability are important aspects of research because they are usually used to determine the overall quality of studies (McNiff, 2008). A good scientifically study is one in which the results, methods, and even the question that is addressed can be verified independently. If a study is not regarded as having a high level of validity, it is likely that the study will not be taken seriously (Figure 2.3).

Figure 2.3: The research ideas that are used in Arts-Based Research need to be original for the study to meet the basic requirements, just as it is the case for the other forms of research.

(Source: Unsplash)

The concepts of validity are reliability are not confined to scientific research. In social sciences research, it is common for researchers to take the time to address the issues of validity and reliability. However, suffice to mention at this stage that validity and reliability are usually treated differently in the social sciences from the way they are treated in scientific studies (Pruzan, 2016). Regardless of the differences in the approach to validity and reliability that are usually experienced in scientific and other forms of research studies, what is important to note is that reliability and validity are equally treated as important concepts in research in the arts. Researchers in the arts have to be cognizant of the fact that they need to ensure that their work meets the requirements for validity and reliability, albeit in ways that are unique to the arts for them to get the respect of their peers and the audience.

2.4. BENEFITS OF ARTS-BASED RESEARCH

There are many benefits of research in the arts. More importantly, it should be remembered that the benefits of research in the arts arise from both the work of art and the research that is conducted in the process. Normally, the process of arts inquiry usually yields the findings of the study and the work of art that is under consideration. The findings of the study that is usually conducted as part of the research may be a source of benefits for all the stakeholders who are involved in the process (Ford, 2000). Similarly, the work of art that is usually used as the subject of the research may also be considered as a source of benefits to the stakeholders of the process of research in the arts. The various stakeholders to the arts process may benefit from the findings of the study in various ways. For example, organizations that fund research studies may benefit from the findings of the work at a later stage. Also, institutions that usually provide the resources that are needed to complete the studies do so because they expect to benefit from the work. Therefore, it is important to note that the benefits of research in the arts may arise from the work of art that forms the subject of the study or the results of the actual study that is usually conducted in the course of the process (Figure 2.4).

Figure 2.4: One of the major concerns of research in the arts relates to the needs of the community in which the studies are conducted.

(Source: Pexels)

A major benefit of research in the arts is related to social change. In general, social change is defined as a situation in which some negative aspect of the society is replaced by a positive one over the course of time (Leavy, 2015). There are as many examples of social change as there are negative situations that may affect a section of the society. For example, in a small society in which the issue of racial discrimination is so rampant that it normally gives rise to racial hate crimes and other vices, social change may be said to have occurred if the rate at which the negative results of racial prejudice in the area decline. In other words, social change is a process by which some positive values are enhanced in a section of the society.

There is a close relationship between social change and research in the arts. In general, research in the arts can trigger social change. The outcomes of research studies in the arts that are usually conducted may be the reason as to why a section of the society starts to experience change. For example, if a research study in the arts highlights the negative consequences of racial prejudice in a region, as indicated in the example, then it can be said that the findings of the study would have effectively triggered a form of social change in the community. Moreover, it should be noted that the results of a research study in the arts can contribute to a social change process that is already taking place by accelerating the process. Given that artists are usually very active participants in the research process that they undertake

and that they are usually required to take a stand when conducting a study, it follows that the artists can directly stimulate the social change process. Moreover, the knowledge that is usually generated from a research study in the arts can speed up the social change process that is already taking place in the society. Therefore, it can be seen that the impact of the results of research studies in the arts on the social processes that take place in the society is an important way in which research in the arts can be beneficial to the society.

The third way in which research in the arts can be beneficial relates to the impact of the findings of Arts-Based Research on the community. It is generally accepted that research in the arts can have both direct and indirect benefits to the communities in which the studies are conducted (Sullivan, 2010). This observation raises the question of what exactly is meant by the term community. In general, it is observed that the community, within the context of research in the arts, is the entity that is composed of people who live in a given area and share a lot of social and cultural norms. Thus, the community is defined by two factors: geographical proximity and the extent to which the people who live within each other's' distance share important values in their lives. It has already been pointed out in this chapter that research in the arts is usually carried out within the context of a community.

Researchers conducting studies in the field usually collaborate with people or various aspects of the community for the sake of completing their work successfully. In other words, there is a very close relationship between research in the arts and the dynamics of the communities in which the studies are conducted. It then follows that one of the major objectives of research in the arts is to ensure that the findings have a direct impact on the community (McNiff, 2008). The work of the researcher as well as what the researcher produces as a work of art usually have direct impact on the lives of people in the community in which the work is performed. Therefore, it is always important for researchers to show that their work is directly beneficial to the communities in which they live and work.

Another benefit of research in the arts is related to the relationship between Arts-Based Research and the individuals who carry out the studies. One of the hallmarks of research in the arts is that it normally entails the development of an intimate relationship between the researcher and the study (Given, 2008). A person who is conducting research in the arts is usually obliged to develop a very close relationship with the content of the study as well as the work of art that is involved in the process. It is because of the intimate nature of this form of research that individuals who conduct it can

benefit in various ways. Primarily, individuals who conduct research in the arts usually benefit from the study because they get inspired and refreshed at the end of their work. The ability of works of art to inspire and refresh individuals is well documented. For example, it is observed that scholars and practitioners of the arts normally experience a sense of exultation by simply interacting with their work (Sullivan, 2010). Moreover, it is argued that the nature of the arts makes it easy for the practitioners to experience a sense of self-gratification that is rarely experienced by individuals who carry out research studies in other fields (Sullivan, 2010). Individuals who conduct research in the arts benefit from the process because they are able to experience a sense of exultation and self-gratification that is only unique to the arts. In so doing, research in the arts helps to benefit the individuals who conduct it.

2.5. TYPES OF RESEARCH IN THE ARTS

There are many types of approaches to research in the arts that can be used by practitioners. What should be emphasized at this point is that the choice of practitioners is usually informed by the nature of the study that they wish to conduct. Every research study has its unique demands that have to be met for it to be complete. Every researcher, therefore, has to factor in the specific requirements of the study that he or she would wish to conduct when making a choice regarding the most appropriate approach. Moreover, it is only when a researcher uses the most appropriate approach for the study that the researcher can realize all the objectives that are related to the research study. Therefore, the choice of the approach that should be used is one of the most important ones for anyone who is conducting a research in the arts. The following is a brief discussion of some of the most popular types of research in the arts that researcher can choose to complete their studies.

One of the most common types of research in the arts is what is referred to as arts-based inquiry. As the name suggests, the essence of arts-based inquiry type of research in the arts is that the researcher who is conducting a study deliberately uses the artistic process to complete a research process. In theory as well as practice, this type of research may take two forms. The first form of art-based inquiry involves the researcher only using the process of arts to evaluate an issue that may not be entirely artistic in nature (McNiff, 2008). When a researcher embraces this first approach of the process, the main focus of the researcher is to borrow the tools and techniques that are used in the arts to complete the research study (see Chapter 1, Introduction).

Thus, this form of art-based inquiry is commonly used by individuals who may not necessarily artists but are interested in using the arts process to examine an issue that is of interest to them as researchers.

The second form of arts-based inquiry is that in which a researcher uses artistic processes to research on an issue that is related to the arts. In general, this is one of the purest forms of artistic research approaches that is in use. The purity of this approach is that its application takes the form of a professional artist using the specific tools of art to examine an issue that is related to the arts. For example, a scholar in painting may utilize the specific methods that are used to critique visual arts to examine the significance of a specific piece of art to the community. In such a case, the professional researcher, who happens to be an artist, uses special tools of artistic examination to research on an issue of art.

Another common type of research in the arts that is in use is that which is referred to as arts-informed inquiry. The main purpose of this form of research in the arts is that it is used to improve the extent to which individuals understand artistic phenomena (Given, 2008). Artistic phenomena may be defined as some of the issues that are specific to the arts, but which may be relevant to the entire community (Sullivan, 2010). Thus, the main purpose of this form of research in the arts is to help the researchers communicate with their audiences more effectively than it is usually the case when the researchers use other common forms of research in the arts. Researcher who use this form of research in the arts are able to communicate with their audiences effectively because this type of research enables them to use the most appropriate tools for communicating with people who may not necessarily be well-educated in the arts.

There are two types of arts-informed inquiry: the one in which the researcher only uses art as a way of communicating the findings of a phenomenon that has been investigated and the other type in which the artists uses art to interpret the findings of a study that is artistic in nature. In the first place, the main interest of the researcher is to use aspects of the arts that he or she believes can be helpful in communicating the findings of a study to the audience. This approach is normally useful when a researcher has to communicate the findings of a study to an audience who do not accurately understand the nature of the study. In the second case, the main motivation of the researcher is to stick to using arts-based methods to communicate findings about a research which is arts-based. Therefore, there is a clear difference between these two approaches.

The third type of research in the arts is what is referred to as art-engaging inquiry. The essence of this form of research in the arts is that it is used to enhance the work that is done under the auspices of research for social change. In some instances, research in the arts is conducted purely for the purpose of stimulating social change. In such instances, the process and finding of the research are meant to encourage community members to change their attitudes towards an issue or take specific steps to address an issue that is of concern to them (Leavy, 2015). What is important to note is that there is a direct relationship between the need to spur social change and the type of research in the arts that is referred to as arts-engaging inquiry. The main objective of conducting research studies that fall in this category is to engage the members of any given community as a process of triggering the change process (McNiff, 2008).

This chapter has presented details about the basics of research in the arts. It has been argued that research studies in the arts are defined by the specific methods that are used to conduct the studies. Researchers in the arts usually borrow various methods, tools, and techniques from other forms of research for use in their studies. It has been pointed out that as it is the case with the other forms of research such as scientific and social sciences research, research in the arts is usually reliant on certain measures of quality such as validity, authenticity, and others. The next chapter of the book will present specific information about content analysis as one of the most effective methodologies that are used in research in the arts.

3
CHAPTER

CONTENT ANALYSIS IN RESEARCH IN THE ARTS

'*An overemphasis on the researcher's interpretations at the cost of participant quotes will leave the reader in doubt as to just where the interpretations came from [however] an excess of quotes will cause the reader to become lost in the morass of stories.'*

—Morrow

CONTENTS

This chapter contains details of content analysis as one of the primary methodologies that are used to research the arts. The chapter first explains the basics of content analysis before proceeding to outline the complex issues that are related to the methodology. The chapter then explains the specific steps that researchers take when conducting research using this methodology. Also, details about the real-life applications of this form of research methodology for the arts are presented in this chapter of the book. The chapter then concludes with a brief review of some of the most common advantages and disadvantages of using this methodology to complete research in the arts.

3.1. THE DEFINITION OF CONTENT ANALYSIS

Content analysis is one of the oldest methods that are used to conduct research (Krippendorff, 2013). It is noted that the origin of content analysis was in the kind of studies that were done to analyze texts during the First World War and Second World War. During the time, there was a need for researchers to analyze the propaganda materials that were in constant use and distribution at the time (Leavy, 2014). Give the complex and then novel nature of the propaganda materials that were used at the time and the nature of the demands of the war, researchers who were involved in the war were forced to develop a new method to carefully analyze the content of the communication materials that were used at the time.

The essence of this method is that researchers focus on the way some specific words in the text that is to be analyzed are used. The researcher normally takes the time to identify specific words in the text that carry related meanings. The work of the researcher, then, is to carefully determine the frequency and distribution of the keywords that are used to trace specific ideas and opinions in the text. If the words are spread in a specific way, then the researcher may conclude that specific issues that are indicated by the words are emphasized in the work. Similarly, the extent to which some of the words occur in the work is usually used as an indicator of the thematic concerns of the authors. Therefore, it can be seen that content analysis is an effective method of analyzing the meanings that are contained in any form of work.

It is important to point out at this stage that currently, content analysis is used to analyze generally all forms of content. For example, it is common to get researchers using the method to analyze textual materials. Researchers who are working on large textual documents may resort on this method as

a way of identifying specific thematic concerns of the text and determining the implications of the approach that the writer uses (West, 2010). However, apart from textual documents, this approach can also be used to analyze pictures. Researchers working on the implications of specific photos and other visual forms of art may resort to using content analysis as the most reliable method of analyzing the works that they have. The use of content analysis to examine images has been well-documented. For example, it is pointed out that there is evidence to suggest that after the Second World War, researchers in the non-scientific fields of study deliberately started relying on this approach to analyze the implications of various forms of visual arts work (Leavy, 2014). Thus, it can be seen that the use of content analysis as the preferred method for analyzing different forms of content has a long history (Figure 3.1).

Figure 3.1: The essence of content analysis is that a researcher refers to the text as the primary subject of the research.

(Source: Unsplash)

In essence, content analysis, within the context of research in the arts, entails using specific approaches to analyze the stylistic and thematic concerns of a work of art. A researcher who chooses to use this method may be confronted by a complex work of art on which the research is based. The researcher may then have to use this method to carefully analyze the meaning of the work and determine the kinds of themes, ideologies, and styles that have been used to develop the work. To achieve this objective, the researcher may have to analyze the occurrence and distribution of specific words and phrases in the text. It is only when the researcher can comfortably analyze such aspects of the work that the researcher can complete the study.

3.2. THE PROCESS OF CONTENT ANALYSIS

There are specific procedures that researchers usually follow when conducting the content analysis. Although specific research studies may require the researchers to use similar steps, it should be noted that basically, the entire process of content analysis as a methodology of research in the arts is based on the inclusion of all the steps that are described in this section. The first step of the process is usually based on determining the theoretical aspects of the research that is to be conducted. At this stage, the researcher is usually concerned with determining the theoretical rationale of conducting the research study. It is usually at this stage that the researcher usually develops the specific questions and hypothesis that are to be used for the study (Berger, 2011). The essence of this stage is that the researcher is supposed to develop the theoretical foundation for the research study that he or she intends to conduct. Therefore, the importance of the first step of the process of conducting a research study in the arts, which is formulating the hypothesis and questions that are to be used in the study, cannot be overemphasized (Figure 3.2).

Figure 3.2: Developing the questions that are to be used in the research is one of the most important steps in the process of completing research in the arts.

(Source: Unsplash.)

The next step of the process of using content analysis to conduct a study in the arts usually entails identifying and developing specific variables, categories, and units that are to be used to measure the various aspects of the research study. In theory, the variables that are used in any gives research

study are usually important indicators of the overall quality of the research (Kripperndorff, 2013). If a researcher identifies different variables that may not be accurately relevant to the specific needs of the research, then it is likely that the value of the research that is to be undertaken will be undermined. In the same vein, if a researcher clearly and accurately identifies the variables that are to be used in a study, the researcher would have made important steps towards making the entire study a success. Therefore, in the case of researching the arts, the researcher is supposed to accurately identify some of the most important variables and categories that are to be used to analyze the content of the text of photograph that forms the subject of the research.

Before the sampling is done, it is always important for the researchers to develop a comprehensive coding scheme that is to be used to carry out the actual analysis. It has already been mentioned in this section that the primary activity that is usually undertaken as part of the process of conducting content analysis as a form of research in the arts is to code the words and phrases that are found in the research work and to use the coding system to analyze the implication of the words. It follows that the researchers who are involved in the process should carefully determine the specific coding scheme that is to be used to complete the work. Therefore, the step in which the researchers develop a comprehensive coding scheme that is usually used in the subsequent steps of the research is an important step that determines the overall level of success of the entire research study.

The coding scheme that is eventually used in the research studies in the arts is usually contained in a document that is referred to as the codebook. The codebook is usually developed before the piloting phase of the research study is conducted. Thus, the coding activity is one of the most important steps that is usually undertaken by individuals who research the arts. Moreover, the importance of the coding process on the entire research is evidenced in the way researchers usually take the time to train the individuals who are supposed to use the codebook in the course of analyzing the data. It needs to be mentioned here that the process of analyzing the content that forms the subject of the research is, by far, the most important activity of the entire process of conducting research studies in the arts. It then follows that for researchers to ensure that the process is successful, they are usually supposed to take the time and train the individuals who are supposed to do the analysis (Leavy, 2014). The essence of the training is to ensure that the individuals who analyze the content understand the codes and categories that are supposed to be used in the process. Thus, the training is usually regarded as a precautionary measure to ensure that the entire process of researching

the arts is completed. Before the compilation of the final report that relates to the research process, individuals who use this method to research the arts usually take the time to test the extent to which every code or variable that is used in the research meets the test for validity. As it has already been stated, validity is an important aspect of research in the arts as it is in research in other disciplines. For example, in research in the humanities, researchers are always interested in ensuring that their studies meet the universal criteria for validity that are used (West, 2010). Similarly, researchers in the fields of the sciences are motivated by the desire to ensure that their work meets all the set measures for validity. It is within this context that individuals who conduct research studies in the arts are also interested in ensuring that their work meets the set criteria for validity and reliability.

3.3. CONTENT ANALYSIS IN THE ARTS: ADVANTAGES AND DISADVANTAGES

Many advantages and disadvantages are associated with using content analysis as a research methodology in the arts. The following are some of the main advantages and disadvantages of using content analysis to research the arts. In the first place, it has been argued that using content analysis to research the arts is beneficial to the researcher because the method is inherently unstructured (Berger, 2011). The informal nature of the content analysis methodology is associated with the fact that the method does not contain many rules, which are supposed to be binding to all the individuals who use the method to conduct research.

For many other methodologies that are used to carry out research studies, there are specific rules and regulations that the researchers are supposed to adhere to when conducting their studies. For example, in many methodologies that are used to research in the sciences, the individuals who do the research are supposed to follow specific rules and procedures. The rules and procedures are supposed to determine the approach that the researchers take when conducting their studies. Similarly, in the case of research in the humanities, the researchers are supposed to research within the framework of specific rules and procedures. However, it has been noted that for the case of research in the arts, the researcher who chooses to use content analysis method is not bound by strict rules about procedures. Thus, using content analysis to conduct research in the arts helps the researcher to embrace the iterative nature of the approach and focus on specific aspects of the study. In the end, the researcher who uses this approach has more room

to be creative than the one who uses any other method to carry out a research study.

Another important advantage of using content analysis to conduct research studies in the arts is that the method is effective in helping researchers examine the content that they are investigating. It is argued that compared to the other methods of conducting research, content analysis helps researchers dig deep into the content that they examine and understand the implications of the various aspects of the content than it is the case with the other methods (Leavy, 2014). There are several reasons as to why content analysis helps researchers to effectively analyze content better than what they can do when they rely on other methods; however, suffice to say that when researchers use this method, they can exhaustively analyze text and other forms of content. Thus, the nature of content analysis makes it necessary for researchers to take the time and examine the content that is the subject of the study.

Another important reason as to why content analysis helps researchers evaluate content exhaustively is related to the extent to which the method helps researchers to focus on the various implications of the content that they examine. When researchers use content analysis, they can deliberately focus on analyzing the various aspects of the work such as its thematic concerns, ideological leanings, and aesthetic aspects to determine the value of the work about the objectives of the research. Moreover, the use of this method of research is important in helping researchers focus exhaustively on the various aspects of the work because the method helps researchers analyze the in-depth and underlying relationships among the various aspects of the work that they analyze.

The third advantage of using content analysis as a method of researching the arts is related to the concept of bias. In research, bias is defined as the tendency of researchers to draw conclusions which are based on inadequate and inaccurate information (West, 2010). If a researcher relies on false information to make conclusions in a study, the chances are that the conclusion will be wrong because of the fault that is included in the process. For example, a researcher who concludes a research question based on false information would have committed bias in the process of collecting and analyzing the information that is used to conclude. In practice, there are many forms of bias that can be committed by researchers in the course of collecting and processing the information that they use to conclude their research studies. For example, it is possible for some researchers to use very small samples when conducting their studies. When researchers use very

small samples, the run the risk of drawing unreliable conclusions. If another researcher strictly follows all the other aspects of the research methodology but only alters the size of the sample, the researcher may end up getting results that differ significantly from those of the previous research. In such a case, it is usually evident that the previous researcher who used a small sample made wrong conclusions because he or she used an inappropriate sample size. In other words, the size of the sample that a researcher uses to conduct research can be the subject of a form of bias in a research study.

Another form of bias in research may occur if the researcher fails to follow the specific aspects of the methodology that is being used to conduct the research. For every methodology that is used to conduct research, there are specific methods that are supposed to be used to help the researcher to address the questions that are used in the study. If the researcher fails to follow the methods appropriately, the chances are that the researcher may fail to conduct high-quality research (Berger, 2011). If this is the case, then the researcher would have committed a form of bias in the study.

It needs to be pointed out that some of these common forms of bias can be committed in all forms of research. For example, a researcher who is conducting a study in the arts may fail to get accurate results because the researcher fails to use the specific methods that he or she is supposed to use to conduct the research. Similarly, if a researcher uses a wrong sample, the researcher may likely get inaccurate results in the process. Therefore, regardless of the type of research that is conducted, it is possible for the researchers who are doing it to commit any of the various forms of bias that have been documented.

However, it should be noted that within the context of research in the arts, researchers can minimize the impact of committing some of the most common forms of bias by using the content analysis method. Primarily, content analysis is one of the most effective methods of researching because it allows the researcher to be fully in charge of the entire process. Moreover, the argument that using content analysis method to conduct research studies in the arts minimizes the chances of committing bias that researchers usually experience when they use any of the many other methods that are available to them is apparent when one considers the specific features of the other methods. For example, when a researcher chooses to use the methodology that is associated with narrative work in the arts, the researcher may easily commit a bias in the course of interpreting the narrative. Unlike the narrative-based methodology, the content analysis-based methodology is

more effective because it helps the researcher to be more accurate in the process of analyzing information and drawing conclusions (West, 2010).

There is also overwhelming evidence that using content analysis to research the arts is an effective method that helps researchers to avoid some of the most common forms of bias that are witnessed in research in the arts. For example, it has been pointed out that when the method is compared with many other similar ones, it emerges to be better than them because it is associated with little instances of bias in research processes (Leavy, 2004). In other words, a researcher who is researching the arts is likely to avoid bias if the researcher uses this method as opposed to the many others that are in use.

Apart from the many advantages that are associated with the content analysis methodology of researching the arts, many other disadvantages are associated with the approach. The basis of the disadvantages of using this approach to research the arts is that in some instances, the approach may not be the suitable one for helping researchers to make the most accurate conclusions in their studies. Therefore, the beneficial nature of any methodology that is used to conduct research is based on how the method helps the researcher to get valid and verifiable results.

One of the major disadvantages of using content analysis as a method of researching the arts is that the method has a limited level of applicability. The concept of applicability within the context of research in the arts is used to imply the extent to which a specific methodology can be used n a broad range of situations to produce the desired results (Leavy, 2014). It has been argued that using content analysis method is only limited to some kinds of research and that it cannot be used in all forms of research in the arts (Berger, 2011). On the one hand, the method is only suitable for research studies that are based on the need to carefully analyze the contents of a work of art. The essence of the method is that a researcher may use it to effectively determine the complex interrelationships among the various themes and other aspects of the text that he or she is investigating. However, the limited nature of the method means that researchers cannot comfortably use it to address a broad range of other issues which are usually apparent in the research studies that they conduct. Therefore, the method is limited in the scope of its applicability as an important research methodology in the arts.

Another important reason as to why the content analysis method is not the most suitable one for researchers to use to research the arts is that the

method cannot be used to provide all the answers in research. It is common for researchers in the arts to use another method to support content analysis. The reason why researchers use content analysis with other methods often is that content analysis is not an excellent stand-alone research method. Thus, researchers who use it are often required to combine it with another method that can be used to complete the study. It should also be pointed out that content analysis as a method of researching the arts has been shown to be inappropriate for analyzing other forms of content such as web content. There has been a spirited debate regarding the suitability of the method for conducting research that is based on web content (Krippendorff, 2013). On the one hand, it is argued that web content has its peculiar features and that the peculiarity of its features undermine the applicability of content analysis is the method of choice for researching the content (Leavy, 2014).

On the other hand, it is argued that as much as web content differs from other conventional forms such as narratives and photographs, the content can still be fully analyzed in a research study using content analysis method (West, 2010). Therefore, the suitability of using content analysis to research any form of content depends on the extent to which the individual researcher believes that he or she can effectively use the method to achieve the desired results (Figure 3.3).

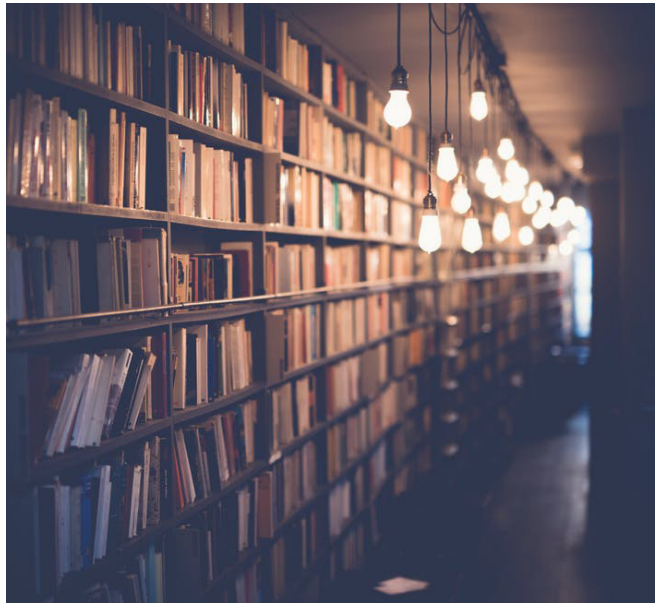

Figure 3.3: One of the main disadvantages of content analysis is that the meth-

od is not strongly anchored in theory as it is the case with other methods of researching the arts.

(Source: Pexels)

Another important disadvantage of using content analysis to research the arts is that the method is not anchored in sound theoretical knowledge. It is indicated that for a methodology of researching to be regarded as one of the most effective ones, the method is supposed to be strongly anchored on specific theoretical developments (West, 2010). For example, many methodologies that may not apply to research in the arts are usually founded on sound theoretical knowledge. For such methods, it is easy for many researchers to rely on them as the most suitable methods that can be sued to conduct their studies because the methods have already achieved a sense of acceptability. However, in the case of content analysis, there is little theoretical knowledge that can be used to support the suitability of the method as the most suitable one that researchers can rely on to conduct their studies. In other words, the absence of theoretical knowledge related to content analysis, which usually forms the basis for the selection of the method as the most suitable one to be used to carry out studies, is regarded as a shortcoming.

3.4. ANALYZING DATA USING CONTENT ANALYSIS METHODOLOGY

Data analysis is one of the most important steps that are usually completed by researchers as part of the research process. In general, data analysis refers to the complex processes that researchers usually use to carefully process the data that has been collected in the course of the research (Berger, 2011). Data analysis is usually conducted on raw data as a way of processing the data so that the researcher can get information that can be used to address the questions that are used in the research. In other words, data analysis as a step in the entire research process is usually carried out after all the data that is to be used in a research study has been collected. Researchers normally rely on the process of analyzing data to convert the raw data into useful information.

Data analysis within the context of content analysis is usually conducted in special ways. In general, the essence of data analysis, when it is used within the context of content analysis research, is that the process strongly relies on counting the number of words. When a researcher finally has the

document that he or she needs to analyze as part of the research process, the researcher focuses on establishing the extent to which specific words are used in the content as the primary method of establishing the thematic concerns of the work. It is normal practice for the researcher to first identify the kind of words that he or she is interested in before the entire process of establishing the number of words in any work of art is commenced. The process of establishing the kind of words that will be of interest to the researcher is usually complicated because of several reasons. In the first place, the researcher has to make an accurate description of the kind of words that he or she believes reveal important information about the work upon which the entire research is based.

Second, it is important for the researcher to determine the importance of the words that he or she is interested in as part of the process of establishing the thematic concerns of the work that the researcher is interested in (Figure 3.4).

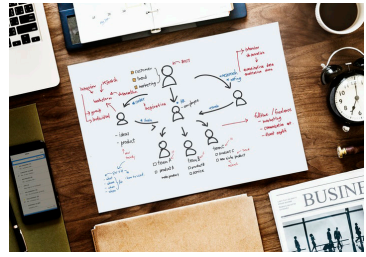

Figure 3.4: Content analysis provides a more accurate method of analyzing data than the other methods which are used in arts-based research.

(Source: Unsplash)

Once the researcher has established the kind of words that are of interest in light of the demands of the research under consideration, the researcher will then determine the specific aspects of the work by counting the words and establishing the extent to which the words are used in work. It is usually based on this procedure that the researcher makes the conclusions of the research study. As much as this process may sound a credible solution to the problem that individuals who research the arts face, it is worthwhile to note that the process is associated with some disadvantages.

The disadvantages of relying on word count as the primary method of analyzing data when carrying out research using content analysis method usually limit the extent to which the researchers can achieve their intended

objectives. One of how the nee of counting words usually undermines the ability of a researcher to achieve their research objectives is that the method is limited in scope. Researchers cannot entirely depend on the method to exhaustively examine the deeper meanings that are contained in texts.

This chapter has presented details on the use of content analysis as a distinctive methodology of researching the arts. This chapter presents details about the suitability of the methodology in completing specific forms of art-based research, the process used by researchers, and other important information. Also, information on the current and future trends of the content analysis method of researching the arts have been presented. And also, the methods that are used to collect and analyze data during the content analysis method have been presented in this chapter. The next chapter of the book contains introductory information about research methodologies that are used in the sciences.

PART II
RESEARCH METHODOLOGY IN THE SCIENCES

4
CHAPTER

INTRODUCTION TO RESEARCH METHODOLOGY IN SCIENCE

'I believe in intuition and inspiration. Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution. It is, strictly speaking, a real factor in scientific research.'

—Albert Einstein

CONTENTS

This chapter presents introductory material on the issue of research methodology in science (Gauch, 2003). The essence of the chapter is to provide a detailed examination of the basics of research methods that are used in scientific research. The chapter contains comprehensive material on the definition of scientific research to achieve its core aim. The definition is based on some of the most important features that are used to define scientific research in practice. Also, information about the aims of scientific research is presented in this chapter. Details about the aims of scientific research that are given in this chapter of the book are followed by those about the most important values of research in sciences. Therefore, the information about the definition of scientific research, the most important features of scientific research and the aims of research in science are supposed to provide a detailed introduction to the broad subject of research methods in science.

4.1. DEFINITION OF THE SCIENTIFIC METHOD

In general, the scientific method of doing research refers to the specific approaches, methodologies, and practices that are used to conduct research studies in the sciences (Betz, 2010). The essences of the scientific method are that the science disciplines are defined by specific attributes. Some of the attributes that define science include the need for logical examination of issues, the use of clearly-defined procedures and an emphasis on the use of specific practices as part of the examination process. These attributes are important because they define the manner in which research is conducted in natural and other forms of scientific disciplines. Therefore, the scientific method can be described as a form of philosophy that is used to define the specific approaches, methods, and techniques that researchers in any of the science disciplines are supposed to follow when conducting studies.

The essence of the scientific method of research is that the entire research process is conducted in a particular way. In general, the researcher takes examines broad issues that are related to the main focus of the research. The researcher than slowly narrows down the scope of the entire research process to the specific issue that requires being examined. In other words, the entire research process is conducted in a way that is said to be similar to the hourglass (Ford, 2000). What this means is that the researcher starts from a position in which they look at broad issues and then narrow down to the main focus of the research. Therefore, as part of the scientific research method, the researcher deliberately focuses on the main issue and analyzes it to conclude it. The conclusions are then used to describe the general

population. The scientific method is applied to all the steps that are usually conducted in the course of research in the sciences. For example, the process of defining the research questions in scientific studies is unique because of the way researchers in scientific studies are supposed to approach it. It is common for researchers in the sciences to focus on clearly identifying the main research question for their studies. The research questions are usually based on the hypothesis that is used. In practice, scientific research studies are defined by the use of the positive and negative hypotheses. The hypotheses that are used in scientific research methods are usually plausible explanations of the issues that the researcher is examining (Gauch, 2003). The researcher usually seeks to prove the validity of one of the hypotheses. If the hypothesis is found to be false, then the alternative one is regarded to be true. Similarly, if the hypothesis that the researcher is testing is found to be true, then the alternative hypothesis is regarded as true.

The scientific method is applied to all the other aspects of the research process in the sciences. For example, the data that is usually collected as part of the process is normally subjected to specific tests and treatments. One of the most common tests that are used in scientific research studies is the significance test or the t-test. The essence of the t-test is to determine the level of confidence that the researcher should have regarding the data and the findings of the study (Pruzan, 2016). The results of significance are usually expressed in the form of percentages. By using the t-test a researcher can confidently claim whether two separate sets of data are similar and the extent to which they can be said to support the hypothesis of the research. Thus, the t-test is an example of an important statistical test that is used in scientific research.

There are two main branches of scientific research: basic and applied. On the one hand, basic scientific research is defined by the need for the researcher to describe, predict or explain a phenomenon. Basic scientific research is concerned with the theoretical aspects of the various scientific disciplines that exist. For example, a researcher may be concerned with describing a general phenomenon as part of the research study. Also, a researcher may conduct a research study with the aim of accurately and adequately explaining why species occur in the universe. Given that the essence of such a study is to examine a theoretical aspect of the universe, it falls within the bracket of basic scientific research. On the other hand, applied scientific research is usually concerned with concrete problems in the universe. Applied research, in general, is conducted with the sole aim of solving specific problems in the universe. A researcher may conduct

an applied study to examine various attributes of a phenomenon and offer practical solutions to the problem that would have been identified.

From the preceding, it can be seen that a scientific method is a form of research methodology that is employed for all research studies that are conducted in any of the scientific disciplines. The essence of the scientific method of research is that the researcher uses specific tools and techniques to examine a clearly-defined issue. The researcher relies on the specific methodologies to develop and test a hypothesis using data that has been collected using special methods. Moreover, it can be seen that there are two forms of scientific research: basic and applied. Whereas basic scientific research is concerned with the theoretical aspects of the disciplines of science, applied scientific research is usually conducted with the aim of addressing a specific problem (Figure 4.1).

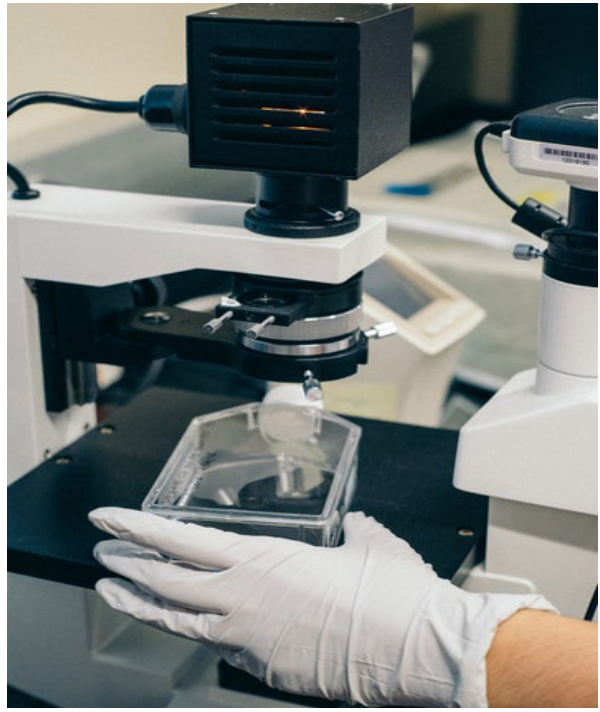

Figure 4.1: The laboratory provides a perfect setting for basic research studies in the sciences.

(Source: Unsplash)

4.2. AIMS OF SCIENTIFIC RESEARCH

There are many aims of conducting research. The importance of the aims of scientific research is that they determine the main reasons why scientists carry out studies in their fields. Moreover, these aims of the scientific research are important because they are commonly applied to all fields of research in the sciences. It should be remembered that there are two classes of research in the sciences: basic and applied research. Whereas basic research is concerned with the theoretical aspects of the various disciplines that researchers undertake, applied research is concerned with addressing specific real-life problems that researchers experience as part of their professions (Ford, 2000). Interestingly, these aims apply to both basic and applied forms of research in the sciences.

One of the main objectives of research in the sciences is related to the description. It is common for researchers to focus their resources on providing an adequate description of specific phenomena. Also, research in the sciences may be conducted with the aim of providing a detailed and accurate description of specific issues that are under investigation. When a researcher takes into consideration the need to describe a phenomenon that is under investigation, the researcher is simply fulfilling the basic objective of defining features of issues that are commonly observed in scientific research practices.

The essence of this objective of scientific research is that scientists are usually supposed to offer a systematic classification or basic description of the phenomena that they investigate. The reason for providing the necessary information about the issues is to facilitate the audience of the research studies to understand the issues that are contained in the publications easily. Therefore, the need for researchers in the sciences to start off the research process by first offering detailed descriptions of the issues that they investigate is paramount for the success of the entire process of research in the sciences.

The second important objective of research in the sciences is to control some aspects of the issues that they investigate. For both basic and applied research in the sciences, the need to carefully control the issues that the scientists investigate is evident (Gimbel, 2011). When scientists investigate any issue within their professional specialty, they seek to provide solutions to given problems or recommendations on how to address some issues. For example, if researchers investigate the nature of the spread of a certain illness, they may be required to offer solutions on how well the disease can

be tackled. In such a case, it can be seen that the research study on how a particular illness spreads addresses the key objectives of describing and controlling the phenomenon that is under investigation. On the one hand, the researchers rely on the scientific method to accurately describe the methods and extent of spread of the disease. Thus, the researchers successfully provide a comprehensive description of the issue that is under investigation. On the other hand, the researchers may have to propose different ways that can be used to arrest the spread of the disease. When researchers provide information on how the spread of the disease can be addressed, they would have used the scientific method of research to control the issue which is under investigation.

The third objective of using the scientific method to conduct research is related to prediction. More often than not, scientists are supposed to predict how specific issues that they are examining will behave in the future. The need for scientists to predict the future behavior is borne from the realization that humanity may need to understand how some phenomena will behave at a later date. A good example of how the scientific method is usually used to predict the future relates to a study about the growth of a colony of a type of microorganism. In such a case, the scientists may be concerned with understanding how the microorganisms behave when they are subjected to different environmental conditions (Pruzan, 2016). Thus, the researchers may subject the specimen of the species to conditions that simulate various environmental situations. The scientists then may use their findings to not only understand the behavior the microorganisms under the given conditions but also to predict how they microorganisms may behave when they are subjected to other environmental conditions.

Therefore, it can be seen that the need to predict future events is an important attribute of scientific research. It can also be seen that for scientists to predict the future confidently, they need to simulate those conditions and subject their specimen to them. They then use the findings to predict how real-life populations will likely react to the scenarios that are simulated in the laboratory if the scenarios occur in real life (Figure 4.2).

Figure 4.2: Measurement and prediction are some of the most important attributes of scientific research.

(Source: Unsplash)

Prediction, under scientific research methodology, is usually based on inference. The inference is a technique that is used to conclude unknown situations by relying on the known information. In practice, researchers may use the technique in the form of doing interpolations and extrapolations (Pruzan, 2016). These techniques are usually heavily dependent on quantitative techniques. For researchers to make predictions, they need to use numbers as the basis of their predictions. For example, in the case of the growth and behavior of the colony of microorganisms, the researchers may use mathematical techniques to estimate the rate of growth of the species under different environmental conditions. They may then use their findings as the basis for predicting how the species will behave when subjected to different environmental conditions.

Another essential objective of the scientific research method is measuring various aspects of the phenomena that are usually investigated during the process. Measurement is an important aspect of the scientific process. For example, when a researcher wants to determine the right dose of a newly developed drug that may be used effectively to achieve the desired results, the researcher will have to measure the effects of the various doses of the drug on the lives of the specimen.

At the end of the process, the researcher would have successfully established the right amounts of the active ingredient in the drug that is required to treat the corresponding health condition efficiently. Moreover, the researcher may have to explain the results that are published in their studies. It is the norm for researchers to offer detailed explanations on the nature of the results of their studies. The reason as to why researchers offer comments is to help their audiences comprehend the quality of their findings. Also, researchers offer explanations for their results as a way of laying the ground for further studies to be conducted on the issue.

4.3. NATURE OF THE SCIENTIFIC METHOD

It has been indicated in this chapter of the book that the scientific method refers to the method, techniques, and approaches that are used by researchers to generate new knowledge. The various methods and procedures that are usually used are accepted by all the stakeholders in the scientific community. The stakeholders in the scientific community usually include the researchers who carry out the actual studies, the organizations that provide funds for the research studies to be conducted as well as other individuals who usually have an interest in scientific research. Therefore, the features of the scientific method are usually universally accepted and used by researchers.

One of the main characteristics of the scientific method is that it heavily relies on criticism. Within the context of scientific research, criticism may be defined as an attribute of the research process which is exemplified by the way researchers regularly and actively question every aspect of their studies (Gauch, 2003). Research scientists are supposed to actively and critically question all the presuppositions, assumptions, and claims that are made in the studies that they interact with. Every professional scientist has to critically examine every statement that they come across in the course of their studies. In practice, this feature is exemplified in the way researchers actively test every aspect of the knowledge, which they handle as part of their studies.

There are many examples of how researchers who are using the scientific research method to conduct their studies exemplify this attribute of testing issues. For example, it is common for researchers first to take the time and review published literature related to the issue that they would like to examine. The importance of this practice is twofold: in the first place, it helps the researchers to formulate a valid and important research problem clearly, and second, it helps the researcher to get important information from other

related studies (Pruzan, 2016). Moreover, researchers often test the findings that are contained in other published studies as a way of ensuring that they are working with known facts as opposed to working with information that has not been verified. Therefore, it is clear that the issue of criticism is critical to the success of the entire research process in science.

The second important feature of the scientific method is what is referred to as self-correctiveness. In general, self-correctiveness refers to the way the scientific method can actively examine itself, identify some mistakes, and offer corrections. It is easy to understand the self-correctiveness of the scientific method by considering a typical example of how a researcher may handle a simple research study. Once a researcher who is conducting a research study has completed the process of collecting and organizing the data, the researcher is supposed to test the data to determine the truthfulness of the hypothesis of the study.

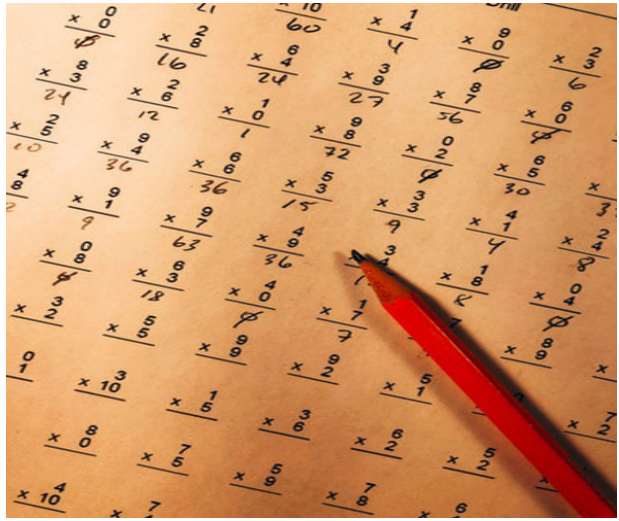

Figure 4.3: One of the main characteristics of scientific research is that it provides a framework for scientists to identify and correct errors in their work.

(Source: Unsplash)

Once the researcher has tested the hypothesis, they may easily reexamine all the aspects of the research process to determine how accurate or valid they are. For example, the researcher may subject the data of the research to various tests to determine whether the data truly represents the population. Also, the researcher may test the data that is used in a research process to

determine the extent to which the data can be relied upon for the issue that is under investigation. In practice, the scientific method provides frameworks for researchers to identify and correct errors. The scientific method helps researchers to clearly identify the errors that they may have committed in the course of collecting or even preparing the data. If a researcher commits errors while collecting or preparing data, the findings and overall quality of the entire study may easily be undermined (Figure 4.3).

If a researcher fails to collect representative data, then the conclusion that is made from the study may not apply to the entire population. Similarly, the scientific method provides frameworks for the researchers to test the suitability of the theories that they use to conduct their studies. When researchers test their theories, they can easily identify faults in the theories and adopt others which may be regarded as more suitable than the defective ones. Therefore, it can be seen that self-correctiveness is an important characteristic of the scientific method of research. Hence, it can be argued that scientific research, unlike many other types of research, has inbuilt mechanisms that allow researchers to identify possible errors in their work and correct the errors. Also, scientific research allows researchers to examine the works of their peers and to identify possible errors in the work. This feature is important because of it minuses the chances of scientific researchers publishing works that have inherent weaknesses.

Another important characteristic of the scientific method is that it is progressive. The progressivity of the scientific method is seen in various ways (Betz, 2010). Primarily, scientific experiments are conducted with the overriding aim of generating new information to enhance the human understanding of issues. What this observation means is that the method is effectively concerned with developing the knowledge that humans have regarding certain complex issues. In other words, the scientific method is charged with the responsibility of helping to advance the extent to which people in the world understand various scientific phenomena that are of interest to them. Another way in which the progressive nature of the scientific method is seen relates to the way the method can be used to correct theories. Researchers usually rely on the findings of their studies to identify faults or shortcomings in the existing literature and propose new ways of addressing the shortcomings. For example, if the method is used to test a theory, the same method can be used to develop a better theory which can be used to explain various phenomena. In conclusion, it can be seen that some important features define the scientific method. On the one hand, the scientific method offers various ways and methods that can be used to correct the work that

researchers produce. If the scientific method lacked the approaches that are used to correct its findings, then it is likely that the method would fail to help researchers to achieve all the objectives of conducting research effectively. On the other hand, the scientific method is focused on helping to improve the level of human understanding of issues of interest. The scientific method provides the basis for researchers to not only generate new knowledge but also to carefully improve on the theories and findings that exist.

4.4. OVERVIEW OF SCIENTIFIC RESEARCH PROCESS

The scientific research process is a series of activities that are conducted by researchers who are doing scientific research studies. The importance of the scientific process lies in the nature and sequence of the activities that are supposed to be conducted by the researchers, regardless of the nature of the studies that they undertake. In other words, the process provides a template that all researchers are supposed to stick to when carrying out scientific research (Ford, 2000). The following is a brief outline of all the activities that are normally carried out as part of the research process in the sciences.

First, the researcher has to clearly define the problem that the research study intends to address. Problem identification is the first step in the research process because it is used to assess the viability of any planned research endeavor (Gauch, 2003). If a researcher cannot identify a real problem that they intend to solve by conducting the planned study, then it may not be necessary for them to try to conduct the study. On the other hand, if a researcher accurately identifies a problem that is of real significance to the society, then the researcher would have done the first part of ensuring that the research is relevant to the needs of the society.

After the researcher has successfully and clearly defined a problem that the research study is supposed to address, the researcher then has to review literature that is related to the research problem. A literature review is an important step in the scientific research process because it allows the researcher a lot of information about the research problem. Researchers are supposed to carefully select published studies which are relevant to their studies and then carefully analyze the findings in light of the research problem that the researchers intend to explore in their planned studies. Moreover, the review of literature is supposed to be done in a way that helps the researcher to perfect the research problem. Based on the findings of the literature review, a researcher is supposed to make up their minds on

the best approach that they have to take while addressing the problem. In other words, the literature review aspect of the scientific research process provides accurate information to the researcher about the possible relevance of the findings of the study and how the findings will be related to those which are found in studies that have already been published (Figure 4.4).

Figure 4.4: As it is the case with all the other forms of research, scientific research is based on a comprehensive review of literature that is related to the subject of the research.

(Source: Pexels)

After a researcher has adequately reviewed existing literature that is related to the research problem, the researcher is then ready to move to the next step of the scientific research process. At the next stage, the researcher is supposed to formulate the hypothesis for the study. A research hypothesis is a statement that is normally tested in the course of scientific research (Ford, 2000). In simple terms, a research hypothesis can be regarded as a fulcrum around which the entire research process turns. The findings of the research can go, either way, depending on whether the researcher finds the hypothesis to be true or false. The data analysis and interpretation stages of the research process are carried out within the context of the hypothesis. Thus, a researcher must devote a considerable amount of time to the activity of developing a sound research hypothesis.

The next step in the process is to design the experiment that is to be carried out. One of the most important hallmarks of scientific studies is that the researchers who use the method always use the experimental form of research design. The experimental form so research design is complex because the researcher has to establish specific protocol and stick to it to

ensure that the objectives of the study are achieved at the end of the research process (Betz, 2010). Also, the research design is a complex aspect of the research process because it is supposed to be anchored on the hypothesis. If the two aspects of a scientific research study are not in harmony, the findings of the research are likely to lack validity and credibility. Therefore, the researchers always must ensure that they develop the right design for their experimental studies.

The next stage of the scientific research process is related to the data that is to be used in the research. The essence of the scientific research method is to develop a hypothesis and then collect data which is analyzed and used to test the truthfulness of the hypothesis. If the data does not support the hypothesis, then the researcher has to reject the hypothesis and adopt the alternative one. However, if the data of the research supports the hypothesis, then the researcher has to accept the hypothesis and base the findings of the research on this development (Gimbel, 2011). At this stage of the study, the researcher is required to collect, organize, and analyze data that is related to the problem that is being investigated in the study. It is always important for the research to use the most advanced data collection, organization, and analysis techniques as part of the scientific research process. If the researcher uses the best techniques and approaches to collect and analyze data, the researcher will easily achieve the objectives of the research study (Figure 4.5).

Figure 4.5: Data provides the foundation for the researcher to test the truthfulness of the hypothesis that is used in scientific research.

(Source: Unsplash)

The next stage in the scientific research process involves interpreting the data to answer the research questions. Researchers normally use a broad range of statistical analysis tools to analyze the data and test the hypothesis

that is used in the research. The choice of the statistical measures that are used in research depends on the nature of the study and the kind of data that is used (Betz, 2010). In simple correlation-based studies, the researcher has to do correlation analysis on the data to determine whether the relationship between the variables is correlative. In other studies, researchers have to test for significance and use many other specific statistical measures to test the hypothesis. Lastly, the researcher has to communicate the findings in peer-reviewed research journals.

4.5. IMPORTANCE OF SCIENTIFIC RESEARCH

There are many ways in which scientific research is beneficial to its various stakeholders. For example, research is important to the researchers, research institutions, and the public because it helps to develop new theories. The basis of the scientific research process is that researchers are supposed to test new theories using the data that they collect and special scientific research methodologies. The researchers are supposed to use their expertise to test the hypothesis and determine their level of truthfulness. In other words, it can be argued that research scientists are tasked with the duty of developing new theories that can be used to advance knowledge in various scientific fields. When researchers determine that the given hypotheses are true, they then accept them as part of the general scientific theory.

Second, scientific research is important because it helps to actualize the theories that are developed. There is always a big mismatch between the theoretical knowledge that is developed as a result of scientific activity and the practical needs and requirements of the world (Pruzan, 2016). For example, the industry needs practical recommendations on what should be done to address specific issues that are faced in the real world. It is always the work of research scientists to determine the best approaches that can be used to address the complex issues that are faced in the real world. For scientists to do this, they need to devise methods that they can use to actualize the theoretical knowledge in the sciences that exists. Therefore, science is important because it not only develops theoretical knowledge but also helps in the actualization of that knowledge for practical purposes.

Third, research is important because it provides solutions to intricate problems in the society. The problems that scientific research solves may be social, economic, ecological or even technological. Scientific knowledge may be required to solve the problems and help to alleviate human suffering. A common example of how scientific knowledge helps to solve the problems

that people face in the world is seen in the discovery and development of medical treatments. Given that diseases have far-reaching consequences on the lives of people as well as the economic well-being of countries, there are always concerted and well-coordinated efforts to develop the most effective treatments for the conditions (Gimbel, 2011). Currently, a lot of research on the possible treatments of various forms of cancer is ongoing. The essence of the research is that cancer has far-reaching consequences on the lives of victims and that it is necessary to develop the most suitable and effective treatment methods to address the problem.

Apart from cancer research, many other disease-based scientific research studies are undergoing. For example, a lot of funding is facilitating research on the treatment options for malaria. The reason for giving the disease a lot of scientific research attention is that it is one of the leading killers in some regions of the world. Thus, researchers are supposed to research on the conditions of the disease and develop the most appropriate treatment options that can be used to address it.

Fourth, scientific research is needed to enhance the professional standing of the individual researchers (Gauch, 2003). Researchers are supposed to research for them to be appreciated in their careers. In many cases, the amount of credible research work that individual researchers are involved in determines their professional standing. Progression in the academia is largely dependent on how widely a researcher is published in peer-reviewed academic journals and other credible publications. If a researcher is not widely published, then the researcher may not get all the accreditation that they need for them to move to higher positions in the academia. In other words, academic research can be highly beneficial to the individual scientists who perform it. If a scientist takes the time to conduct credible research, the researcher may directly benefit from the publication of the research.

Fifth, research in the sciences is beneficial to the industry (Betz, 2010). Some business enterprises are built on the discovery and development of very innovative products or processes. For example, companies such as Apple Inc. and Microsoft have been built on the development of very innovative technological products. Also, other old school firms in the computing industry such as IBM and Dell were established because researchers discovered new products and the owners of the firms invested massive amounts of resources to the process of developing commercial products. In other words, were it not for scientific research, then the companies and the industries could not have been born. What this means is that scientific research is an essential

source of industries and companies. The scientific research process forms the foundation for the economic development of the society because of gives birth to companies and entire industries. Also, the process contributes to social progress, a process by which the society adopts new methods and processes of doing things which are better than the old ones.

Lastly, scientific research is important because it helps to sustain the existing industries (Ford, 2000). For many businesses, the need to constantly improve the quality of the products that they sell is their key competitive advantage. For such companies, they are required to invest in continuous research to identify possible faults in their products and develop new ones that can be used to address the shortcomings in their products. It is because of this reason that many companies invest resources in the process of researching on how to improve their products. For such companies, the need to develop highly innovative products supersedes any other approach that may be used to gain a competitive advantage. It is because of this reason that scientific research is said to contribute to the development of new and innovative products. Companies usually collaborate with research institutions to develop new and innovative products that can address the needs of the clientele better than those which exist.

From the preceding, it can be seen that scientific research is beneficial to the society, the researchers and other stakeholders of the scientific research process. Scientists may be required to research for them to rise in their academic careers. The industry depends on scientific research to develop new and innovative products.

This chapter has presented all the basic information about scientific research. Details about the meaning of scientific method of research have been presented. Also, information about the importance and role of scientific research has been discussed in this chapter of the book. Additionally, details about the importance of scientific research to the industry, the society and other individuals and institutions who are stakeholders in the process have been addressed. The next chapter of the book is about the concept of hypothesis in scientific research.

5
CHAPTER

HYPOTHESIS IN SCIENTIFIC RESEARCH

'There are two possible outcomes: if the result confirms the hypothesis, then you've made a measurement. If the result is contrary to the hypothesis, then you've made a discovery.'

—Enrico Fermi

CONTENTS

This chapter contains details about the concept of hypothesis in scientific research. The purpose of the chapter is to present a comprehensive introduction to the concept of hypothesis as it is used in scientific research. For this chapter to achieve this aim, the chapter offers details about the definition and characteristics of the hypothesis. Next, the chapter contains details on the different types of hypotheses that are used in scientific research. Also, information on the various ways that are used to formulate, test, and evaluate hypotheses in scientific research are presented in this topic. Finally, information about the significance of the hypothesis in scientific research is presented in this chapter of the book.

5.1. DEFINITION OF HYPOTHESIS

There are many ways of defining the concept of hypothesis as it is used in scientific research. A hypothesis can be defined as a tentative explanation of a relationship or issues that are of interest to a researcher in a specific study (Bunge, 2008). In other words, a hypothesis is regarded as a brief explanation of issues or answer the questions that are raised in specific research. Given that research may examine relationships between issues, the nature of concepts or the prevalence of a condition within a given population, it follows that a hypothesis is usually used to address any of these various aspects of scientific research.

For example, in a study in which the researcher only seeks to establish the nature of the relationship between two situations, a hypothesis is used to provide a temporary or tentative explanation of the nature of the relationship. In a typical example, a researcher may use a hypothesis such as X is directly proportional to Y as a way of explaining how the two variables, X, and Y are related to one another. In such a case, the researcher then seeks to establish the real nature of the relationship of the variables by testing the hypothesis that is used in the research. If the hypothesis is found to be true, then the researcher concludes that indeed X is directly proportional to Y. If the hypothesis is found to be untrue, then the researcher concludes that X is not directly comparable to Y.

It should be noted that in the given example if the hypothesis that X is directly proportional to Y is found to be false, it cannot be argued that the converse is the case. In other words, if a researcher establishes that the hypothesis X is directly proportional to Y is false, he cannot conclude that Y is directly proportional to X. It will be necessary for the researcher to establish another hypothesis to test the relationship between the variables

again. Another critical issue that arises from the definition of research hypothesis that has been presented here is that research hypothesis can be regarded as a theory that has not been tested (Lynch, 2013). In some cases, scientific research is conducted for the purpose of developing new approaches to explain particular phenomena. In such cases, a researcher examines the relationship between several issues or attempts to provide a detailed and credible explanation of the nature of particular phenomena. For the researcher to succeed in the process, they have to develop a temporary theory to explain the relationships or nature of the phenomena. Thus, a hypothesis can be regarded as a theory that has not been tested. The entire research process is conducted to test the veracity or truthfulness of the hypothesis. If the hypothesis is found to be true, then the theory contained in it is said to be verified.

The third important issue that arises from the definition of a hypothesis that has been presented in this section of the book is that the concept of hypothesis, as it used within the context of research in the sciences, is an important part of the entire process of research (Poincare, 2012). The research process usually starts with the step of clearly defining the problem that needs to be addressed. Once the researcher has clearly defined a specific problem, the researcher then has to develop a hypothesis as a framework for acquiring knowledge that can be used to test the hypothesis. Thus, the formulation of a research hypothesis is an essential step in the research process because it is used to link the process of acquiring knowledge to that of testing it to determine its truthfulness.

5.2. IMPORTANT FEATURES OF RESEARCH HYPOTHESIS

It is common for young researchers to poorly frame research hypothesis. In such a case, a researcher may not achieve the desired aims of the research process when they use a weak hypothesis. If a researcher uses a faulty hypothesis, the researcher may end up making equally faulty conclusions regarding the issue of the research. Therefore, it is important for every researcher who is conducting a study to ensure that the hypothesis is formulated in the right manner (Basten, 2011). A correctly formulated hypothesis has specific features. The following are some of the most important features that every appropriate hypothesis that is used in a scientific research process should possess. The first important characteristic of scientific research hypothesis is that it should be based on careful

observation of phenomena. A good researcher always has to examine issues before formulating a hypothesis carefully. It is important to remember that a hypothesis is not a blind guess on the reasons for why issues are interrelated. On the contrary, any good research hypothesis is usually a culmination of a detailed observation process in which the researcher uses their knowledge to formulate a tentative explanation of issues. Therefore, a good hypothesis is always convincing because it is based on a detailed explanation of the issues that the researcher is concerned with (Figure 5.1).

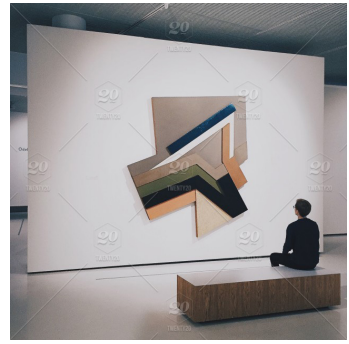

Figure 5.1: Observation is one of the key aspects of the process of scientific research in general and hypothesis formulation in particular.

(Source: Pexels)

The second important characteristic of research hypothesis is that it is testable. It is impractical for a researcher to formulate a hypothesis which cannot be easily tested. In general, scientific research studies are conducted to test the hypothesis to establish its truthfulness. If a hypothesis that is used in research cannot be easily tested, then the researcher cannot get accurate and verifiable findings. Therefore, it is necessary for a hypothesis that is used in a research study formulated in such a way that it can be easily subjected to the test process that is used in the research study. For a research proposal to be testable, it has to be written in a clear and logical language. The hypothesis is usually written in the form of a simple statement that expresses the presupposed relationship between or nature of specific variables.

Moreover, a reasonable research hypothesis should be related to the general theory that is used in the research. Every research process can be interpreted within the context of a particular type of theory. In general, research is merely conducted for the purpose of expanding the knowledge base that already exists. Thus, a hypothesis has to be related to the body of

knowledge for it to be regarded as credible (Bunge, 2008). Another important characteristic of a research hypothesis is that it should provide an answer to the research problem. If a researcher develops a research hypothesis that does not adequately and accurately answer the researcher problem, then the researcher may not easily achieve all the main goals of the research study. However, if a researcher develops a research hypothesis that is related to the body of knowledge and accurately answers the research question, then the researcher may get accurate results at the end of the research process.

Also, a good research proposal should contain the aspects of comprehensiveness, clarity, and economy. The aspect of the economy, as it is used within the context of research, means that a hypothesis should use a few words to express the presupposition of the phenomena that are addressed in the research (Basten, 2011). It is always pointless to use very long sentences to explain an issue that can otherwise be expressed in very few words. Thus, a good hypothesis should be concise in that it should show a wise and economical use of words to express all the issues that the hypothesis is supposed to address. Regarding the issue of comprehensiveness, a good research proposal should be based on logical unity. If a research proposal is based on particular relationships, it is necessary for the proposal to be within the confines of the issue that it is examining. In other words, a good research hypothesis shows a unity of purpose and can be easily interpreted within the context of a specific theoretical frame. Also, a good research hypothesis is one that underscores a sense of clarity and unity of purpose. Clarity, within the context of the research hypothesis, is used to indicate the extent to which a research proposal only addresses the issues that it is supposed to address. A clear or lucid research proposal does not examine other aspects of the research process apart from the ones which are of primary concern to the researcher.

Another important feature of a good research hypothesis relates to controversy. A good research hypothesis should not be controversial. It is necessary for a researcher to formulate a hypothesis that does not evoke highly emotional responses in the readers. Given that research is usually carried out to provide a fringe addition to the already existing corpus of knowledge, it makes sense for researchers to develop hypotheses that are not controversial at all.

It is important for a research proposal to have all these features for any research process to be successful. On the one hand, if a research proposal lacks any of the important characteristics that have been indicated in this

section, then the chances are that the researchers who are conducting the studies may not get accurate results of their study. On the other hand, if researchers are careful enough to develop research proposals that contain all the important features that have been indicated in this section of the book, then the researchers stand a better chance of achieving all the objectives related to their research studies (Lynch, 2013). Moreover, it is important for students and other researchers to learn how to develop credible research hypotheses. The main features of a good research hypothesis that have been explained in this chapter of the book can be very useful to researchers. Researchers can use the methods to develop very valuable research hypotheses and ensure that they develop the most appropriate research proposals for their research projects.

Therefore, it can be seen that a good research proposal is usually anchored on the theoretical knowledge, based on reflection and observation and is easily verifiable. Also, a good research hypothesis directly provides a tentative answer to the questions that the research attempts to address. Moreover, a sound research proposal uses very few words to express a specific explanation of phenomena that is being examined in a research study. Thus, researchers must ensure that they develop a hypothesis that meets all these important criteria.

5.3. TYPES OF RESEARCH HYPOTHESES

Science-based researchers can use several types of hypotheses in the course of conducting their studies. Importantly, the choice of the hypothesis that a researcher uses depends on various factors (Nevid, 2012). For example, it is common for a researcher to use the two most common forms of research hypotheses: the null hypothesis and the alternative hypothesis. However, some other forms of hypotheses may be less common in actual practice than these two. Therefore, the nature of the study is an important factor that determines the actual types of research hypotheses that are used.

Moreover, the categorization of research hypotheses may be based on various factors. The most common criteria for categorization relates to the statistical significance of the hypothesis. If a hypothesis is used to cover all the phenomena, then it is regarded as a universal hypothesis. The other hypotheses that are restricted to phenomena that meet particular criteria are regarded as existential. The following is a brief discussion of some of the most common types of research hypotheses. Based on the nature of the language that is used to frame research hypotheses, the hypotheses

can be categorized into the following types: declarative, question-based, operational, directional, and non-directional. In practice, a directional hypothesis is one in which the researcher predicts a relationship between variables and describes the nature of the relationship. A researcher who decides to use this type of hypothesis deliberately explains that one variable has a positive or negative effect on another variable that is used in the research. For example, a researcher may formulate a hypothesis as follows: an increase in the concentration of substance K leads to a decrease in the size of substance M. In this hypothesis, it is important to note that the researcher not only indicates that there is a relationship between the two variables, K, and M but also indicates that the relationship is a negative one. Similarly, if the relationship is positive, then the researcher will indicate that an increase in one substance has a positive effect on the concentration or size of the other substance.

On the other hand, a non-directional hypothesis only indicates that two phenomena are related but does not detail the nature of the relationship (Poincare, 2012). For example, a researcher may formulate a hypothesis which states that there is a relationship between two variables. In such a case, the researcher does not indicate whether the relationship between the variables is negative or positive. Therefore, such a hypothesis can be regarded as an example of a non-directional hypothesis. In the case of a question-based hypothesis, the researcher formulates a question and then endeavors to answer the question by conducting the research study. The action that follows depends on whether the researcher accepts the question which is posed as the hypothesis of the research study.

There are many other types of hypothesis based on their functionality. For example, all hypotheses can be categorized either as universal or existential hypotheses. Universal hypotheses are described as such because they are used to offer explanations of phenomena in general. For example, if a researcher develops a hypothesis that states that the rise of global temperatures undermines the global population of fauna and flora, for example, the researcher can be said to have developed a universal form of a hypothesis. The universality of the hypothesis arises from the fact that it is used to describe a relationship between variables under all circumstances and at all times. In other words, a universal hypothesis is not confined by specific attributes such as time, location, and the type of variables that are used. A researcher may easily use this type of hypothesis to conduct research and get credible findings.

An existential hypothesis is developed in such a way that it is used to explain the relationship of phenomena within a specific setting. In an existential hypothesis, it is clearly stated that the supposed relationship between the variables only exists for a single case or under specific conditions which may not necessarily be universal. Thus, a researcher who decides to use this type of hypothesis formulates it in such a way that the hypothesis is said to be applicable only when certain conditions are adequately met.

There are many other types of hypotheses, based on their functionalities. For example, the null hypothesis is one of the most common types of hypotheses that are used in scientific research (Lynch, 2013). The essence of the null hypothesis is that if the researcher accepts it, then it means that nothing needs to be done. In other words, the acceptance of the null hypothesis means that there is no need for any action. Thus, if the null hypothesis is found to be true in a research study, it means that the researcher will not recommend any radical changes that have to be implemented. Thus, the null hypothesis is associated with the status quo.

The alternative hypothesis can be regarded as the testable antithesis of the null hypothesis. The purpose of using the alternative hypothesis in scientific research is to provide a hypothesis that can be tested. If the null hypothesis is rejected, then the alternative hypothesis is accepted. The researcher then builds their findings on the strength of the theoretical content of the alternative hypothesis. Therefore, it can be seen that the alternative hypothesis is a critical aspect of any scientific research process. Researchers usually focus on rejecting the null hypothesis and accepting the alternative hypothesis as the standard way of conducting credible research in the sciences. However, it is possible for researchers to accept the null hypothesis and, by so doing, reject the alternative hypothesis. Therefore, the data that is collected and processed in the course of a research study determines how the researchers treat the null and alternative hypothesis which they use in their research studies.

In conclusion, there are many types of research hypotheses. The types of hypotheses that are used in the scientific research process are usually based on their functionality and nature. The basic types of research hypotheses are the null and alternative hypotheses. These two forms of research hypotheses are used to offer direction to research studies.

5.4. FUNCTIONS OF HYPOTHESIS IN SCIENTIFIC RESEARCH

A hypothesis serves many functions in scientific research. The following are some of the functions or purposes of a hypothesis in scientific research. In the first place, a hypothesis helps a researcher to effectively test specific conditions and establish the truthfulness of the tentative theory that the researchers usually develop to explain phenomena (Nevid, 2012). It has been stated that researchers normally develop a plausible explanation of phenomena in the form of a hypothesis. The researchers then test the truthfulness of the hypothesis to establish the accuracy of their proposition. Therefore, the development of a good hypothesis facilitates the theory-testing process that is used in the research.

The second function of hypothesis in scientific research relates to the need for the researcher to carry out other related activities that entail the research. Researchers are supposed to select the sample that they need to use for their studies, decide on the specific methodologies that they intend to apply to the study and then implement their overall research strategy. For researchers to make all these decisions, they need to have in place the most appropriate hypothesis. If it happens that researchers fail to formulate the right hypothesis for their studies, they may end up selecting less appropriate methodologies and approaches that can be used to complete the studies (Bunge, 2008) (Figure 5.2).

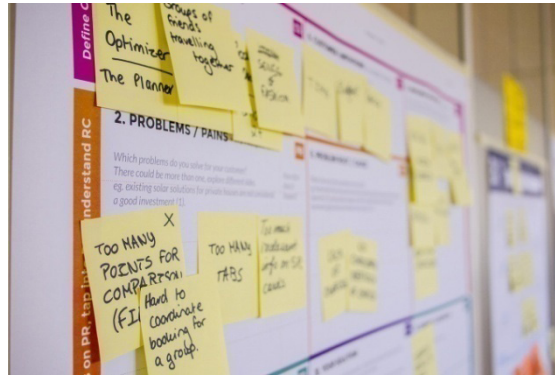

Figure 5.2: Having a good hypothesis provides overall guidance and direction to the researcher.

(Source: Unsplash)

The third important function of research hypothesis relates to the overall direction that the research study takes. A researcher usually relies on the hypothesis to get an overall direction of the entire study. In some instances, a hypothesis may have to be modified to allow the researcher to address certain critical issues in the study that is being undertaken. It is necessary for the researcher to rely on the hypothesis to get a general sense of direction and vision of the entire research process (Basten, 2011). Therefore, for a researcher to complete a scientific research study within the stipulated time and achieve all the desired results, it is necessary for the researcher to formulate the right hypothesis and address all the pertinent issues.

The fourth function of a hypothesis in scientific research relates to determining the boundaries for the entire research. In general, a good hypothesis is anchored on theoretical knowledge. It is important for the researcher to take the time and evaluate all the theoretical knowledge on the issue of research that exists before formulating a hypothesis for a research study. After the researcher has formulated the hypothesis, it is still important for the researcher to use the hypothesis to determine the scope of the research study. In other words, a sound hypothesis is important because it helps to set the boundaries for the researcher to evaluate theoretical knowledge that is related to the issue of the research (Bunge, 2008).

Fifth, the formulation of the hypothesis is an important precursor for the whole research process. In practice, the activity of developing a hypothesis is critical because it plays a key role in facilitating the entire process of conducting the research study. It is only when the researcher has formulated an acceptable hypothesis that they can proceed with the other steps of the research process. Moreover, it should be remembered that once the researcher has formulated the right hypothesis, they can easily collect all the data that is required to test the hypothesis and, by so doing, complete the entire research process. Therefore, the step of formulating an appropriate research hypothesis is critical in that it facilitates the completion of the other important steps in the research process.

Another important function of hypothesis in scientific research is that it provides the foundation for the establishment of facts and new knowledge. It is important to remember that basically, a hypothesis is simply a theory that has not been proven. The researcher has to go through the entire research process to establish whether the hypothesis is true. If the hypothesis is correct, then the researcher can say that they have developed a new theory to explain specific relationships among phenomena or the nature of issues which are

of interest to them and other researchers (Lynch, 2013). Therefore, it can be deduced that a hypothesis provides the foundation that researchers need to verify problems and establish new facts. Researchers rely on the hypotheses that they develop to decide on whether they have enough evidence to support their tentative explanations. When the researcher rejects the hypotheses, they usually adopt alternative ones.

Moreover, a hypothesis in research may form the basis for specific recommendations. In a typical scientific research study, a researcher usually uses two hypotheses: the null hypothesis and the alternative hypothesis. The null hypothesis is usually developed for the sole purpose of being rejected at the end of the research process. If the researcher finds evidence that supports the null hypothesis, they have to accept it and then reject the alternative hypothesis. In such a case, the researchers may not have to make any recommendations on what needs to be done. For example, in a typical scientific research study to establish the efficacy of a drug, the researchers may formulate the null hypothesis as such: administering a specific amount of compound Y reduces the pain in a specimen by 50% within three days. In such a case, if the researchers find evidence to support this hypothesis, they may not recommend anything. However, if there is evidence to show that this hypothesis is false, then the researchers have to develop current recommendations for the drug to be reconstituted.

From the preceding, it is clear that hypothesis plays a critical role in the process of conducting a research study. Researchers rely on the hypothesis to define the scope of the entire research, develop a sense of direction for the entire study and demarcate the theoretical issues that shall be addressed as part of the study. Also, it is based on the research hypothesis that researchers can establish new theories and develop specific recommendations that need to be taken to address various issues which are of concern in the research study.

5.5. FORMULATING RESEARCH HYPOTHESIS

The process of formulating a research hypothesis is usually made up of two phases. In the first phase, the researcher has to establish the main issues that should be addressed in the hypothesis. It is in this phase that the researcher decides on the variables or other phenomena that should be addressed in the hypothesis. In other words, a researcher has to refer to the primary problems that are supposed to be addressed in the research when managing this part of the process of formulating hypothesis.

In the second phase of the process, the researcher has to phrase the hypothesis in a language that is logical, complete, and reflective of the theoretical foundations of the research. A language is regarded as logical when it clearly elucidates the main issues of concern. In this case, it makes sense for a research hypothesis to be framed in a language that clearly states the proposed relationship among variables. For example, if a researcher frames the hypothesis in a superfluous language, then the researcher may note easily test it. Similarly, it is important for the researcher to clearly identify the relationship that they intend to test in the hypothesis. If the hypothesis is based on a supposed causal relationship between variables, then this relationship is supposed to be clearly identified in the hypothesis. In other words, the researcher should frame the hypothesis in a language that shows that there is a causal relationship between the variables that are used in the research.

More so, the language that is used to formulate research hypothesis in the sciences should be reflective of the theoretical concepts that are used in the study. Research studies are anchored on theoretical knowledge. It is the work of the researcher to use existing theoretical foundations to develop and test new hypotheses. It is for this reason that researchers in the sciences are supposed to use hypotheses that are reflective of the theoretical knowledge that the whole research study is related to. In some cases, it may be necessary for the researcher to mention the most important concepts that are used in the research. It is by doing so that the researcher can ensure that the language that is used to formulate research hypothesis is complete, reflective of theory and complete. Completeness in the case of research hypothesis refers to the extent to which the hypothesis that is used in any given scientific study contains all the basic attributes of the study. A good hypothesis that is complete is one in which the entire scope of the research is contained.

Therefore, these two phases of the process of formulating a research hypothesis have to be adequately addressed for the entire research process to be completed successfully. Several steps are usually involved in these two phases of the process of formulating research hypothesis. The following is a brief discussion of the activities that are normally undertaken in these two phases of the process (Figure 5.3).

Figure 5.3: For the hypothesis to be credible, it has to be formulated in such a way that the researcher can test it easily.

(Source: Unsplash)

The first important step that a researcher undertakes as part of the process of formulating the hypothesis is to ensure that the hypothesis will be testable. The testability of the hypothesis facilitates the completion of the entire research process. If a hypothesis cannot be tested, then the researcher cannot complete the research because the whole process of the research is based on determining the truthfulness of the hypothesis. The hypothesis testing process normally yields a 'yes' or 'no' answer. The hypothesis may be accepted or rejected, depending on the strength of the evidence that is shown in the data which is collected, processed, and interpreted within the framework of the research methodology.

For a researcher to make a hypothesis testable, the researcher should start with identifying a problem that is genuine and relevant. Next, the researcher should frame the problem in a statement that can either be expected or rejected. The entire hypothesis statement should make sense whether it is accepted or rejected. In other words, the phrasing of the hypothesis should mirror that of the alternative hypothesis so that when the researcher rejects the null hypothesis, it is easy and logical to accept the alternative one.

The second thing that researchers normally do when formulating research hypothesis is to phrase it in the form of conditions. It is common for researchers to use two methods to phrase their hypotheses. For example, researchers may use the conventional phrasing technique that uses the words, 'if…then.' This approach is a common way of phrasing research hypothesis

because it underscores the values of clarity and logic. For example, a researcher may develop the following hypothesis using this method:

'If the amount of substance M in the composition is doubled under normal conditions, then the efficacy of compound C doubles.'

In this example, it can be seen that the approach is used to develop a highly logical form of the research hypothesis. Thus, the researcher can easily test the hypothesis on the strength of its implication. Moreover, it can be seen that two conditions are included in the hypothesis. The first condition is referred to as the antecedent condition becomes it has to exist first for the second one to occur. The second condition is referred to as the following condition because it arises from the presence of the first one.

Another way of phrasing the hypothesis is by using the word, 'whether.' A good example of a hypothesis that uses this word is as follows:

'Whether the doubling of substance M under normal conditions doubles the efficacy of compound C.'

It can be seen that in such a case, the precondition is the doubling of substance M in the compound and the resultant condition is the doubling of the efficacy of compound C. Therefore, a skilled researcher can quickly determine the best words to use to phrase the hypothesis and ensure that all the important conditions are taken into consideration in the final hypothesis.

5.6. TESTING RESEARCH HYPOTHESIS

Researchers normally use a specific approach to test the veracity of a hypothesis (Betz, 2010). The following is a brief description of the steps that are used to test a research hypothesis. In the first place, a researcher has to formulate the null and alternative hypothesis. The choice of the null and alternative forms of research hypotheses largely depends on the nature of the study that is being undertaken. A researcher who understands the theoretical foundations of the study will easily select the most appropriate forms of null and alternative hypotheses for the study.

Once the researcher has clearly stated the null and alternative hypothesis, the researcher has to select the sample carefully. A sample is a small group of subjects which are used to test the truthfulness of the hypothesis of the research. A good researcher focuses on selecting a sample that is not only manageable but also very representational of the entire population that is being investigated (Lynch, 2013). Many considerations have to be taken into account when one is selecting a sample; however, suffice to say at this point

that the researcher only focuses on choosing a sample that reflects the entire population upon which the study is based, and which can be easily managed in the course of the research.

As part of the next step in the process of testing the research hypothesis, a researcher has to establish the significance level of the hypothesis concerning the sample. For any given sample, a researcher has to carefully identify the criteria that shall be used to judge the sample. The level of significance is important in research because it provides the researcher with guidance on how to decide whether a hypothesis should be accepted or rejected. Thus, a researcher heavily relies on the level of significance to test the truthfulness of any given hypothesis of a research study.

The last step of the process usually involves judging the entire sample that is used in the research using the set criteria. A researcher has to establish whether the hypothesis is true by applying its conditions to the sample. If the sample meets all the criteria that are used in the research, then the researcher has to accept the hypothesis. However, the researcher rejects the hypothesis is the conditions of the hypothesis are not fully met in the sample that is used in the research study.

5.7. CHALLENGES OF FORMULATING RESEARCH HYPOTHESIS

There are many challenges that researchers encounter when formulating research hypothesis. One of the main challenges that researchers usually encounter when conducting research studies relates to the knowledge that they need to access for them to complete the research. On many occasions, the absence of the theoretical knowledge that researchers need to complete their research studies may be a major hindrance to the hypothesis formulation process. This is the case because researchers need the theoretical knowledge for them to develop the most appropriate hypothesis. It is always necessary for researchers to ensure that they match their hypotheses to the theoretical knowledge base which they use.

One of the reasons for the absence of knowledge may be that the researcher may not be able to access the knowledge. In other instances, the knowledge that the researcher needs may not be available. In all these scenarios, the process of developing a valid hypothesis is undermined by the absence of theoretical knowledge. A researcher who faces this type of challenge may end up developing a hypothesis which is not anchored

on sound theoretical knowledge. If this happens, the quality of the entire research study is severely undermined because the researcher cannot develop a hypothesis that is based on theory.

The second challenge that researchers normally encounter when they are developing research hypothesis arises when the researcher fails to process the theoretical knowledge that is related to the research (Poincare, 2012). As part of any research study, the researcher is supposed to take the time and read through other studies that have been published which are relevant to the current research. It is by reading the findings of other published studies that a researcher can gain a lot of important theoretical information about the research that they intend to conduct. If the researcher fails to collect and analyze theoretical knowledge which is relevant to the research, the researcher may not easily develop the most appropriate hypothesis for the complete research (Figure 5.4).

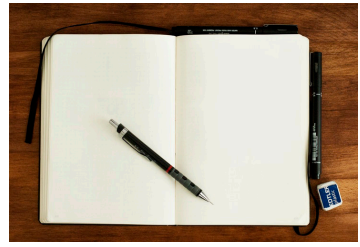

Figure 5.4: Lack of knowledge is one of the major challenges that researchers face when developing hypothesis for scientific research studies.

(Source: Unsplash)

One of the reasons why some researchers may fail to process theoretical knowledge that is related to their research studies is that the researcher may be unable to comprehend all the theoretical information which is related to the subject. In such a case, the researcher may easily develop a research hypothesis which is too simplistic to be used to deliver credible results at the end of the research process (Basten, 2011). Another reason why researchers may fail to adequately process theoretical knowledge that is related to their research studies is that they may lack the time and other resources which they need to collect and analyze the information. Regardless of the actual reason why researchers may fail to process information, it is clear that failure to do so may easily undermine the process of formulating the research hypothesis. The third challenge that occurs during the process of forming research hypothesis is that the researcher may fail to understand the complex

procedures and techniques that are used to research in the sciences. There are many techniques that researchers are supposed to have mastered before they undertake a study in the sciences. The techniques and methodologies cover various aspects of the research such as collecting information, preparing samples and processing the data to test the hypothesis that is used in the process. It is important to note at this stage that although the process of developing a research hypothesis is one of the most preliminary ones in research, it is important for the researcher to be cognizant of all the complex processes that they have to undertake when doing the other parts of the research process.

Knowledge about the preferred research methodology and other technical aspects of the research process is essential and helpful for any researcher during the process of formulating the hypothesis. For example, if a researcher does not accurately understand the process of forming a research hypothesis, then the researcher may not correctly develop a good research hypothesis. Also, if a researcher fails to understand the sophisticated methods that apply to the research that they may be conducting, then the researcher may fail to develop the most appropriate research hypothesis (Bunge, 2008). Therefore, it is possible for a researcher to fail to develop the suitable hypothesis for research if the researcher fails to access all the information that is needed for the purpose or if the researcher is unable to comprehend all the technical aspects of the research process.

In conclusion, this chapter has presented basic information about the concept of research hypothesis as it is used in research in the sciences. It has been established that a hypothesis can be regarded as a form of theory that is used to explain the specific issues that the researcher is interested in. The hypothesis is used as a tentative explanation of the all the phenomena that the researcher intends to test in the course of the research process. It has also been pointed out that there are several types of research hypotheses. The most common forms of a hypothesis that are used in scientific research are the null hypothesis and the alternative hypothesis. The null hypothesis is formulated with the sole intention of being tested against the information which is collected in the course of the research process. When the researcher rejects the null hypothesis, they usually adopt the alternative hypothesis.

Furthermore, details about the most important characteristics of the research hypothesis and the function of research hypothesis in a research study have been discussed in this chapter. It has been pointed out that a sound hypothesis should be logical, clear, and strongly anchored on theoretical

knowledge that is relevant to the issues which are addressed in the research. It has also been indicated that a good research hypothesis provides direction to the researcher on how to complete the research study. Furthermore, a research hypothesis offers a critical foundation upon which the researcher collects and tests information to establish new theories and facts. The next chapter of the book will examine the issue of research data in scientific research.

6
CHAPTER

SCIENTIFIC RESEARCH DATA

'My work shows how important it is that independent researchers should have access to data so that government statistics can be checked and so that the democratic debate within India can be informed by the different interpretations of different scholars.'

—Angus Deat

CONTENTS

The purpose of this chapter is to present a detailed analysis of the subject of data in scientific research. The chapter contains details about the methods that are used to collect data in research sciences, the techniques that are used to prepare data and the ways that are used to manage data security. The chapter also contains information about the ways that researchers use to share data with their peers. In addition, a discussion of the life cycle of scientific research data is also presented in this chapter of the book.

6.1. WHAT IS SCIENTIFIC DATA?

The term scientific data is used to describe the numerical data that is usually collected by scientists during the process of scientific research (Bunge, 2008). In general, scientists rely on quantitative data when researching. Quantitative data refers to the numerical form of data that is collected from careful observation of variables. Scientists get the data that they use in their experiments from the physical phenomena that they observe (Gimbel, 2011). For example, if a scientist is working with a group of patients to measure the effect of a particular compound, then the scientist will observe and measure the patients to get information about the impact of the compound. By so doing, the scientist collects quantitative data that they end up using to test the truthfulness of the hypothesis of their research studies (Figure 6.1).

Figure 6.1: Scientific data is the bedrock upon which the entire practice of scientific research is built.

(Source: Unsplash)

Scientific data is used for various reasons. In the first place, it is based on scientific data that researchers can successfully test the hypothesis that they use in their studies. Given that hypothesis testing is one of the most critical parts of any research process, it follows that scientists are supposed to devote a lot of attention and effort to this activity. Scientists deliberately collect specific kinds of data for their studies. The nature of the study usually determines the kind of data that is collected. Another importance of data to scientific research relates to the need for researchers to provide credible findings in their studies. For findings of any research to be regarded as credible, it is essential for the researchers to show that they used data that is relevant to the subject of the study (Ford, 2000). In other words, having the right kind of data and in the most appropriate amounts helps to enhance the overall quality of a research study in the sciences.

6.2. DATA COLLECTION METHODS IN SCIENTIFIC RESEARCH

Researchers collect a lot of data in the course of conducting their research studies. Primarily, researchers seek to collect data that suits the particular needs of their studies. Also, researchers seek to collect data that is available and which they can quickly collect because they have the tools and skills needed to complete the process. For example, a researcher who is conducting a laboratory-based study will be interested in data that suits the nature of the study. The researcher, in such a case, would make a point of identifying and collecting information that only suits the specific needs of the research study. Similarly, a researcher who is conducting a field-based study may be interested in collecting data that is suitable to the needs of the research study.

The methods that researchers choose to collect and manage research data are usually determined by the nature of the design of the study, the resources that are available to the researcher and the level of skills that the researcher possesses. If a researcher does not have all the resources that are required to access raw data and the research design that is used for the study allows the researcher to use secondary data, the chances are that the researcher may resort to accessing data that has already been collected and published in past studies. Also, a researcher can only collect a type of data for the research process if the researcher has the skills that are required to collect and handle the data (Betz, 2010). Therefore, before a research scientist settles on a specific form of data for the research, the scientist takes typically the time to determine their capacity to access and handle the data

that is required for the process. Also, the researchers usually depend on the research design when deciding the kind of data that is needed for the study.

One of the types of data and methods that are used in scientific research is related to the physical measurements of specific features. Physical measurements usually include all the attributes of the phenomena that are used in scientific research. When a scientist measures aspect such as the height, weight, and distance of things, then the scientist is collecting data that is related to the physical attributes of the issues that are being investigated. Also, when a researcher has to collect physical measurements, the researcher must have access to all the aspects that are under investigation. For example, a researcher who is investigating the rate of growth of plants which are in a greenhouse must have access to the plants so that he can measure their height and all the other physical aspects that are being investigated. Similarly, a researcher who is investigating the rate of growth of a culture in a laboratory environment may have to access and calculate the volume of the cells at specific intervals. In other words, data that is related to physical measurements of phenomena is usually connected to specific things that are regarded as criteria for determining the changes that the researcher is interested in (Figure 6.2).

Figure 6.2: Data that is used in scientific research may be in any form, depending on the nature of the research study.

(Source: Pexels)

The second method that research scientists use to collect data relates to observing the behavior of their subjects. Behavioral observation is one of the most critical forms or methods of collecting scientific data. The essence

of the method is that a researcher takes the time to monitor individuals or animals who or which are being used in experiments. The underlying assumption of the method is that the behavior that animals and individuals exhibit is a representation of their true nature. Therefore, a researcher can get accurate information about the behavior of animals by merely observing the animals under specific conditions and for a set period. Also, a researcher can gain valuable insights about specific individuals in a sample, who represent a given population, by merely observing the behavior of the individuals under particular conditions and for a set period.

This method may be suitable for specific studies in the sciences. For example, a psychologist who is investigating the behavioral aspect of a population may find this method the most appropriate one to use to collect the data that is needed for the research. The researcher may select a sample and then observe how the individuals who make up the sample behave when they are subjected to specific conditions. Thus, the researcher will manage to get all the information about the nature and behavior of individuals by merely collecting information about the behavior of the sample for a given period.

When researchers choose this method, they have to transform the data that they collect into a form that can be used in their research designs. It usually is necessary for researchers to transform the data into a form that suits the quantitative nature of scientific research. To this end, researchers may have to first code the data as part of the process of changing it into a form that can be easily used to complete research studies (Figure 6.3).

Figure 6.3: Research studies in the sciences may be based on primary or secondary data.

(Source: Pexels)

The third form of data that researchers used to complete studies in the sciences is secondary data. Primarily, research data in the sciences and other disciplines may be classified in the form of primary or secondary data. Primary data is usually collected by the researcher who is doing a study for the first time (Lynch, 2013). The researcher has to go out in the field and get the data from the phenomena that form the subject of the scientific investigation. On the other hand, secondary data is usually available in published studies. A researcher goes through published studies to get the data that has already been collected and published for the researcher to complete a new study. Thus, secondary data is different from primary data because primary data is new while secondary data has already been used in past studies.

6.3. DATA PREPARATION

Data preparation refers to the steps that researchers take as a way of ensuring that the data that they collect is in a form that can be used for the intended purpose. The main aim of preparing data in the course of scientific research is to ensure that the researchers who are conducting a specific study can efficiently use the data to test the hypothesis. Also, data preparation is undertaken as part of the research process to facilitate data sharing practices. A researcher who intends to share the data with others who are conducting related studies may have to conduct the data preparation process to ensure that the data is in the right form (Basten, 2011). Therefore, data preparation is a critical aspect of the entire scientific research process. The process of preparing data for use in scientific studies can be summarized into the following steps: organizing, reviewing, cleaning, and describing the data. The following is a brief explanation of how all these steps are conducted as part of an actual scientific research process.

Data organization is one of the most critical activities that are usually undertaken as part of the process of preparing data for use in scientific studies. Primarily, data organization refers to the methods that a researcher uses to input the data into a database. A database acts as a form of storage for the data that is to be used in a research study. However, for a researcher to complete a study successfully, it is always important to organize the database in such a way that the researcher can efficiently process all the data that is in the database. Therefore, a database cannot be regarded as a small reservoir of research data but rather as a tool that can be used to facilitate the completion of a research study.

For a researcher to build an appropriate database to organize the research data, the researcher has to understand the various tools that can be used to build an excellent database. It is common for researchers in the sciences to use readily available tools such as spreadsheets and others. The researchers have to input the data in the spreadsheets following a specific protocol for them to be able to use the data later at the data analysis stage. However, it is worth mentioning that researchers have to organize the data using identifiers. Identifiers are used to help the researcher to categorize the data and organize it based on specific criteria. More importantly, a researcher has to code the data and then input it into the database in a consistent manner. It is when a researcher codes the research data and uses a highly consistent approach to transfer it to the database that the researcher can meaningfully use or share the data (Figure 6.4).

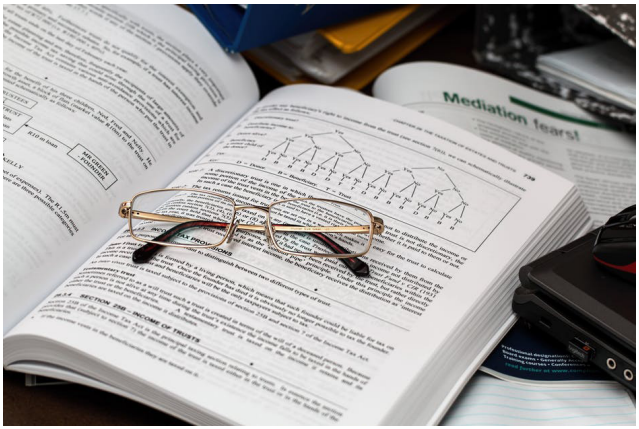

Figure 6.4: Regardless of whether the data that is used in a scientific study is secondary or primary, the data has to be subjected to a rigorous evaluation process.

(Source: Pexels)

Another important activity that is undertaken by researchers as part of the process of preparing data is related to reviewing the data that they use. Data review refers to all the activities that researchers undertake with the intention of ensuring that the data which they have in the dataset is useful for the specific task at hand (Bunge, 2008). It happens at times that not all the datasets that researchers have can be of use to them for the scientific studies that they are conducting. At times, researchers may realize that some data is irrelevant to the research on hand because of its level of accuracy or

that it fails to meet specific criteria. In some cases, researchers may decide to eliminate some data items from their spreadsheets because they are convinced that using the data items may undermine the quality of the whole research study. Therefore, regardless of the nature of the research study, it is always essential for the researchers who are involved in reviewing the data and ensuring that they have the data that they truly need for their research. Also, researchers usually review data to ensure that they have accurate data that they can use to test the hypothesis of the study that they are conducting.

The third activity that is undertaken by researchers as part of the process of preparing the data for research purposes is cleaning the data. Data cleaning is a significant activity that is generally undertaken by researchers. The essence of data cleaning is to ensure that the researcher has only the data that is accurate and relevant to the study. To achieve this objective, researchers usually screen the dataset for any anomalies, diagnose the anomalies and edit them to perfect the data. The screening process is done by carefully examining the data to determine whether it is the of the required size. Also, the data screening process provides the framework for strange patterns, the existence of outliers and other forms of abnormality in the data. Once the researcher has accurately screened for defects in the data set, the researcher may then diagnose the problem to identify its cause. In some cases, the researcher may discover that there are real extremes in the data and that they do not have to remove them. However, in many other cases, the researcher may identify the real causes of the abnormalities and remove them to make the data useful.

The last aspect of the data cleaning process is to edit the data to remove the anomalies (Poincare, 2012). The editing process usually entails all the activities that the researcher uses to remove abnormalities in the data and ensure that the final form of data is ready to be used in the research study. It is after a researcher has cleaned the data that they may describe it in ways that suit the needs of the research study. The data description step is the last one in the data preparation process in scientific research. It is important to note that all these steps are critical and that any reasonable researcher must create the time to go through them carefully for the entire research process to meet all the set requirements.

6.4. RESEARCH DATA LIFE CYCLE

The concept of research data life cycle means that the data that researchers collect and use in their studies undergo various stages of use. For any typical

research study, the researchers usually collect and use raw or primary data to test the hypothesis. Once the researchers have to use the data, they usually publish it together with their findings. The published data is then made available to other researchers and stakeholders in the research process who may be interested in using it. Therefore, by collecting, analyzing, and using data, researchers take the data through a process in which other researchers can access and use the data at a later date.

Data undergoes various stages in its lifecycle during the research process. The stages are related to the various activities that are carried out in the course of research and how the activities demand the researcher to treat or handle data in specific ways. The first stage of the research data life cycle is planning. At the planning stage, the researcher concentrates on laying all the plans on the kind of data that will be used in the research, how the data shall be accessed and the methods that shall be used to process the data. Also, it is at this stage of the process that the researcher makes a conscious decision on whether the data shall be made available to other researchers and if this will be the case, the particular methods that the researcher shall use to share the data with anyone else who may be interested in the data. Therefore, the researcher prepares the protocols and templates that will be used to guide all the data-related activities that shall be undertaken in the course of the research.

Also, at this stage of the process, the researcher establishes the relationship between the data that is to be collected and the design that is to be used to complete the research. Suffice to say that for a research process to be successful; the researcher has to ensure that there is a high degree of harmony among all the aspects of the research (Nevid, 2012). The data collection and processing methods and techniques that are used should be in line with the entire design that is used in the research process. Also, many other aspects of the research should arise from and be related to the design that is used. Thus, the planning stage is critical for the completion of the whole lifecycle of data in research.

The second stage of the lifecycle of research data relates to the actual collection of the data. The data collection process covers all the activities that researchers undertake to access the data that they need for them to complete their studies. It has been pointed out that researchers can use either primary or secondary data. These two types of data are different from each other because of their nature and the approaches that researchers use to access them. In the case of primary data, a researcher has to go out in the field to

measure and record the specific criteria that are related to the subject of the research. Also, if a scientific study is based on laboratory processes, a researcher has to carefully measure the physical attributes of the sample of the study to get primary data. Thus, the process of collecting primary data is more involving and detailed than that of collecting secondary data.

For secondary data, the researcher only has to identify published studies that contain the data which they are interested in. The researcher will then have to access the data from the secondary sources and use it for the current study (Basten, 2011). What is important to note about the data collection process is that it is very critical for the entire lifecycle of the research data. If a researcher uses approaches that are inappropriate for the research, the researcher may collect data which is not a perfect fit for the needs of the research study. Therefore, for a researcher to ensure that the whole research process is successful, the researcher has first to identify the most appropriate data and then use the right techniques to collect the data.

Data processing is the next stage of the lifecycle of data. Data processing entails all the activities that researchers do to ensure that they use the data to test the hypothesis in their studies. The essence of data processing or data analysis is to use the data to answer the research questions. As part of processing the data, researchers usually check the data to ensure that it meets the basic requirements of the study. Also, researchers usually correct any anomalies in the data before the actual use it to complete the study. Also, as part of the data analysis process, researchers may describe the data and use specific tools to analyze it in light of the needs of the research study. In a typical scientific study, researchers rely on various statistical analysis tools to interpret the data and test the hypothesis of the research.

The fourth stage of the lifecycle of data in a scientific research study is the publication of the data. Publication of data is usually undertaken as the last activity of the research process. Before a researcher publishes the findings of a study and the data that has been used to get the results, the researcher has first to establish the criteria that shall be used to share the data. The data sharing protocol helps to prevent instances of violation of the copyright of the individuals who own the data. Also, the researcher has to establish backup mechanisms for the data to ensure that a copy of the data can be easily obtained when need to do so arises. Once researchers have published the data and established all the frameworks that are needed facilitate the data sharing process, the researchers would have made it possible for other researchers who are interested in the data to obtain and use it.

6.5. DATA MANAGEMENT IN SCIENTIFIC RESEARCH

The concept of data management in scientific research refers to the activities that researchers undertake to ensure that all the aspects related to data of their research as successfully conducted. It is important to note that data is of critical importance to the success of any scientific examination. If researchers fail to manage a single aspect of the activities related to data, then the integrity and validity of the whole research may be severely undermined (Lynch, 2013). Therefore, researchers must carefully identify all the activities that they are supposed to carry out as part of the process of managing the data of the research and ensure that they complete them as it is required.

For data management to be successfully implemented, researchers are supposed to develop a data management plan. A data management plan is a unique document that lists all the activities which are related to data, and that is supposed to be undertaken in the course of the research. For example, in the data management plan, a researcher will provide specific information about the kind of data that is to be collected for the research process to be successful. Also, in the data management plan, a researcher will identify all the sources of the data and describe and challenges which may be experienced in the course of collecting the data. Moreover, as part of the data management plan, a researcher will identify the key things that need to be done to ensure that the data that is collected for the study is in the most appropriate form. Therefore, the essence of undertaking the data management exercise as part of the scientific research process is to ensure that a researcher understands all the data-related things that need to be done to make the research undertaking successful.

A good data management plan covers various aspects of all the activities that are related to the collection, use, and storage of data. For example, a suitable plan contains details about the kind of data that the researchers are supposed to collect for the research study. A good plan contains accurate and detailed descriptions of the types of data that the researcher is interested in. Also, a good plan shows how the data that is to be collected by the researcher is relevant to the research study that is to be undertaken.

Moreover, a good plan contains information about the standards that shall be used to manage the research data. Data management standards provide the framework for researchers to determine the overall strategies that they can use to handle the data. Moreover, standards help researchers

to scrutinize data and detect anomalies in the data carefully. Usually, if researchers do not carefully scrutinize data, they may end up using data that has a lot of errors and abnormalities, thus undermining the reliability of the whole research process. Therefore, for researchers to prevent such a scenario from occurring in the curse of completing other activities related to the research, they are supposed to include all in the data management plan all the essential standards that are to be used to assess the suitability and usefulness of the data.

Another essential component of a good data management plan in scientific research relates to the security of the data. Data security is one of the most important issues that any researcher should be clear about (Ford, 2000). The importance of data security cannot be overemphasized; on the one hand, data security ensures that a researcher can complete a study without getting worried that unauthorized persons will gain access to the data. On the other hand, data security helps researchers to manage all the other activities of the research process with ease. Therefore, any kind researcher must ensure that there are adequate and reliable strategies to safeguard the integrity of the data in place.

Related to the issue of data security is that of the overall roles of individuals who are usually involved in the data management activities that are undertaken as part of a research. It is always necessary for a researcher to explicitly state the individuals and institutions who will be responsible for specific activities related to managing the data for the research. Thus, a good data management plan contains all the details about the individuals who will carry out particular activities that are related to handling the data that is used in the research.

Having a right data management plan when conducting a research study can be beneficial in several ways. A good data management plan helps a researcher to gain a clear picture of the activities that need to be undertaken for the entire research study to be complete. When a researcher develops a good data management plan, the researcher gains a clear picture of the kind of data that is supposed to be used, its source and overall treatment. Therefore, a good data management plan helps a researcher to complete all the tasks related to handling data correctly.

Moreover, a good data management plan facilitates the successful implementation of the entire research plan. Data is one of the most critical aspects of a research process. A good data management plan contains all the details of how a researcher should approach eh issue of data when carrying

out the research. If a researcher develops a good data management plan, the researcher can then efficiently complete the whole research study by relying on the plan to do all the other activities that are related to it. For example, if a researcher has a good data management plan in place, the researcher can then start collecting the data, based on the hypothesis, analyzing it and testing the hypothesis of the research (Puzan, 2016). The fact that the development of a data management plan is one of the preliminary things that are done during a research study, it follows that a researcher relies on the plan to carry out all the other activities of the research. Therefore, for a research study in the sciences to be successful, the researcher who is involved must develop a good research data management plan.

In this chapter, details about the way researchers are supposed to treat data when conducting their studies have been presented. Information on the kind of data that researchers in the sciences deal with and the techniques that they use to ensure that the data is secure and shareable have been outlined. Also, information about the way researchers are supposed to plan to manage their data has been presented in this chapter of the book. The next chapter will present details about sampling in scientific research.

7
CHAPTER

SAMPLING IN SCIENTIFIC RESEARCH

'Sampling, statisticians have told us, is a much more effective way of getting a good census.'

—Rob Lowe

CONTENTS

This chapter contains details about the subject of sampling in scientific research. The chapter aims to present a concise discussion of the concept of sampling in scientific research. For this chapter to achieve this purpose, it contains details on the definitions of basic terms and concepts that are related to sampling. Also, the chapter contains information about the various sampling methods that are used in scientific research. Information about the effect of the size of the sample on the quality of scientific research as well as other issues related to the subject of sampling in scientific research is presented in this chapter of the book.

7.1. SAMPLING: DEFINITION OF TERMS

Before examining details about the sampling methods that are used by researchers and how the methods affect the quality of research, it is necessary to revisit the definitions of some of the basic concepts which are related to sampling. First, it is easy to define the concept of sampling when considers how it is used in various forms of research activities. Primarily, sampling refers to a process by which researchers access a small number of items from the more extensive collection of items or phenomena that they would like to study (Gauch, 2003). The essence of sampling is that researchers may not have the time and resources that are necessary to examine every single item that forms the population. If, for example, a research scientist is studying the effect of genetic engineering on the output of wheat, the researcher, or plant breeder, in this case, may not have the time to investigate all the varieties of wheat that are commercially available (Betz, 2010). For the research study, the researcher may only work with a handful of varieties of wheat. Also, for the practical purposes of the study, the researcher may select a few plants from those that have been grown in a laboratory or greenhouse for investigative purposes.

Therefore, a sample is a small group of items that are used by researchers to study a phenomenon. The researcher has to work with a sample because the entire population of the phenomena that the researcher is examining is unavailable for examination. A researcher is obliged to work with a sample because it is the only feasible way by which the researcher can successfully examine the issues. Also, it is important to note that a sample is typically smaller than the target population and is used to facilitate the completion of a research study (Figure 7.1).

Figure 7.1: The purpose of sampling in scientific research is to enable researchers to study entire populations by focusing on a small group of representatives.

(Source: Pexels)

Another relevant term that is related to sampling that should be defined at this stage is sampling frame. In straightforward words, a sampling frame is a small subset of the target population from which the individual items that are included in the real sample of a study are derived (Ford, 2000). A sampling frame is developed by developing specific criteria that only a section of the population meets. The kind of a sampling frame that is used largely depends on the nature of the research study. Every study has specific demands that influence the way the sampling frame is developed. It is, therefore, the duty of the researcher to carefully develop a frame that suits the demands of the research study.

The third concept that should be defined at this stage is the sampling design. Sampling design refers to the framework that the researcher uses to move items from the sampling frame to the sample that is finally used in the research (Leavy, 2004). It should be noted that not all items in the sampling frame are included in the final sample in some studies. However, it is typical for all the items in the sampling frame to have a chance of being included in the sample. In some cases, however, the sampling frame may be used as the final sample of a research study. Many methods are used to move items from the sampling frame to the final sample. The following are some of the important sampling design methods: nonprobability, probability, and convenience sampling.

From the preceding discussion, it can be seen that the concepts of the target population, sampling frame, and sampling are intimately

interconnected. In general, the target population is the entire population of items that have to be investigated in the course of research (Gold, 2012). The sampling frame, which is a subset of the target population is smaller than the target population. Finally, the sample is a subset of the sampling frame and is composed of the items or individuals that or who are used in the actual research study. An excellent example of how these three concepts are interconnected can be visualized when one considers a typical research study of a scientific study to determine the level of efficacy of a drug. In general, the human population may be regarded as the target population for this study. It is practically impossible for the researchers who are conducting the study to test every person in the world, therefore, they only have to work with a very small sample and then generalize the findings by using them to describe the human population. To achieve this aim, the researchers may have to select individuals who are suffering from a specific disease. In this case, all the people who are suffering from the condition form the sampling frame which, as it can be seen, is smaller than the target population. Moreover, the researchers will have to only choose about 200 individuals, for example, to be used for the study. In such a case, the 200 individuals now form the sample for the research study. The process of getting the 200 individuals from all the people in the world who have the health condition which is of interest to the researchers is referred to as the sampling design (Figure 7.2).

Figure 7.2: A sampling frame is a subset of the entire population from which the final sample that is used in the research is derived.

(Source: Unsplash)

7.2. SAMPLING METHODS IN SCIENTIFIC RESEARCH

In general, scientists use probability sampling design to identify and move some items from the sampling frame to the actual sample that is to be used. The essence of probability sampling is that every item that is found in the sampling frame stands an equal chance of getting identified and moved to the real sample of the study. In the case of nonprobability sampling, the researcher makes a conscious decision to move some items from the sampling frame to the final sample (Pruzan, 2016). Given that nonprobability sampling does not use the scientific method of selecting items based on mathematical probability, the method is rarely used in typical scientific studies. Moreover, the scientific nature of probability sampling is that a different researcher can accurately replicate the method to yield similar results. In fact, one of the most important values that are used to assess the overall quality of a scientific research study is whether the entire research can be replicated by other researchers (Gimbel, 2011). A good analysis study is one in which is a different researcher from the one who initially conducts and publishes its findings, gets a similar sample and target population and follows all the procedures that are used, gets similar results. If it happens that a researcher fails to get similar results to the ones that have been published, even after the researcher has followed all the procedures, then the overall quality of the whole research may be undermined.

One of the critical methods of probability sampling that are used in scientific research is random sampling. For a random sampling exercise to be successful, the researcher must devise a method that ensures that all the items in the sampling frame stand an equal chance of being moved to the real sample of the research. In practice, researchers use tables of random numbers to assign the numbers to values or items that they would wish to use in their research studies. The researchers then use the random number tables to generate a highly randomized sample from the sampling frame. Thus, random sampling is an effective method of identifying and moving items from the sampling frame to the real sample which is used in a research study (Figure 7.3).

Figure 7.3: While using systematic sampling, researchers should ensure that the items in the sampling frame are not organized in a way that may introduce a form of bias in the final sample.

(Source: Unsplash)

Another important type of probability sampling that is used in scientific research is systematic sampling. In practice, when researchers decide to use systematic sampling, they have to arrange their data in such a way that it meets the basic requirements of the process. It will be unwise or researchers to use this method on a data that is organized in a way that sampling it using this process would result into a sample that is not representative of the actual needs of the population. For example, if this method is applied to a sampling frame of 50 items, assuming that the researcher only needs ten items for the sample, the researcher may decide to select every 5^{th} item so that at the end, they have ten items in the sample. However, if the data is arranged in such a way that selecting every 5^{th} item as part of the systematic sampling procedure yields a sample that is openly biased, then the researcher may have to avoid using the procedure. Therefore, the main issue related to systematic sampling is that the researcher should organize the sample frame in such a way that its treatment does not create a form of bias in the final sample that is used in the research.

Another universal probability sampling method that is used in scientific research is multistage sampling. The main issue about this approach to sampling is that for the researcher to come up with the final sample that is to be used in the research; the researcher goes typically through a series of steps. A researcher may first classify the items that form the sampling frame into clusters or categories. The clustering of the items is usually done in a way that does not openly create a bias (Ford, 2000). For example, if a researcher who is testing the efficacy of a drug in the given example has to develop a sample based on the multistage approach, the researcher may first have to divide the sampling frame into regions. For example, the researcher

may categorize the children based on their home continents as the first step of the process. Once the researcher does this, they may then use the random numbers to get a genuinely randomized sample for use in the research.

In such a case, it can be seen that the researcher would have combined some sampling methods to identify the items that can be included in the final sample for the study. A researcher may even use clustering and the representative randomized sampling methods to generate a sample that can be used in the research process when using the multistage sampling technique. Also, as part of the multistage sampling procedure, a researcher may deliberately use stratified sampling techniques by creating strata from which they can identify the items that can be included in the final sample (Singh, 2010) (Figure 7.4).

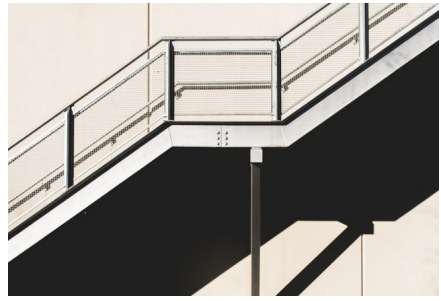

Figure 7.4: In multistage sampling, the researcher uses a series of sampling procedures to complete the sampling process for the research in stages.

(Source: Unsplash)

From the preceding discussion, it can be seen that there are many probability sampling methods that can be used by a researcher to create a sample that can be utilized in a scientific study. Primarily, a researcher is concerned with generating a sample that is indeed representative of the target population. If the researcher does not come up with a truly representative sample, then the researcher would have committed a bias in the course of developing the sample. The occurrence of a bias in the sampling process normally undermines the quality of any research study (Betz, 2010). Therefore, by using probability methods, researchers seek to eliminate the bias that can occur if they use nonprobability sampling methods to create samples for their research studies.

7.3. SAMPLE SIZE IN SCIENTIFIC RESEARCH

The size of the sample is one of the most critical things that determine the overall quality of a research study (Ford, 2000). It has already been indicated that in scientific research studies, researchers have a to be careful about the sampling methods that they use. It has also been indicated that the basis of all scientific studies is to test a given hypothesis by subjecting the items of the sample to the conditions that are spelled out in the hypothesis. The researcher then makes a conclusion based on the findings of the research by generalizing the findings. In other words, a researcher needs to have a sample that represents all the features of the target population. For a researcher to get such a sample, they have to use the right sampling methods and techniques. Therefore, the sampling method and process, in general, are important indicators of the quality of any research study.

The size of the example that is used in any given scientific research is important because of various reasons. In practice, there are many formulae for calculating the ideal size of the sample that should be used for particular studies. However, it is necessary to point out that the reasoning behind many of the formulae that are readily available are not usually provided. In other words, if a researcher uses any of the formulae to calculate the size of the sample to be used in a study and then uses the sample in the study, the researcher may not be able to explain the rationale behind the size of the sample, if a need to do so arises. Thus, whereas using such formulae to calculate the size of the sample may be convenient, using this approach may inadvertently undermine the integrity of the work of a researcher.

Ideally, researchers are supposed to use a formula that takes into consideration all the essential tenets of their studies. For example, the size of the sample that is used in any scientific research project has a direct effect on the level of significance and Type II error that is used in any research study. These two aspects are important because they underlie the extent to which the researcher is willing to accept a null hypothesis when, in truth, it is false. This measure is usually indicated regarding probability. For a researcher to work with the acceptable levels of significance in research, they have to get the right sample size. In effect, a researcher is supposed to consider these and many other factors when calculating the sample that is to be used to complete the research study.

Interestingly, researchers should ensure that they use the ideal sizes of samples in their studies because using either very small or very large samples have far-reaching effects on the findings of studies. On the one hand, when

researchers use very small sample sizes, they inadvertently increase the chances of committing a form of error in which researchers can accept as valid a premise which is false (Betz, 2010). Given that scientific studies are based on testing hypothesis, if a researcher uses very small sample sizes in studies, the researcher may either accept or reject the hypothesis based on the findings of the sample. If the sample size that is used in the study is very small, then the researcher may have committed a big mistake by either accepting or rejecting a hypothesis based on the sample.

Another adverse effect of using a small sample size to complete scientific research relates to the effect of the erroneous findings on the stakeholders to the research. In typical scientific studies, public resources may be used to fund the studies (Gauch, 2003). If this is the case, the taxpayer would be the loser because the findings of the research would be erroneous according to the small sample size that would have been used. Similarly, the public may lose even if the research in question was not funded by public resources, but the researchers end up making wrong conclusions because the researchers used very small sample sizes. In a typical example of clinical tests of a drug, the pharmaceutical company that is behind the drug that is undergoing a trial may suffer unimaginable losses if the clinical trials erroneously show that the drug is not effective. The effect of the loss on the companies can be calculated by considering the number of resources that are usually invested in the process of researching and developing new drugs. Therefore, it can be seen that the main disadvantage of using a small sample size is that a researcher can make a wrong conclusion. The erroneous conclusions that researchers may make can be very harmful to many other stakeholders (Figure 7.5).

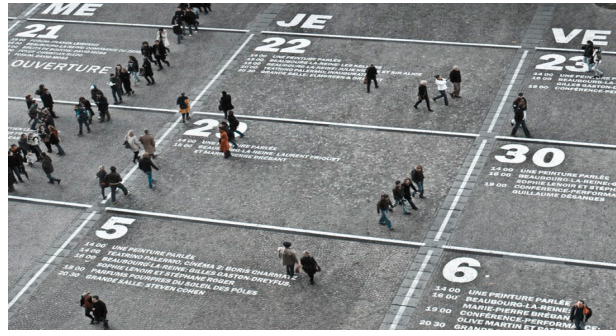

Figure 7.5: The size of the sample is an important indicator of the quality of a research endeavor.
(Source: Unsplash)

On the other hand, using very large samples may present many other problems to researchers. The main problem that is associated with small samples is that they present technical problems when the researcher is finally analyzing the data. The statistical tools that are used to analyze quantitative data are specially designed to manage small data sizes that ideally form samples (Gimbel, 2011). If the tools are used to analyze very large sample sizes, then their level of effectiveness and reliability drastically reduces. In other words, researchers who use abnormally large sample sizes risk getting results that are less credible than those who use ideal sample sizes.

Another critical weakness of using very large samples is related to the economics of research. In typical scientific studies, researchers have to ensure that the resources that are availed in the form of funding are appropriately utilized. If researchers use very large samples, it means that they end up spending a lot more resources to get results than what they would have ideally used (Ford, 2000). Thus, using very large samples to complete research studies not only compromises the quality of data analysis that is done but also undermines the need for researchers to use resources prudently.

7.4. IMPORTANCE OF SAMPLING

Sampling is one of the most critical aspects of scientific research. The importance of sampling lies in the fact that it determines the direction to which the entire research process is taken. There are many ways in which sampling is essential. Here are some of the most critical reasons for researchers to engage in sampling as part of the process of completing scientific research projects.

In the first place, sampling is necessary because it enables researchers to manage the aspect of time when completing their research projects. It is very important for researchers to manage the time that is allocated for their research projects because it determines whether they achieve their objectives and meet the requirements of the stakeholders of the research process. An excellent example of how timing is essential in research can be seen when one considers a process by which scientists may be researching on a new issue that is affecting the society. If there is a new disease outbreak, and that research studies are supposed to be conducted to determine the extent which the disease is spread in the society, it is important that the study has to be completed within a specified period and produce the required results. For this to happen, the researchers have to understand how to get the right

sample from the entire population.

Also, the researchers have to master the process of ensuring that the sample is relevant to the study and that it can be useful to the research before the time expires. It is because of these issues; it comes into importance. In such a case, on sampling methods, get the right support, and did so that they get the right results. Yeah, sampling, researchers could not manage to complete such a research project within the required time and produce the results that are needed by all the other stakeholders. In conclusion, appropriate, and effective sampling enables researchers to overcome the constraints that they first encounter when researching. Also, using effective sampling procedures help the researchers to complete research projects within the time that is required.

Another importance of sampling in scientific research is seen in the way researchers are supposed to study huge populations at times for them to get the results that are needed. It has already been pointed out in this section of the book that researchers cannot work with entire populations when the populations that they are studying are very large. Ordinarily, scientists who are studying the efficacy of a new drug may have to work with the entire population of people who are unwell. Such a research exercise may end up taking years even decades to be completed against the desires and the needs of the stakeholders of the research process. However, for the researchers to meet the expectations of their stakeholders, they may be required to work with very small populations. The small population that is used in such a scenario is regarded as being representative of all the essential characteristics of the entire population. Moreover, using the small and representative sample enables researchers to achieve their research objectives and then use the findings of the entire study to describe the effect of the process that they are studying on the entire population even when they are not studying the whole population. Sampling in scientific research is critical because it enables researchers to avoid looking at all the items that form the populations but only focus on a small group of items or individuals and then use the findings to extrapolate and find the relationships of the variables within large populations.

The third importance of sampling in research is related to cost. Completing a scientific study is usually a very costly affair because of the amount of money that is used not only to get the data but also to access the information that the researchers need for them to achieve the objectives. One of the most important and costly aspects of any research process is to get raw data from

the population of items or individuals who are used as the subjects of the research. Researchers have to travel long distances, develop, and administer questions and review primary sources of data to get information that they need for them to complete their research processes. For this to happen, they need a lot of funding because in some cases, accessing critical data may be costly to everyone who is involved in the research process (Betz, 2010). It is important to note that sampling enables researchers to complete research studies within the required time and budget. Consequently, it can be seen that sampling enables researchers to overcome the expensive costs of completing research studies and do so within the required time.

Another importance of sampling in scientific research is seen in relation to the errors that researchers at times commit when they are completing their research studies. It has been pointed out that any research process can be affected by the errors which researchers may inadvertently commit when carrying out activities of the research process (Boudon, 2005). Standard errors that are committed by researchers revolves around the selection of the sample that is used in the research. If researchers fail in the process of selecting a suitable research sample, then the findings of the research may not be regarded as credible. Moreover, if researchers use the wrong methods or approaches to process the data that they collect during the research process, then the findings of the research might be undermined by these errors. The sampling process that is used in research is supposed to help researchers overcome such kind of errors which are related to selecting the sample that they use in their studies.

All sampling methods are based on the concept of ensuring that every individual item that is found in the research sample frame stands an equal chance of being included in the sample that is used in the study. When researchers use sampling, they ensure that they overcome the possibility of committing the error associated with selecting sample items that do not meet the required standards.

7.5. BIAS IN SAMPLING

Sampling bias is one of the most critical issues related to scientific research in general. Bias in sampling can be defined as a type of error in research in which the researcher fails to get credible answers because of the way of collecting data that is used (Hayler, 2016). For any research process to be successful, the right kind of data using the right process should be accessed and used. However, the process fails at times, and this may lead to the

commission of errors which are related to the sampling process that is used in the research. For example, researchers at times may collect information that they do not need for the research process that they are undertaking. In some cases, researchers may fail to get the information that meets the requirements of their research projects. Therefore, sampling bias is a form of error in which the findings of a research process are based on a faulty or wrong premise.

In scientific research, bias refers to an error in which the researcher does not get the right kind of information because they use a sample that has faults or errors in it. The following is a brief discussion of some of the most important ways in which bias occurs in the sampling process that is used in scientific research.

One of the ways in which bias in the sampling process in scientific research occurs relates to the way the researcher accesses the sample that is used in the study. Ideally, scientific research is based on probability sampling methods. Probability sampling methods are used in such a way that, all the items that are included in the final sample of the research using methods that are specially prepared for the process are chosen by a random method. On the other hand, nonprobability sampling is usually based on the independent judgment of the researcher when selecting the items that are used in the sample for the entire research process.

It can be seen that non-probability sampling exposes an entire research process to the errors that are committed by the researcher when identifying the items that used in the research sample. A good example of how nonprobability sampling is an important source of sampling bias in a research process is seen in the way a researcher may deliberately select some items and leave out others from the final sample of the research. Given that the researcher may not be required to give a valid explanation for leaving other items out, it follows that the final sample may not be representative of the population. In other words, a researcher who uses this method to come up with the sample may simply base the decisions on personal preferences as opposed to using verifiable and objective methods of selecting the items.

It is important to note that the entire scientific method is based on the concept of objectivity. Objectivity means that researchers should select sample items using a scientifically proven method rather than relying on personal preferences and judgment. Therefore, when nonprobability sampling used in scientific research, the researcher may commit the error of selecting sample items using personal preferences as opposed to using

scientific processes or methods. Another very important of sampling bias in scientific research process relates to the relationship between the sample frame and sample population that is used. It should be remembered that the sampling process is a culmination of the process of scientifically identifying items or individuals that fit a specific sampling frame. Moreover, it should be noted that the sample is a subset of the sample frame which, in turn, is a subset of the sampling populations. What this means is that for the sample population to be wholly studied in the scientific research process, the researcher is supposed to use a process that ensures that the items which are included in the final sample are representative of the salient characteristics of the entire sampling populations.

At times, the final sample that is used in a research process fails to represent all the characteristics of the sampling populations (Kershaw, 2011). This error may happen if the researcher does not properly use the methods which are supposed to be employed when selecting the final items that will get included in the final sample. If this is the case, entire findings of the research process cannot be regarded as credible because the sample population that is used does not reflect all the characteristics of the entire population.

The third source of sampling bias in scientific research is related to the extent to which the items that are included in the final sample as used in the research process. When researchers are using humans as the subjects of the research process, they may face a major challenge when the people who are supposed to provide the data that is to be used in the research deliberately refuse to provide information. Subjects or participants of the research process may be unwilling to provide accurate information that is supposed to be used in the scientific research process for various reasons. For example, some people may be unwilling to provide information because they feel that the findings of the study will not be beneficial to them (Gunn, 2011). In other cases, participants may refuse to provide information because they feel that they do not understand the nature of the research study (Ekko, 2008). In these and many other cases, the failure of the participants to provide data may be a cause of an error in the sampling process. Moreover, the error that may occur in the research process at this time may end up undermining the overall quality of the final findings of the research.

In this chapter, information about the methods that are used to develop samples in scientific research has been discussed. Also, definitions of samples, sampling frames, and target populations, as they are used in

scientific research, have been presented in this chapter of the book. It has been indicated that the sample size is an important determinant of the quality of the findings of any research study. Researchers are supposed to use the best methods to arrive at the right sizes of the samples that they use in their studies. It has also been indicated that if researchers fail to use ideal sample sizes, they may produce results that are erroneous. For example, using very small sample sizes may lead to the commission of a common type of fallacy in scientific research in which the null hypothesis is accepted yet it is not true. Also, the use of abnormally large sizes of samples for scientific research studies may undermine the quality of the research because it may lead to dilution of the effectiveness of the data analysis processes that are normally used in scientific research. The next chapter of the book presents information about analysis of data in scientific research.

8
CHAPTER

DATA ANALYSIS IN SCIENTIFIC RESEARCH

'If you torture the data long enough, it will confess.'

—Ronald H. Coase

CONTENTS

The purpose of this chapter is to present detailed and accurate information about data analysis in scientific research. The chapter contains information about the definition, purpose, and principles of data analysis. Also, the chapter presents information on the specific techniques that are used to analyze data in scientific studies. Moreover, details on the importance of data analysis and the common errors that researchers commit when they are analyzing data in scientific studies are included in this chapter of the book. The main purpose of the chapter is to offer a concrete introduction to the methods that are used to analyze quantitative data which is mostly used in scientific studies.

8.1. DATA ANALYSIS: DEFINITION AND CONCEPTS

Data analysis can be defined as a complex process by which researchers impose order on the mass of data that is collected in the entire research process (Pickering, 2008). It should be noted that in any research process, researchers may be bombarded by a lot of information or data. The researchers are supposed to consider the data when answering the questions of the research. The data that researchers receive is usually collected from the field or all the other secondary sources of data that are used in the course of a research process. For researchers to answer the research questions, they need to analyze data by administering specific processes and procedures on the data and to get the information that they need. Therefore, data analysis provides the method which researchers use to analyze the data and identify important information from the patterns that exist in the data. It is based on data analysis that researchers can effectively test the hypothesis that they use in their studies.

Usually, data analysis is conducted using scientific methods which have been specially prepared for the purpose. It happens that scientists rely on these methods to determine the extent to which the data that they have addressed the specific needs of the research (Kothari, 2004). For example, scientists may use statistical methods to calculate specific measures which can be used to derive important information from the data that is used in the research process. The statistical measures may be related to correlation in that the researcher uses to them to determine whether there is a correlative relationship between two variables that are used in a research study. Also, the statistical measures that are used in research studies may be based on the need to determine causality between variables. A researcher may use the

measures to determine whether the relationship between two variables that are used in a research study is causal.

It is important to note that from the definition of the data analysis process that is presented in this section of the book, the process of data analysis is used to identify what is normally referred to as a signal from the noise that is contained in the mass of data that researchers have to deal with (Khan, 2011). In other words, the data analysis process is used to identify specific patterns in the data that are relevant to the researcher. Also, the process helps the researcher to identify and ignore other patterns that are not relevant to their research studies. Also, it is important to note that for researchers to complete the data analysis process, they normally use two forms of logical reasoning: induction and deduction. Induction is a form of logical reasoning in which the researcher works from a given standpoint by getting information that supports the standpoint. For example, if a researcher states that a particular substance that is contained in plastic causes cancer, then the researcher may prove the statement by collecting data that shows that indeed the substance causes cancer. This approach is inductive because the researcher works from a given point of view and tries to get as much information as possible that can be used to support the position.

On the other hand, deductive reasoning is seen when a researcher works through a mass of information to reach a specific conclusion. In the given example, if a researcher who is working on a different issue but uses plastics in the process suddenly discovers that there is a relationship between exposure to the substance and cancer. In such a case, the researcher deduces that the substance causes cancer unlike what normally happens when a researcher uses inductive reasoning. It is important to note that all these methods of reasoning are facilitated by the data that researchers collect and analyze in the course of the research. What this means is that researchers make use information of the information to make conclusions about the kind of issues that affect the entire population which forms the subject of the studies that they conduct.

It is also noted that data analysis is based on the concept of a data nodes that are used in the research process (Kumar, 2010). Data points or nodes are specific patterns that are seen in the data that is used in the research process. Normally, the patterns become apparent when the researcher subjects the data to rigorous analysis procedures. It is also important to remember that researchers normally collect data using a specific framework that has been specially prepared for the process. The framework normally contains the

kind of questions that the researchers use on their sources so that they get the data that they need. Also, the framework is related to the entire approach that is used to carry out the research. The need for the framework to be in tandem with the entire research approach cannot be overemphasized. If the researcher uses a method that does not match the nature of the research study, then the researcher may not get accurate results.

Also, the framework is used to present the data or information at the end of the research process. Therefore, in any research process, the researcher normally uses the framework that that has been specially developed not only collect the data that is needed for the research, but also to analyze the data to identify specific patterns and answers to the questions that are used in research. What this means is that data analysis does not take place in a vacuum. In practice, data analysis is a process that is intertwined with all the other complicated issues that are handled in the research process (Chand, 2003). It is common for a researcher to rely on a data analysis process that meets the requirements or is in line with all the other aspects of the research process. For example, if a researcher is carrying out a qualitative study, the researcher may be required to use qualitative methods of analyzing the data to ensure that the entire research process is carried out uniformly. Similarly, if a researcher is conducting a study that is heavily reliant on quantitative data, as it is the case in all scientific studies, then the researcher may have to use an approach that is related to this kind of data.

Similarly, if a researcher uses a mixed methods approach when carrying out a research study, then the researcher is supposed to stick to methods of data analysis that are suitable for such a study. It is when a researcher uses such a method when analyzing the data that they can get all the information that is needed to achieve the objectives of the research. It is for this reason that researchers need to understand the nature of their studies and stick to methods that are in line with the specific features of their research studies. For example, it would be inappropriate for a researcher to use quantitative methods of analyzing data to deal with data that is nonnumerical. In the same way, a researcher cannot use qualitative methods to analyze a dataset that is quantitative. Therefore, it is of paramount importance for researchers in the sciences as well as other disciplines to use data analysis methods that are in line with the research approach and methodology that they use.

Two types of data analysis are used in scientific research. The first type is what is referred to as qualitative data analysis. Qualitative data analysis is used to analyze data that is part of the research process that is qualitative.

A qualitative study is one in which the researcher concentrates on accessing and analyzing information that is not numeric. In general, there are many examples of qualitative studies that can be pointed out here; however, suffice to mention that that qualitative approaches to research are rarely used in scientific studies. However, in other disciplines, researchers may resort to using this approach to complete their research studies.

The quantitative, qualitative framework of describing data analysis is broad. In general, there are many methods which are used by researchers in practice but which are not covered by this framework. There are many instances in which the researcher is supposed to use aspects of both methods when completing their research studies in the sciences. For example, when a researcher is conducting research based on testing the efficacy of a process, and the researcher is supposed to use a framework that meets all the requirements of the study, it is common for the researcher to use a mixed methods approach to complete the study. Thus, it is clear that using the mixed methods approach means that researchers may utilize qualitative and quantitative data as part of the research process. Also, this observation implies that researchers may use qualitative and quantitative methods to analyze the data and answer the questions of the research, depending on the nature of the studies that they carry out.

8.2. SIMILARITIES BETWEEN QUANTITATIVE AND QUALITATIVE DATA ANALYSIS METHODS

It has been pointed out that both qualitative and quantitative data analysis methods have specific similarities and differences. The following is a brief discussion of some of the most important similarities between quantitative and qualitative methods of analyzing data in scientific research. In the first place, data analysis processes are hinged on the concept of inference. Inference, within the context of research in the sciences, is the process that researchers get information about the research questions by analyzing the data and then using the findings to make conclusions about the populations that they study (Gold, 2012). It should be remembered that researchers normally cannot study entire populations and only rely on small samples to study specific attributes of the populations that are of interest to them.

There are three important things which form the process of inference as it is used in data analysis in research. The first one is that the entire referencing process relies on the use of reasoning or logic. Logical reasoning can be described as a process by which a researcher uses specific methods to arrive

at desired conclusions for a research study (Betz, 2010). The second one is that in both processes, the researchers have to rely on the evidence before they conclude. Evidence can be in the form of data or any other information that support specific points of view which are adopted or posed by the researchers during the research process. The third one is the entire inferencing process is carried out with the aim of reaching specific conclusions. Researchers infer specific issues as a way of testing their hypothesis and making valid conclusions about the issues that they investigate in their studies.

It is important to indicate at this point that both quantitative and qualitative methods of analyzing data rely on these methods and inferencing for them to be complete. In practice, inferencing is used in studies that use both qualitative and quantitative types of data. Another important similarity between quantitative and qualitative methods of analyzing research data is what is referred to as comparison. In general, it is through comparison that a researcher can determine whether two phenomena that are used in research are similar to or different from one another. Thus, it can be argued that comparison is an important aspect of research in general and scientific research in particular.

There are many reasons for using comparison in scientific research. In the first place, scientists who are conducting studies may be required to compare the phenomena that they are examining. For example, it may be necessary to examine the extent to which two processes or items which are the subject of the study have similarities in their characteristics or behavior. Also, it may be necessary for researchers to use comparison as a way of determining the extent to which two variables are related with one another in the form of causality. If two variables are related to one another in the form of causality, then it means that if one variable is present, then another one occurs. If two variables do not have a causality relationship, then it means that the emergence of one variable does not necessarily mean that the other one will follow. Also, a comparison may be used to determine the extent to which two variables are related to each other and the context of the correlation. Correlation is an important aspect of scientific research because it is used to determine whether changes in one variable lead to similar or different changes in other variables to that used in the research (Gold, 2012). In this case, the comparison is used to determine the extent to which correlation between two variables exists and indicate ways in which the correlation relationship can be used to identify and address the specific needs of the whole research process (Figure 8.1).

Figure 8.1: Data analysis forms the foundations for the conclusions that researchers make in the course of conducting research studies.

(Source: Unsplash)

Another important similarity between quantitative and qualitative methods of analyzing data in scientific research is related to the need to minimize errors. It is always important for researchers to devise methods that they can use to minimize the commission of errors during the research process. It has been indicated before that normally, the commission of errors usually undermines the quality of the entire research process or the findings of the research. If research is comprehensive of errors, and the findings of the research cannot be independently verified, then the research cannot be regarded as one of high quality. Thus, it is because of this reason that researchers use specific methods to ensure that they identify possible causes of error and develop the right methods to prevent the errors from occurring.

During the process of analyzing qualitative or quantitative data, the researcher usually focuses on identifying potential causes or sources of the errors, and development and methods to address the problems. For example, in quantitative data analysis, researchers use specific methods to prevent the development of errors which may lead to faulty or questionable results. Also, in qualitative data analysis, researchers are supposed to use specific methods that can be relied upon to help them to avoid committing errors in the process of analyzing the data. Therefore, the need to avoid committing errors is an important similarity between qualitative and quantitative data because it is used in both forms of analyzing data in scientific research processes.

Another important similarity between quantitative and qualitative data analysis methods is that both processes are used in such a way that the researcher relies on the design of the study when managing them. It is easy for one to understand the implication of the similarities between these two methods of analyzing data by considering that in any given research, the data analysis method that is used is part of the whole design of the research. It has already been indicated that if a researcher is carrying out a qualitative, then it is necessary for the researcher must use qualitative methods to analyze the data and present a method in ways that are in line with qualitative requirements of research. Similarly, a researcher conducting a quantitative study is supposed to analyze data using a quantitative method and also present information that is uniquely used in quantitative studies. Therefore, in this case, the researcher uses a method that is in line with the design that is used for the study.

8.3. DIFFERENCES BETWEEN QUALITATIVE AND QUANTITATIVE DATA ANALYSIS

There are many important differences between qualitative and quantitative methods of analyzing data research. On the one hand, the differences between the two methods are important because they determine the quality of the outcome of the studies that are conducted using either of the methods. On the other hand, it is when a researcher understands the key differences between qualitative and quantitative methods of analyzing data that the researcher can competently use the methods. The following is a brief discussion of the most important differences between qualitative and quantitative methods of analyzing research data, particularly in the sciences.

One of the major differences between analyzing data using quantitative and qualitative methods lies in the fact that qualitative methods are based on words while quantitative methods are based on figures. The essence of qualitative methods of analyzing research data is that the researcher collects and carefully analyze the information that is contained in the words which are collected in the course of the process of the research (Ekko, 2008). A researcher who is conducting a qualitative study relies on specific methodologies that have been designed to help researchers analyze words to identify special themes and any other information that can be used to address the needs of the research. Therefore, for qualitative methods, the researcher does not have to use statistics to analyze the information to answer the research questions. However, it is important to note that the

use of words to analyze information in research studies as it defines the qualitative approach to analyzing data is not as precise as when a researcher uses figures. Analyzing the themes and other important forms of information that are contained in texts in qualitative research means that the researcher relies on the context and meaning of the words as opposed to using very objective methods that are based on statistical processes as it is used in quantitative analysis. Therefore, it has been observed that regarding the issue of objectivity, qualitative data analysis is less reliable than quantitative data analysis method (Hayler, 2016). It is important to note that does not mean that qualitative data analysis is in. Detective data analysis. On the contrary, it largely depends on the kind and nature the study that is being conducted.

Another important issue related to the quantitative method of analyzing data in research is based on statistical methods and processes. There are many statistical measures that are used to analyze data in research. For example, the researcher may use what is referred to as descriptive statistics to describe the basic features of any sample that is used in research. Also, quantitative research normally entails the use of various methods to measure specific aspects that are addressed in any given research study (Gold, 2012). For example, it is common for researchers to use specific correlation measures to measure the extent to which two variables are related to one another. Also, it is common for researchers to use quantitative data analysis methods to measure the strength of the relationship two variables that are used in research. From the preceding, it can be seen that the fundamental difference between qualitative and quantitative methods of analyzing data lies like the data that is used. Whereas qualitative data is based on textual data, quantitative data use figures.

Another important difference between quantitative and qualitative methods of analyzing research that arises in the level of standardization of the processes. Standardization refers to the extent to which a researcher is supposed to follow specific processes and methodologies when using any of the methods of analyzing data that are used in research studies (Boudon, 2005). For example, when a researcher is conducting research which is founded on qualitative methods, the researcher has room to use the basic methods of analyzing data to get the answer that is needed. What this means is that qualitative data analysis is not a standardized as detective data analysis methods. Moreover, a researcher who is conducting a qualitative study may be free to use many methods which are subjective and which are not tied to specific and standardized processes of analyzing information. However, in the case of quantitative data analysis, the researcher is tied

down to specific statistical approaches and activities which are supposed to be undertaken as part of the research process. In other words, carrying out a study based on quantitative data analysis means that the researcher has little room to manipulate the process. This observation further means that regarding objectivity, quantitative data analysis is more reliable than qualitative data analysis. However, it should be remembered that in scientific research studies, the emphasis is on using quantitative data and, by necessity, quantitative data analysis methods. In some studies that are non-scientific in nature, the researcher may choose to use both methods to complete the study. In such cases, the choice of the method that is used to complete the study depends on the nature of the study and the expertise of the researcher.

Another important difference between quantitative and qualitative methods of analyzing data lies in the approach that researchers use when employing the two forms of data analysis in their research endeavors. Primarily, in qualitative studies, the essence of the research is to generate new theories and expand the repertoire knowledge that exists in any given field (Smith, 2009). It is for this purpose that the researchers who use the approach test the theories that exist and then use personal information to formulate new theories. By so doing, researchers who conduct studies using this approach can effectively expand the areas of knowledge on which the research is based. However, in quantitative research, the researcher is motivated by the desire to test a hypothesis and determine whether they are true or not. In other words, the essence of conducting quantitative research is that the researcher is testing the truthfulness of the proposed theory. Strictly speaking, this approach to conducting research may not be said to be an effective way of generating new theoretical knowledge.

From the preceding discussion, it can be seen that there are many differences between quantitative and qualitative methods of analyzing data in research in general and in scientific research in particular. It is necessary to mention at this stage that in scientific research, the primary method that is used to analyze data is the quantitative one. A researcher who is conducting a qualitative study in the sciences is supposed to reply to statistical tools to measure the extent to which the hypothesis is true. Also, such a researcher is supposed to determine whether there are relationships between the variables that are used in the research. This argument implies that unlike what the case is in studies that are conducted in other disciplines such the humanities and social sciences, in the natural sciences, the purpose of the researcher is to use statistical tools to test hypotheses and determine the kind of relationships between variables that may exist.

8.4. DATA ANALYSIS METHODS

Many methods can be used to analyze data quantitatively. Moreover, the researcher may choose specific tools from the methods when handling research data. Some of the factors that define the various methods that are used to analyze quantitative data include the level of complexity that is involved in the process, the amount of time that it takes to use the methods, and the suitability of the methods for specific research studies. In practice, a good researcher is supposed to understand how to use all the methods of analyzing quantitative data for the researcher to be able to complete research studies in the sciences comfortably. The following is a brief discussion of some of the most important quantitative data analysis methods that are used in scientific research studies in general (Figure 8.2).

Figure 8.2: The choice of the method that is used to analyze data depends largely on the nature of the research study.

(Source: Unsplash)

The first important method of analyzing quantitative data that is used in scientific research studies is referred to as descriptive data analysis. Descriptive data analysis refers to a method that is applied to a set of data as one of the most important and preliminary steps of analyzing data. The importance of descriptive analysis lies in the fact that it is used to provide the initial and general description of a set of data that is used in a research study (Kothari, 2004). When a researcher has all the data prepared and ready to be analyzed, the researcher may refer to the data analysis to have a brief

overview of the way the data is organized and get general information about what can be described from the data. Therefore, descriptive analysis is used by researchers to help them gain a basic understanding of how a sample of data is organized, some of the most important things that can be derived from the data, and what the most important measures that should be used to gain further insight from the data in the future. It is important to bear in mind that some of the major statistical measures that are used to calculate basic descriptive statistical features of a sample of data cannot provide a lot of insight into the data. However, one can confidently rely on the general measures to get the most rudimentary information about the data. Also, a researcher can use the measures to figure out the most important and detailed statistical methods that are supposed to be used on the data to gain important information that would enable them to answer the questions of research.

Another important method of analyzing quantitative data is what is referred to as exploratory analysis. As the name suggests, an exploratory analysis is a method that is based on the need for the researcher to determine or explore possible relationships between variables in a set of data. In a typical quantitative study, the researcher is supposed to determine whether two or more variables are related to each other and if the relationship exists, to analyze the nature of the relationship (Khan, 2011). It needs to be remembered at that when a researcher determines that there is a relationship between two or more variables, in a study, it does not mean that the researcher has proven that the relationship is positive. There are many examples of variables which are related to one another but which in practice do not result in each other or have a causal relationship, as is known in technical terms. However, a researcher can use exploratory analysis to measure the nature of the correlation between variables as well as to prove whether two or more variables are related to each other (Kumar, 2010). What this means is that exploratory analysis is a more advanced form of quantitative data analysis than a descriptive method of analyzing data. Therefore, a researcher may start with the descriptive analysis method before proceeding to use the exploratory methods of analyzing research data.

Another important method of analyzing quantitative data in scientific research is a predictive method of analysis. Predictive analysis is based on the premise that data that has been collected about specific issues or phenomena can be used to describe changes that may occur in the phenomenon in the future (Chand, 2003). It is important to point out that using predictive analysis to analyze quantitative data is one of the most important methods that are used in scientific research studies. In some scientific research studies,

it is necessary for the researchers to predict the changes that may appear in the future and to develop specific models that can be used to analyze those changes. Predictive quantitative data analysis methods provide the right framework that can be used by researchers to not only predict the future but also to develop the most appropriate approaches that can be used to manage the effects of the future changes.

It has been pointed out, that one of the most important things related to predictive data analysis is that the future is not predicted by the variables of the research but rather by the model that is used. In other words, When a researcher uses predictive data analysis methods on any sample of data, the predictions that they make are not indicative of the behavior of the research variables in the future but on that of the models. For the predictions to be true, it is necessary for the conditions that are created in the models to take place in real life. Therefore, when the predictive analysis method is used to predict the future, it does not mean that variables used in research will be the cause of the future changes.

Another importance of quantitative data analysis method that is used in scientific research is related to causal analysis. Causal analysis is a method of analyzing quantitative data that is used in research. The use of the method is based on the observation that it is possible for two variables to have a causal relationship. A causal relationship exists between two variables if the existence of one variable leads to the emergence of the other. A very simple example of a causal relationship in scientific research is seen in a study in which scientists attempt to determine the cause of an illness in a sample of individuals. In such a case, the scientist may try to prove the existence of a certain condition which may be regarded as a variable for the research, is the reason for the emergence of the other variable in the research, which in this case which in this case is the illness. Therefore, in such a case, the work of the scientist is to prove that the timeframe between the occurrence of one variable and that of the other is the determining factor that is used to indicate the existence of a causal relationship between the variables.

As it is the case with all the other quantitative data analysis methods, using the causative data analysis methods requires that the researcher builds specific models that can be used to predict and analyze any positive relationship between the variables. The models are built based on various designs that are used to conduct quantitative scientific research such as the randomized trials and others which are suitable for the study. The researcher then uses the models to test for causality between variables that are used in

the research. Another important method of analyzing quantitative data in scientific research is what is referred to as inferential data analysis. As the name suggests, inferential data analysis is based on the need for researchers to infer specific conclusions and use them on the entire study populations based on the samples that they use. It should be remembered that researchers identify a small sampling frame, then use specific methods to identify the elements or individuals who are used in the final sample of the study. Once the researchers have tested the hypothesis and determined whether it is true or not, the researchers can then report their findings. In other words, the entire process of analyzing data is based on the choice of the methodology that is used in basic scientific research processes.

8.5. IMPORTANCE OF DATA ANALYSIS IN SCIENTIFIC RESEARCH

There are many ways in which data analysis is important in research. The following is a brief description of some of the most important ways in which data analysis is relevant for research studies. Statistical analysis forms the most important part of the entire research process. In scientific research, a researcher depends on statistical analysis to complete the research. The essence of the scientific method is first to formulate a hypothesis and then to use the data that is collected to test the truthfulness of the hypothesis. If the data shows that the hypothesis is not true, then the researcher will have to accept the alternative hypothesis as a valid explanation of the phenomena that is under investigation. On the other hand, if the researcher finds that the hypothesis that is being tested is true, then the researcher accepts the null hypothesis as a valid explanation of scientific phenomena.

Statistical analysis provides a means for the researcher to test the hypothesis and complete the research process (Chand, 2003). A researcher will use statistical analysis methods to test the data that is collected and complete the entire research process. Thus, data analysis is important in scientific research because it forms a critical step in the entire process of scientific research (Figure 8.3).

Figure 8.3: Many statistical measures are usually used to analyze quantitative data in research studies.

(Source: Unsplash)

The importance of data analysis is tied to the objectives of the scientific research. For example, individuals conduct research to compare or contrast things. Research studies that are based on comparing or contrasting things are meant to help the researcher identify differences and similarities between phenomena. For researchers to achieve this objective, they have to use statistical methods. Some of the statistical methods that are used by researchers to identify similarities and differences among phenomena include descriptive statistical analysis methods and others. Therefore, statistical analysis is important because it helps researchers accurately identify similarities and differences among the phenomena that they are interested in.

Second, statistical methods are important because they help researchers to make predictions about issues upon which the research is based. In some scientific researches, researchers are interested in predicting how phenomena will change in the future. In such cases, the basic objective of the research is to determine whether the phenomena will change in the future and, if this is the case, the extent to which the changes will occur. Statistical methods are important because they help the researcher to carefully predict the future by examining trends that have occurred in the past. A good researcher can use the trends to make very accurate predictions of trends of the phenomena. For

example, a researcher can use past statistics that indicate the prevalence of a condition within a given population to make future predictions about the prevalence of the condition on the population. Therefore, statistical analysis is important because it helps researchers to predict future trends.

Another importance of statistical analyzes is related to testing the relationship between variables. It has already been indicated that scientific research is carried out with the purpose of testing existing relationships between variables. The relationships between variables that are tested in scientific relationship scientific studies maybe causal or correlative. Causal relationships are based on the fact that one variable causes the emergence of the other. On the other hand, correlative relationships are based on the fact that changes in one variable lead to changes in the available. Statistical analysis provides researchers with the best tools that can be used to determine the nature and extent of relationships among the variables that are used in research studies. In the case of testing for causality, researchers can use statistical methods to determine whether one variable causes the existence of another. In the case of correlation, researchers can use statistical methods as tools to not only determine whether two variables are connected to each other but to also determine the nature of the relationship between the variables (Khan, 2011). Therefore, it can be seen that using statistical analysis methods is necessary for a scientific research project because it provides the means that researchers need to not only determine whether two or more variables are related to one another but also to help them understand the nature of their relationship.

Therefore, it can be seen that data analysis is important to researchers because it provides a method that the researchers can use to analyze and interpret the data that they normally collect from their source. Also, data analysis is important for scientific research because it provides a method that the researchers can use to analyze possible relationships among the variables that are used in any scientific research study. By relying on data analysis methods, researchers can determine whether there is a causal or correlative relationship between the variables that are used in scientific research projects. Also, by relying on the provisions of data analysis methods, researchers can effectively complete research projects in the sciences.

In this chapter, detailed information about the subject of data analysis in scientific research has been presented. It has been pointed out that data analysis is one of the most critical aspects of scientific research because scientific research is largely based on quantitative data. Also, in the chapter,

important information about the types of methods of data analysis that are used in scientific research has been presented. It has been indicated that the choice of the method that the researcher uses largely depends on the preferences of the researcher on the one hand, and the needs of the scientific study that is being conducted on the other hand. Apart from information about the definition of data analysis and the methods that are used to conduct data analysis in scientific research, information about the similarities and differences in qualitative and quantitative data analysis methods and presented in this chapter of the book. It has been indicated that there are salient features which differentiate quantitative and qualitative methods of conducting data analysis for scientific research studies. The next chapter of the book contains details about experimentation in scientific research.

9
CHAPTER

EXPERIMENTATION IN SCIENTIFIC RESEARCH

'No amount of experimentation can ever prove me right; a single experiment can prove me wrong.'

—Albert Einstein

CONTENTS

The purpose of this chapter is to present information about experimentation, which is the most common form of research design in the sciences. In the chapter, a discussion on the importance of experimentation, the reasons for the use of the method and the procedure that is used to conduct typical scientific experiments is presented. Also, information on the types of experiments and how researchers need to approach the process of experimentation is included in this chapter of the book.

9.1. WHAT IS EXPERIMENTATION?

Experimentation is one of the critical aspects of the research methodology in the sciences (Ford, 2000). The basis of experimentation is that the researcher performs a series of tests on a sample to determine the impact of the tests on the items that make up the sample. In any typical experiment, the researcher has to prepare for the whole experiment, conduct a series of tests and then analyze the results of the tests in light with specific objectives. Also, the researcher seeks to test a specific hypothesis to determine their truthfulness by subjecting the items that make the sample to carefully designed and controlled tests.

The experimentation method can also be defined as the approach to conducting research studies in which a systematic and scientific method is used to change or manipulate variables and then detect and measure the changes that occur in the other variables (Betz, 2010). In this definition, the interrelationship between the dependent and independent variable is clearly emphasized. Thus, the experimentation method is regarded as a highly logical and carefully controlled process of studying the effects of changes on one set of variables on the other set of variables.

It is important to indicate that this definition applies to the physical sciences where strict experimentation is used. In other disciplines such as psychology and applied sciences, the definition of experimentation is tied to the rigidities of manipulating variables and measuring the effect of the manipulation on the other set of variables. In many experimentation studies in applied sciences, the researchers are not supposed to stick to the strict interpretation of the method as it is the case in studies that are conducted in applied sciences disciplines (Figure 9.1).

Figure 9.1: The essence of experimentation is that a researcher tests the effect of treatment on a sample under very controlled conditions.

(Source: Pexels)

In practice, an experiment is anchored on various theoretical and practical principles. It is the manner in which the principles interact with one another that the complex relationship of theory and observation is brought to the fore in the experiments that are conducted. In other words, the principles that are used to define experimentation can be divided into two categories: those that are based on theory and the others which are based on observation.

On the theoretical level, experimentation can be described as a process that is used to determine and measure the cause and effect relationship that may exist among variables (Ford, 2000). This definition implies that for any experimentation process to be successful, the researcher must clearly define what is meant by cause and effect. The meaning of cause and effect as they are used in experimentation processes are usually outlined in the objectives of experimental studies. Researchers normally identify possible cause and effect relationships in the world and them construct objectives that help them to test whether the relationships truly exist. Also, as part of the experimentation process, researchers usually attempt to determine the nature of the cause and effect relationships among variables.

The observation level of experimentation contains the treatment-outcome construct or principle. The essence of this principle is that when a specific treatment is administered to variables, the variables are supposed to behave in specific ways. It is the work of the researcher to carefully observe and measure the outcome of the treatment process on the variables that are used in the research study. It is based on the actual operation of the

experiment that the effect of the treatment on the variables is seen. To clearly outline the experimentation process, it is necessary for one to understand the meaning of some of the key terms that are used in the process. For example, the dependent and independent variables are some of the most important concepts that are used in experimentation. There is a very clear difference between dependent and independent variables. On the one hand, dependent variables are the factors that researchers are interested in studying and finding out how they behave when changes are applied to the other variables. The independent variables, on the other hand, are the issues which are controlled, changed or manipulated in the course of an experimental study. For any scientific study, the researcher has to define the independent and dependent variables clearly.

Another important concept of experimentation that is worth defining at this stage is the test. In any scientific experiment, the researcher may apply a series of tests or trials to get the desired results. The tests are usually applied to the factors of the experiment. The results of scientific studies are determined by the effect of the trials on the subjects of the experiment. In other words, in experimental studies, the researcher seeks to show that the independent variable causes a change in the dependent variables that are used in the study (Pruzan, 2016). The variable is subjected to specific conditions that are regarded as treatments or trials. The nature of the experiment carefully defines the trials. If a researcher seeks to conduct a major experiment over an extended period, then the researcher may use a series of tests to get the desired results. Moreover, if a researcher only wishes to conduct a short experiment to test a specific hypothesis, the researcher may then have to design the tests or treatments that are used in the research study in line with the requirements of the research.

9.2. THE EXPERIMENTATION PROCESS

For any typical experimental study, the researcher follows a basic process to complete the study. Primarily, the researcher has first to formulate a hypothesis that will be tested in the course of experimenting. It should be remembered that the process of developing a hypothesis is one of the most critical ones that determine the overall success of the research. If a researcher develops an inappropriate hypothesis, the chances are that the findings of the entire study will be strongly undermined. Therefore, a researcher has to devote the time and effort that are required to ensure that they develop the right hypothesis. The hypothesis is usually based on the issue that the researcher

wishes to test or study. At this stage of the experimentation process, the researcher normally develops the null and alternative hypotheses that are used in the study.

The next step in the experimentation process involves deciding on the independent and dependent variables. It is important for a researcher to ensure that they have full control over the variables that are to be manipulated to cause a change in the others. If a researcher does not have full control over one set of variables, then the entire experimentation study may not meet the requirements of a strict scientific experiment. The manner in which a researcher decides on the dependent and independent variables is largely a result of the level of expertise that the researcher shows (Khan, 2011). Researchers who understand the topics of their research well and who have been doing several studies in the past are likely to find it easy to figure out dependent and independent variables than those who are new in conducting experiments.

The next step in the process of experimentation is to limit the number of possible alternative explanations of the effects that are to be observed. It should be remembered that the purpose of conducting experiments is to determine the extent to which the changes in the independent variable cause corresponding changes in the dependent variable. For a researcher to get this result, it is necessary for the researcher to identify other possible causes of variation and limit them carefully.

A good example of how this works can be seen when one considers a typical experimentation process to determine the relationship between the amount of fertilizer that is applied to crops and their rates of growth. In such a study, the researcher may have established about 100 plants that are being monitored in a greenhouse or laboratory setting. The amount of fertilizer that is repeatedly applied at fixed intervals may be accurately measured. The length of the crops, which represents their rate of growth and, forms the dependent variable, is closely monitored. The amount of fertilizer that is applied to the plants forms the independent variable in such a study. If the researcher accurately changes the independent variables and detects, measures, and records the effects of the changes on the dependent variable, then the researcher will accurately explain the effect of fertilizer on the rate of growth of crops. Given that the researcher may also use a control group, it is evident that it will be easy for the researcher to test the hypothesis of the experiment and produce credible findings (Figure 9.2).

Figure 9.2: At the heart of the experimentation process is the need for the researcher to apply the treatment to the variables and observe the changes.

(Source: Pexels)

However, it may be the case that some of the crops that are used in the experiment have been affected by a crop disease and that the researcher has not realized it. In such a case, it can be seen that the crops that have been affected by the disease will grow much slower than those who have not been affected by the disease. Thus, the disease will be an important variable in the experiment that affects the outcome of the whole research. Also, other factors such as the breed of the seeds of the crops and any variations in the level of exposure to climatic conditions may adversely affect the outcome of the study (Kothari, 2004). In such a case, the researcher may have to identify all the other variables that can affect the dependent variable. In other words, the researcher has to ensure that the independent variable dominates the entire research environment. All the other factors that may compete with the independent variable must be identified and eliminated.

The next step is for the researcher to identify and analyze all the changes that occur in the dependent variable in the course of the research. The researcher will have to identify the effects of manipulating the dependent variable on the independent variable at this stage of the experiment. Also, the process of identifying the changes and analyzing them is done within the context of the control group. The control group is usually composed of items that are maintained under special conditions as a way of evaluating the effect of the changes in the dependent variable on the independent variable. In the example that has been provided here, the control group may be composed of a group of crops on which fertilizer is not applied. The rate of growth of the

plants that form the control groups are usually measured at the same time as those that are treated as part of the experiment.

It is important for researchers to use the most appropriate statistical analysis techniques to analyze the data that they collect from their samples. Many statistical tools can be used to measure variance among experimental variables. The choice of the experimental method largely depends on the nature of the data that is collected in an experiment and the other aspects of the experiment. Typically, researchers may choose statistical measures that best explain the variances in their variables. Also, researchers will choose measures that they understand how to use. Therefore, the level of personal experience of the researcher and the nature of the research data are the two determinants of the data analysis method that is used in scientific research.

The analysis of the changes in the dependent variables should be based on the premise that all the observable or measurable changes that occur in the dependent variables should be a consequence of the changes that are applied on the independent variables of the experiment. The changes that are observed and analyzed statistically form the basis for the researcher to draw inferences about the study. In other words, the researcher determines the truthfulness of the hypothesis by considering the results of the process of analyzing data collected from the variables (Kershaw, 2011). If the findings support the null hypothesis, then the researcher will have to adopt it; however, if the findings show that the null hypothesis is not true, then the researcher will have to adopt the alternative hypothesis.

9.3. THE NEED FOR EXPERIMENTATION

There are many reasons for researchers to conduct experimental research studies. The following is a brief explanation of some of the most important factors that make it necessary for researchers to carry out experimental research studies. In the first place, an experiment may be conducted when it is suspected that a correlation between variables. Correlation is a form of relationship between variables which is exhibited when changes in a variable trigger corresponding changes in another variable (Gunn, 2011). For example, the amount of carbon gases that are in the atmosphere has a correlative relationship with the average global temperatures. Studies have indicated that changes in the number of carbon gases that are in the atmosphere affect the average global temperatures. In such a case, researchers may, and they have already done so, set up experiments to determine whether this is the case.

When researchers conduct experimental studies to determine correlation, they are usually motivated by the need to establish the nature and extent of the correlation. The nature of the correlation is usually determined by the kind of effects that a change in one variable causes on the other. For example, a positive correlation is said to occur when an increase in one variable causes a corresponding increase in the other variable. In this case, the relationship between greenhouse gases and global temperatures is positive because an increase in the number of gases produced leads to an increase in the average global temperatures. Negative correlation relationships between variables are said to exist when an increase in a set of variables leads to a corresponding decrease in the other variables. In experiments, very few variables are used. Therefore, a negative correlation relationship between two variables can be easily tested and determined in a typical experimental research study.

While determining the nature of a correlation between a set of variables, researchers normally determine the extent of the correlation. Correlative relationships can range regarding percentages. A strong positive correlation can be contrasted with a strong negative correlation. Similarly, researchers can find a weak negative or positive correlation in their correlation-based experimental studies. Therefore, it is clear that experiments in research may be used to determine the existence of a correlation and measure the relationship to ascertain its nature and extent.

The second reason for experimentation is related to causality. A simple definition of causality is that it is a form of relationship among variables in which the existence of one variable is thought to result in the existence of the other variable (Pickering, 2008). In simple terms, if there is a causal relationship between two variables, Y, and X, then the existence of Y may trigger the emergence of X. Also, if there is a causal relationship between these two variables, then changes in Y may trigger other changes in X (Figure 9.3).

Figure 9.3: Experimentation is used to provide answers to complicated problems that are faced in the society.

(Source: https://www.conferencesthatwork.com/wp-content/uploads/2014/04/2014-04-15-19.06.05.jpg)

Experimentation may be used to determine the effect of time in the causal relationship between two variables. If the time lag between the emergences of two variables is significant, then it can be said that the relationship is a classic one in which cause precedes effect. A simple example of how a cause-and-effect relationship among variables may be established relates to cancer. The researcher may be intrigued by clinical observations to the effect that when patients of advanced cancer are subjected to the first cause of chemotherapy, for example, the rate of growth of the cancerous cells dramatically spikes before it starts to decline. In such a case, the researchers may be concerned with the question of whether the first course of chemotherapy causes an increase in the rate of growth of cancerous cells or not. It should be remembered that there may be many other causes of the condition. The researchers may be interested in the time lag that passes after patients receive the first course of the treatment and the onset of the rapid growth of cancerous cells in their bodies. By conducting a complex scientific research, scientists may establish whether the first course of chemotherapy causes an increase in the rate of growth of cancer cells.

Another scenario that s related to causality and which may trigger the conduct of a scientific investigation relates to the strength of the causality between variables. The strength of causal relationships among variables varies considerably (Kothari, 2004). In some cases, the causal relationship may be clear and very strong that any changes in a variable always causes

corresponding changes in the other related variable. In such a case, researchers may have to experiment to determine the extent of the causal relationship. Such an experiment may also be used to determine the level of consistency, apart from magnitude, of the correlative relationship between variables.

In summary, an experiment is usually conducted to explain phenomena. Researchers are supposed to provide new knowledge about issues that are of interest to the society (Chand, 2003). Research studies are not conducted in a vacuum; rather, they are conducted within the setting of very committed stakeholders. The stakeholders may be academic institutions, individual researchers, students, government bodies and the public. Thus, researchers use their expertise to explain complex phenomena. The explanation may be in the form of indicating that one factor precedes of causes another. Also, experimental findings may be in the form of showing that two variables are either positively or negatively related to each other. Furthermore, the findings of experimental studies may be used to explain changes in phenomena. In all these cases, researchers are supposed to provide information that can be helpful to the society. The findings of experiments may be used to not only explain complex issues but also to develop solutions for specific problems in the society. Therefore, experiments are first and foremost conducted when there is a need for the society to get an explanation of phenomena. Researchers then use experimentation to establish and measure the relationship that exists among variables.

9.4. TYPES OF EXPERIMENTS

There are many types of experiments from which researchers can choose. The choice of the specific type of experiment that is used largely depends m the nature of the study on the one hand and the preferences of the researchers, on the other. Some scientific research studies require that researchers use specific approaches that match the unique qualities of the studies. In such a case, the researchers who are carrying out the study have very few options about the design that they can use. Thus, the nature of the scientific study that is to be conducted is an important indicator of the type of research that is finally used to complete the study (Kumar, 2010). Also, the researchers who carry out scientific studies are individuals who have specific preferences. Some researchers, based on their past professional experience, may favor a few scientific research types. In such a case, it may be necessary for the researcher to stick on using the methods that they are most comfortable with

to complete their scientific research studies.

Moreover, it should be noted that the various types of scientific research studies that are in use today are based on the specific aspects of the design of the studies. In other words, the various types of research studies which are available to researchers today reflect the many ways in which the studies can be designed and implemented.

One of the main types of scientific research studies is what is referred to as a factorial design. The essence of factorial design experiments is that they allow a researcher who is using them to test two hypotheses concurrently. It is possible for a researcher to test two hypotheses in a single research project when using this design because the design allows a researcher to manipulate a set of independent variables and observe the changes on the dependent variables. In other words, when a researcher decides to use this type of scientific experiment, the researcher can test the effect of the changes that are carried out on two independent variables on the dependent variable that is used in the experimental study.

In practice, this form of the scientific research study is suitable for a researcher who would like to save time and other resources when conducting a research study. Instead of a researcher designing an experiment project that is based on the two sets of independent variables, a researcher can implement a research project by using this form of design. If a researcher uses this form of design, they can easily test the changes that occur on the dependent variable of the experiment following the manipulation of the two independent variables that are used in the research study.

The second important type of experimental research in the sciences is what is referred to as randomized block design experiments. The purpose of using this form of experimental design is to address the problem of the effect of differences among subjects on the test that is applied to them. In practice, scientists may have to deal with subjects that have inherent differences. The differences are usually considered important if they can affect the results of the experiment that is conducted. In such a case, scientists have to devise a method of ensuring that the test that is applied to the subjects is not affected by the inherent differences in the characteristics of the items of individuals that or who form the sample for the experiment (Singh, 2010). In this type of experiments, a researcher randomizes the items of the sample into blocks, based on the inherent characteristics of the items. For example, if a researcher is evaluating the effect of a new pesticide on rice and works with various varieties of rice, the researcher may create blocks to represent

the various varieties of rice. It should be noted that using this approach will only be necessary if the researcher is convinced that the salient features of the items of the sample, in this case, the varieties of rice that are used in the study, can influence the findings of the study (Figure 9.4).

Figure 9.4: Treatment is used to change one set of a variable that is used in scientific research to allow the researcher to observe the effect of the change.

(Source: Unsplash)

The third major type of experimental study that is commonly used to complete scientific research studies is the Repeat Measures Design. As the name suggests, this type of experiment is based on subjecting the items that form the sample to various and repeated forms of treatment as a way of measuring the effect of the treatment on the items. The reason for using this approach may be that the items that form the sample are very similar to one another and that the researcher would like to ensure that the treatment and testing processes are highly efficient. In such a case, a researcher does not have to use a control group to complete the study because the subjects of the experiment serve the purpose of control groups. In such studies, the researcher focuses on repeatedly subjecting the items to the treatments and ensuring that the order in which the subjects are treated is randomized (Chand, 2003). The need to randomize the order in which treatments are administered to subjects under this experiment is based on the fact that the response of subjects to treatments is influenced by their experience of the previous treatment. Given that this form of behavior may introduce a type of bias in the findings of the research study, it is important for the researcher

to use a method that can effectively remove all the risks that are associated with this form of bias. The fourth main type of experimental design in the sciences is the Solomon Four-Group Design. As it is the case with all the other experimental designs that are used in research, the Solomon Four-Group Design is used to minimize the chances of error in the research findings. Errors can arise from any of the many aspects and processes of scientific research studies. It is the duty of researchers to identify possible errors in their work and adopt methods that they can use to minimize the occurrence of the errors. The use of this type of experimental design represents an attempt by researchers to minimize the chances of committing errors when completing their research projects.

For this type of research, the items of the sample or subjects are divided into four groups. The four groups are composed of two experimental groups and two control groups. The application of the treatment is applied alternately to the groups as a way of minimizing the chances of occurrence of any of the most common forms of errors that are seen in scientific studies. Moreover, all the four groups are subjected to the posttest treatment as a way of improving the level of validity of the whole research study. The application of the two sets of tests alternately helps to provide credible information that the researcher can use to measure the effect of the treatment on the items that form the sample (Khan, 2011). Moreover, because the groups are subjected to the two tests, the researcher can use the findings to assess the differences in the effects of the first and second treatments on the sample of the population.

The Post-Test Only is another important type of experiment that is used in scientific studies. This method is defined by the way the researcher uses the control and experimental group. In practice, researchers use this type of experimental research when they cannot apply the pretest to the two groups that are used in the study. Thus, in effect, when researchers use this approach to complete research studies, they only apply the treatment to the experimental group. The post-test is usually applied to both groups. In other words, the control group is not subjected to the treatment when researchers use this type of experimental research to complete studies.

Another important type of experimental research that is used is the Pretest-Post-test only design. In this case, as it is in the others, the subjects of the research are either treated as belonging to the control or experimental groups. In this example, the experimental and control groups are subjected to the post-test as a way of assessing the impact of the treatment on the

behavior of the dependent variable (Figure 9.5).

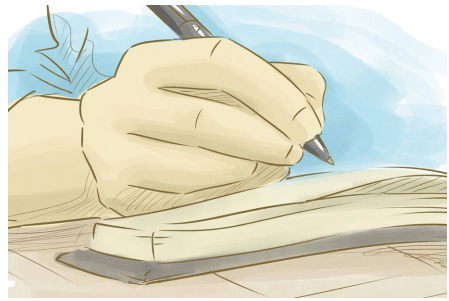

Figure 9.5: All types of experiments are defined by the process of collecting and analyzing data to test the hypothesis.

(Source: https://www.wikihow.com/Test-a-Hypothesis)

In general, these are some of the most important types of experiments that are used by researchers. A researcher can choose any method and use it to complete a study as long as the researcher is convinced that the method meets all the basic requirements of the study that is to be conducted (Betz, 2010). Also, a researcher may select a method based on the need to minimize the errors that may occur when researchers attempt to complete research studies. However, it should be remembered that in all these models of experimentation, the researcher deliberately uses treatment to evaluate the changes that occur on the dependent variables when the researcher alters the independent variables of the experiment.

The essence of this chapter was to provide a concise explanation of the subject of experimentation in scientific research studies. In the chapter, information about the nature and purpose of experimentation has been presented. It has been shown that experimentation is the primary approach that is used by a researcher who is doing studies in the sciences. It has also been pointed out that there is a clear procedure that is followed by all researchers who are doing a study using this design. Lastly, information about the need for experimentation and the various types of experiments that can be carried out by researchers has been presented in this chapter. The next chapter of the book contains information about the ethical considerations that research scientists take when completing their research studies.

In this chapter, information about the experimental method of research has been presented. Details on the definition of the concept of experimentation have been presented in this chapter. It has been pointed out,

and experimentation is a critical don't of conducting scientific research. It has also been indicated that scientists rely on experimentation to not only measure possible relationship among variables to determine the nature and the scientific phenomena. In the chapter, information about a need for experimentation and scientific research has been presented. Agustin that scientists that experiment to determine the nature of relationships among variables. It has also been indicated that the need for experimentation arises from the kind causative relationships that exist between variables. The chapter has also presented information about the various types of experiments that are conducted as part of the scientific research. It has been indicated that the kind of experiments are determined by the kind of format that the scientists follow when conducting the relationships. Thus, the types of relationships depend on the design that is used to conduct all the activities of relationships. The chapter has also presented information about the process of research and is carried out as part of the scientific research process. It has been indicated scientist normal specific process that is defined as the scientific method when completing scientific research studies. The next chapter will present information about the concept of ethics in research.

10
CHAPTER

ETHICS IN SCIENTIFIC RESEARCH

'We define empirical research in biomedical ethics as the application of research methods in the social sciences to the direct examination of issues in biomedical ethics.'

——Jeremy Sugarman

CONTENTS

The main purpose of this chapter is to provide a detailed discussion on the issue of ethical considerations in scientific research. For this chapter to fulfill this purpose, it contains information about the definition of research ethics in the sciences, the various theories that are used to define ethics in scientific research and cases that show the importance of ethics in research in the sciences. Also, the chapter contains numerous examples of some of the most important codes of ethical contact that are used to govern the professional behavior of research scientists.

10.1. ETHICS IN SCIENTIFIC RESEARCH: DEFINITION

Ethics is a complex term because there are many definitions of the term that have been advanced in the recent times (Ford, 2000). It is easy to indicate what ethics is not as one of the first important ways of providing a detailed definition of the concept. The term ethics does not refer to rules and regulations that bind individuals in any given society. Ethical principles or codes cannot be regarded as binding rules and regulations. Individuals are not obliged to follow the rules of ethics in the society but rather, use them to help them behave in ways that are regarded as appropriate in the society. The second important thing about ethics that should be pointed out at this stage is that ethical principles and codes are not static. For any given society, perceptions about good or appropriate behavior change continuously. Many activities were regarded as inappropriate in some societies years ago which are now regarded as appropriate social norms. A good example of the way ethical codes change constantly relates to the issue of gay marriage. In the past, homosexuality was considered an unnatural act, and it was criminalized in many legal jurisdictions in the world. However, in the recent past, as the society has been undergoing social change and social progress, the concept of homosexuality is now widely accepted, and it is no longer criminalized. It is important to note that there are some societies in which the issue of homosexuality is still a controversial one. However, the fact that many societies have not embraced it means that the moral norms of the society, and in effect its ethical codes, change over the course of time.

The concept of ethics refers to ethical principles and codes that are used to guide the behavior of individuals. Ethical principles are used to by people to help them make the right decisions at times when there are many competing and equally plausible options. When individuals find themselves in dilemmas, they are supposed to rely on ethical principles to guide them

in the decision-making process (Gauch, 2003). Moreover, it is important to note that ethical principles are relative and constantly changing. What may be regarded as socially acceptable in one society may be considered a taboo in another. Similarly, the norms of society change with time to reflect the level of social change that is occurring in any given society at a time.

It is important to note that ethics plays a key role in helping individuals make decisions when they are facing equally competing situations. The concept of dilemma means that a professional, individual or even organization has to choose between choices which are equally bad because of their consequences. The purpose of ethical principle is to provide individuals and organizations in the society with the basic framework that they can use when making decisions. People do not rely on ethical principles to make the correct decisions but rather as a way of ensuring that they make decisions that can be justified.

Within the context of scientific research, ethical principles are applicable in various ways. For example, the researcher is supposed to make decisions on whether to conduct their planned research studies, bearing in mind that the studies may have positive and negative effects on various stakeholder. For researchers to decide on the need to complete their research studies, they usually have to weigh the pros and cons of completing their studies. Ethical principles provide the right framework for the researcher to use to evaluate the merits and demerits of completing research studies. It is important for researchers to weigh the pros and cons of completing their studies as one of the preliminary things that they do in the course of completing research studies. The importance of this decision cannot be overemphasized (Pruzan, 2016). On the one hand, researchers often have a lot of responsibilities to bear about their duties and obligations to their stakeholders. It should be remembered that researchers may be beholden to the stakeholders who fund their research studies. Although in practice researchers have control over their professional work, they still need to justify their decision to conduct research studies. Also, researchers have to evaluate the possible impact of the findings of their studies on the society. If the negative effects of the research outweigh the positive ones, then the researcher may have to rethink the idea of completing their research studies.

Another way in which ethical principles are used in research studies relates to the way researchers manage the entire research process. It is common for researchers to face conflicts when completing some of the most important activities of their research studies. For example, the researcher

faces moral dilemmas when attempting to collect data which they later use to complete their studies. The data collection process may be problematic because it may involve interfering with the privacy of the people to give the data. Researchers may have to evaluate the possible impact of their actions on the people from whom they collect their research data. In other cases, the researcher may have to evaluate the need to disclose all the information about the intended use of the data to the subjects of the research. For example, if data scientists are collecting personal information about people from their social media profile, they may have to consider the merits and demerits of telling people about the reason for collecting the information and the nature of the study. If the researchers choose to conceal the true nature of their research study, then they have to have enough reasons that can be used to justify their decision (Figure 10.1).

Figure 10.1: One of the most common sources of ethical dilemma in scientific research relates to how the researchers handle human subjects.

(Source: Unsplash)

Also, researchers normally face ethical dilemmas when they have to deal with the complex aspects of processing data and reporting their findings. It is important to remember that research studies are usually funded by individuals and organizations that may have interest in the findings of the research. The organizations and individuals who fund the researchers are not supposed to exercise control over the research process. Also, researchers are

not supposed to produce results for the sake of meeting the expectations of their donors. In practice, it happens that researchers face the complicated situation in which they may be forced to process data to ensure that they meet the expectations of their donors. In some instances, researchers may be tempted to alter the research process to ensure that they get results that are in line with what other stakeholders in the research process need. In such a case, the researchers may rely on ethical principles to ensure that they make the right decisions on how to handle the entire research process and ensure that they are not held captive by the vested interests of their donors and other stakeholders.

The third way in which ethics applies to research relates to the way researchers manage complex research activities such as reviewing literature review and others. It is widely established that researchers are supposed to follow specific conventions when carrying out all the activities of the research process such as managing the sources of information and processing the data (Gimbel, 2011). It is based on established moral norms that researchers are supposed to acknowledge all the sources of the information that they use in their studies, prepare their research reports in specific ways and ensure that the entire research process meets all the requirements of quality.

10.2. ETHICAL PRINCIPLES IN SCIENTIFIC RESEARCH

Ethical principles are expressions of social norms and expectations. In this case, some specific norms and values are used to guide the work of scientific researchers. The following is a brief discussion of some of the most important ethical norms and principles that scientists are aware of when carrying out research studies. One of the most important ethical principles in scientific research is the truth. Within the context of science, the truth is regarded as information that has been taken through the rigorous testing process of scientific inquiry. Science is a branch of knowledge that is concerned with unraveling the truth. The essence of scientific research is to subject credible propositions or hypothesis to the testing procedure to determine the hypothesis which is true. It is the duty of scientists to find out the truth and contributes to the growth and development of the corpus of knowledge in their respective fields of specialization.

Scientists are supposed to show their commitment to the truth when conducting their research studies. It is necessary for researchers to strictly follow the complicated procedures that are associated with carrying out

research studies. For example, it would be unethical for a researcher to ignore complicated data processing methods in the course of researching because doing so would undermine the value of their findings. In other words, research societies are committed to finding out the truth as the core part of their research undertakings. The importance of truth as an ethical principle in scientific research is also related to the fact that science is a profession. Various codes of ethics bind professional researchers by their respective professional bodies. Scientists, because they belong to their respective professional bodies, are bound by the codes of ethics of their professional bodies. Given that science values objectivity, it follows that scientists are obliged to pursue the truth in their work.

From the preceding discussion, it can be seen that scientists are obliged to observe various ethical principles as part of their research practice. Scientists are professionals who belong to specific professional bodies. The professional bodies have specific codes of conduct that they use to control the behavior and activities of their members. Members are supposed to be guided by the codes of conduct that are used by their professional bodies.

Another important ethical principle that is used in scientific research is collaboration. Within the context of scientific research, collaboration means the willingness of research scientists to interact with their colleagues and share important knowledge and information which is related to their work (Betz, 2010). Collaboration for research scientists further means that the scientists should be willing to share the findings and methods of their studies with their peers for professional criticism. In other words, the ethical principle of collaboration is meant to ensure that scientists can easily access information that is important for their work. When researchers collaborate, they can pull resources and expertise to complete research studies and share the credit of their achievements.

The practical implications of the ethical principle of collaboration in scientific research are seen in many ways. For example, scientists are supposed to create and maintain an environment in which they can share information and data when doing their work. Also, scientists are supposed to openly encourage their associates to find out about their work and ensure that they give access to their work to individuals who are conducting similar or related research studies. Moreover, as a result of collaboration, scientists are supposed to devise the best methods of sharing credit for their successes. What this means is that as much as scientists should respect the copyrights to the materials that they use, they should be willing to share information

and even credit for success with their peers.

Therefore, the ethical principle of collaboration means that scientists seek to build and maintain very strong networks that they use to share and access important information. It has been argued that one of the most important characteristics of scientific research and which distinguishes it from other forms of academic research is that it fosters collaboration among individuals (Singh, 2010). Unlike research in the humanities (see Chapter 11, Introduction to Research Methodology in the Humanities), research in the sciences is usually carried out in a highly collaborative environment. Researchers who are working on research projects are often required to collaborate with others who are working on similar research projects. Moreover, researchers are supposed to collaborate with others by sharing information with those who need it, as long as doing so does not undermine the need for secrecy.

The third important ethical principle that applies to scientific research is responsibility. In general, research scientists are supposed to be responsible because scientific research has far-reaching effects on the society, the environment, and people. Scientific research affects people because, at times, researchers use humans as subjects of their research. Thus, the entire scientific process may have a direct impact on the lives of people because of the way it utilizes humans as subjects. A good example of how scientific research may use humans as subjects of research is seen in the studies that are used to try the efficacy of drugs.

Although currently there are very strict regulations that are used to govern the way drug companies can carry out trials on human subjects, the fact remains that the process exposes humans to many dangers (Pruzan, 2016). It is because of the potential effect of scientific studies on the individuals who are used as subjects that scientists who carry out the studies are supposed to observe very high levels of ethical considerations. In the case of medication trials, it is necessary for scientists to ensure that the tests do not affect the health of the individuals who participate in the complex trials. Given that the trials are usually very complex and run for a long time, it is of paramount importance for the scientists and organizations who are involved in the process to ensure that they accurately predict the effect of the studies on the human subjects. Also, the scientists are supposed to take all the necessary measures to reduce the negative effects of the trials on the subjects that are used in the studies. These steps are supposed to be taken proactively and not as a way of complying with the regulations that are in place (Figure 10.2).

Figure 10.2: One of the basic principles of ethics in scientific research relates to the need for scientists to collaborate while conducting their studies.

(Source: Unsplash)

Also, scientific research may be harmful to animals and the environment. In the case of animals, scientists may use some animals as the specimen for scientific inquiry. The main concern of the authorities is that in some scientific processes, the animals that are used as specimen may be subjected to painful experiences. About the physical environment, scientific experiments may be harmful to fauna and flora.

It is based on the impact of scientific experiments on people, the society and the environment that scientists are supposed to be fully responsible when conducting their studies. The principle of responsibility means that scientists are supposed to be personally accountable for any damage that may occur in people or the society as a result of their scientific experiments (Gimbel, 2011). Moreover, scientists are supposed to be aware of the dangers that they expose the society and other stakeholders to when they are carrying out their studies. In other words, a responsible scientist understands the possible impact of their studies on the society and seek to minimize the impact on the overall success of the process. Moreover, research scientists are supposed to use the ethical principle of responsibility when making key decisions during the research process. Therefore, it can be seen that the ethical principle of responsibility is one of the most critical values that are used to guide the way research scientists engage in research activities.

The fourth important ethical principle that is used in scientific research is free. Primarily, freedom, within the context of scientific research, means

the ability of scientists to conduct their experiments based on the practical demands of the society and their research needs as opposed to being held captive by vested interests (Betz, 2010). A scientific inquiry occurs in an environment in which many stakeholders may have competing interests. Some of the stakeholders that may have vested interests in the scientific inquiry process include the funding organizations, governments, and individuals who believe that they can benefit from the findings of the process. Scientists, on the other hand, are bound by the requirements of the scientific inquiry process and methodologies. It is the duty and obligation of scientists to ensure that they work independently of any form of undue influence. Although the reasons for this are varied; some of the most important ones relate to the integrity the work of scientists and the need for scientists to benefit the entire society.

It is necessary for research scientists to ensure that the findings of their studies are beneficial to the entire society as opposed to only serving the interests of a few persons of organizations in the society. Moreover, scientists are supposed to ensure that their work does not cause harm to the society. For them to achieve these and many other goals that are related to their work, they have to ensure that they are free from the influence of parties who are pursuing their interests. It is when scientists can prove that they conducted their research independently that the findings of their studies can be regarded as credible.

Moreover, the ethical principle of freedom as it is used in the scientific community means that researchers are supposed to have the right to make the key decisions and choices that are related to their research work. It is important for researchers to have the autonomy to make important decisions because if they do not have it, they will end up conducting studies that serve the interests of other stakeholders at the expense of integrity. Some of the key decisions that researchers are supposed to make when conducting experiments include those associated with whether to terminate studies if they realize that the effect of the studies is negative. Also, researchers may have to decide on the course of the entire study even when they face pressure from other stakeholders. It is when a researcher is fully independent that the researcher can withstand the pressure that scientists face when managing highly sensitive research projects.

10.3. IMPORTANCE OF ETHICS IN SCIENTIFIC RESEARCH

There are several reasons for the importance of ethics in research. In the first place, ethics is important in research in general and scientific research in particular because of the trend in which the press has been focusing on reporting on issues of science which are of ethical importance. It is generally noted that the press has played a critical role in popularizing the importance of ethical considerations in scientific research (Ford, 2000). Given that the public may not easily comprehend the complex processes of scientific research, the press has been on the forefront in helping the public to understand the intersection between scientific research and ethics. Also, the press has been instrumental in helping the public to understand the impact of ethical consideration in scientific research on the lives of individuals in the society. To achieve these and many other objectives, the press has been focusing on carefully selecting issues and disseminating information to the public.

It is noted that the press has played an important role in highlighting the importance of ethics in scientific research to the public by highlighting cases in which researchers perform actions and processes that are harmful to the society. A good example of how the press has been a leading player in enhancing the importance of ethics in scientific research was seen in the way the press covered news about secret medical experiments that were conducted in Nazi Germany. Towards the end of the Second World War, the Nazi regime in Germany secretly established a research facility. The purpose of the facility was to carry out experiments using human subjects to establish the possible impact of some of the gruesome torture methods that the regime was using on its victims at the time (Gauch, 2003). Primarily, a selected group of doctors was responsible for the cruel experiments that were conducted in a secret location at the time. It was as a result of the effect of the work of the press that the world learned of the atrocities.

Another good example of how the work of the press has been critical in highlighting the importance of ethics in research relates to nuclear arms. In the recent past, the international community has been committed to ensuring that the world is a safe place by limiting the proliferation of nuclear arms. It has emerged that some states, such as Iran and North Korea, have been committed to developing and testing nuclear arms, in contravention of agreed-upon ethical principles and considerations. In this case, the press has been on the forefront by highlighting the secret activities of the states of the

two countries and showing how the activities of the states of the countries could be harmful to the entire world. Therefore, as a result of the work of the press, the public is now conscious of how a high-tech issue such as nuclear research can be of enormous consequences to global peace and stability.

Second, the importance of ethics in scientific research is evident in the complex relationship between science and industry that exists. In general, the relationship between science and industry is complicated because the two stakeholders are intertwined. Business organizations need cutting-edge knowledge to develop new products and processes that they use for their commercial activities. However, the organizations cannot carry out the rigorous scientific research which is needed for the discovery and development of the new products. For the organizations to achieve their goals of developing innovative products and services, they have to partner with academic institutions. Academic institutions have the human and other forms of resources that are needed to carry out complex scientific studies. Therefore, universities normally collaborate with business organizations to conduct studies that yield new products and services.

However, the collaboration between universities and business organizations to conduct research studies raises several important ethical issues. On the one hand, universities in many countries in the world are usually funded by public resources. However, the findings studies that they carry out on behalf of business organizations are usually owned and marketed by businesses. In other words, business organizations benefit from public resources by collaborating with universities to conduct specific research studies (Gimbel, 2011). This relationship raises an important ethical issue because businesses end up profiting from the results of their findings with universities. In other words, ethical considerations raise important issues regarding the meaning and implications of the relationship between universities and businesses when they conduct scientific studies. Ideally, it is expected that universities should be interested in research studies that are owned by the public. Also, it makes sense to expect that universities should not engage in partnerships with researchers if they are convinced that the findings of the study will primarily benefit private enterprise. However, in practice, this is not the case because institutions of higher learning are increasingly collaborating with private enterprises to develop new technologies that primarily benefit the private enterprise (Figure 10.3).

Figure 10.3: The press has been on the forefront in advancing the concerns of the public about the negative effect of science.

(Source: Unsplash)

Moreover, the collaboration between universities and businesses raises the question of who finally owns patents to the innovations that arise from the research. It has been the norm for universities, researchers, and businesses to engage in contracted legal battles related to the ownership and distribution of the knowledge that arises from the research. On the other hand, it is expected that the findings of the collaborative research between universities and businesses should help to improve the overall state of the society (Betz, 2010). However, if it cannot be adequately proven that the findings of the studies are beneficial to the society, then the collaboration between the two stakeholders may not e easily justified. Therefore, ethics is important in scientific research because it helps to streamline the relationship between industry and the scientific community. Also, it is based on the principles of ethics that organizations and research institutions can form collaborations which can be beneficial to the entire society as opposed to only serving the partisan interests of the parties to the collaborations.

Therefore, it can be seen that ethics is important in research because it provides a framework that can be used to guide the relationship among all the stakeholders. Research institutions and funding organizations can rely on ethics to manage their relationships and ensure that the objectives of the research projects are achieved. Also, it is because of ethics that researchers and the other stakeholders can interact with each other in the course of a research project and ensure that they can comfortably complete

their research work. The third aspect of the importance of ethics in scientific research relates to how science treats human subjects, animal guinea pigs and the environment in general. Science is supposed to justify the means that it uses to conduct research (Khan, 2011). If researchers cannot justify the means that they use to carry out research, it is unlikely that they can be allowed to complete the studies. The example of how scientists abused human subjects in the course of conducting experiments during the Second World War has been highlighted in this section. In other cases, scientific experiments may have adverse effects on the physical environment. Ethics is needed to guide the way scientists conduct their studies and to safeguard the interests of human subjects, animals, and even the physical environment (Figure 10.4).

Figure 10.4: Scientists are supposed to provide all the information to would-be participants so that the individuals can make informed consent about their participation in the experiments.

(Source: Pexels)

Another important ethical principle for research scientists is related to the value that the findings of the research will have to the society. In general, science is meant to serve the needs of the society. Scientists are supposed to ensure that the findings of their research studies are of direct benefit to the society. Before scientists conduct any research study, it is important for them to evaluate the possible effect of their work on the society. Given that science is supposed to address the pressing needs of the society and to benefit it, there is always a need for researchers to engage in studies whose findings will address the pressing needs of the society. Researchers are supposed to

assess the possible social value of any research proposal and only take on studies that have social value.

Another important ethical value for scientific research is the consent of participants. In many instances, research in the sciences requires that the researcher collects the required information from human subjects. In such a case, the researcher may administer questionnaires on individuals who form the sample or interview some people from whom the researcher intends to get important information. It follows that researchers are supposed to follow specific guidelines when collecting information from humans in the course of conducting their research studies. For example, researchers are supposed to inform their subjects of nature and purpose of the research. Also, researchers are obliged to discuss with their subjects the possible impact of the study on the wellbeing of their subjects. If the subjects fully understand what the study is all about and how their participation in it may affect their wellbeing, they will be in a good position to decide on their participation. It is only when participants freely consent that researchers can be said to have adhered to the ethical principle of free consent when conducting their studies.

In this chapter, the issue of ethics in scientific research has been discussed at length. It has emerged that ethics has been a very important issue in scientific research because of the role that research in the sciences plays in the lives of people. It has been indicated that if researchers fail to adhere to the principles of ethics when carrying out their research studies, they may end up producing results that are not up to the set standards. It has also been shown that research in the sciences can have positive and adverse effects on the lives of people in the society. Thus, ethical considerations help researchers to ensure that they enhance the positive impact and minimize the negative effects of research on the society. The next chapter of the book provides introductory information about research methodologies that are used in the humanities.

PART III
RESEARCH METHODOLOGIES IN THE HUMANITIES

11
CHAPTER

INTRODUCTION TO RESEARCH IN HUMANITIES

'The effort to understand the universe is one of the very few things that lifts human life a little above the level of farce and gives it some of the grace of tragedy.'

—Steven Weinberg

CONTENTS

The purpose of this chapter is to present a concise introduction to the subject of research in the humanities. The chapter contains details about the definition of the category of disciplines that is referred to as humanities. Also, the chapter contains details about the basic features of humanities and the process that is undertaken by researchers who are managing research projects in the humanities. Also, the chapter contains information about some of the most important challenges that researchers encounter when completing research projects in the humanities. Finally, a detailed explanation of the connection between humanities and other disciplines is presented in this chapter of the book.

11.1. DEFINITION OF HUMANITIES

There are many definitions of the concept of humanities that have been developed over the course of time. In general, researchers, and practitioners in the field have been concerned with the need to develop a concise definition of what constitutes humanities. On the one hand, it has been a concern of academics to develop a definition of humanities that clearly delineates this group of subjects from other related ones such as the social sciences and the arts. On the other hand, it has been the concern of all who have tried to develop a good definition of the concept of humanities, to ensure that the definition is different from that of the pure arts (Boudon, 2005). Also, it has been the concern of researchers, academics, and practitioners to indicate the various ways in which the humanities are connected to other disciplines (Hayler, 2016). The connections between humanities and other academic disciplines have been limited to research practice. For example, it is noted that the humanities are connected with the sciences and even the arts because of the way researchers can use specific research techniques to complete studies in any of these disciplines (Kershaw, 2011). What these observations mean is that humanities are at the intersection of two kinds of disciplines: pure arts and the social sciences. Moreover, this observation means that for one to define humanities clearly, it is necessary to take into consideration the connection between humanities and social sciences on one hand, and humanities and the arts on the other hand. It is based on this observation and considerations, that some of the most convincing and widely used definitions of humanities have been developed over the course of time.

In general, humanities can be defined as the study, analysis, and interpretation of those subjects that are related to the social sciences but have

a clear connection to the aspect of humanity in the society (Gunn, 2011). Humanities as a category of disciplines can be defined as the study of the aspect of humanity in the society which focuses on the following disciplines or subjects, languages, ethics, religion, philosophy, archaeology, and anthropology. This is not an exhaustive list of all the subjects that comprise humanity; there are many other academic disciplines that are regarded as part of the humanities that are not included in this list. For example, it is important to note that studies such as those in history and other disciplines are still considered humanities because they are focused on addressing the human or cultural aspect of social life. Therefore, it can be concluded that the category of disciplines that is referred to as humanities is broad and includes many subjects (Figure 11.1).

Figure 11.1: Humanities are based on the cultural aspects of human life in the society.

(Source: http://futurestudents.csu.edu.au/courses/humanities-social-sciences)

It has also been noted that for one to understand the concept of humanities in the society, it is necessary to consider the relationship between humanities and the physical sciences as well as the arts. The relationship between humanities and the social or physical sciences is in the form of similarities and differences between them as far as the process of conducting research is concerned. One of the major differences between humanities and the other groups of disciplines lies not only in the methodologies that are used to conduct research, but also to study specific aspects of the discipline. In the case of the physical sciences, the researcher is concerned with a testing hypothesis and developing new knowledge based on data and rigorous treatment processes that are used. This approach of conducting research is what is referred to as experimentation, and it forms the basis for all scientific research processes. However, in the pure arts, the focus of the researcher is on using specific methods which are considered as purely qualitative to

develop new knowledge or examine new issues which are of concern to the researchers. Interestingly, research in the category of subjects that is referred to as humanities is characterized by an application of methodologies that combine the aspects of the physical sciences on the one hand and the pure arts on the other. It is common for researchers in the humanities to borrow methodologies that are typically used in the arts or even in the pure sciences to complete their studies. However, it should be noted that this observation does mean that there are no specific methods for conducting research in the humanities. On the contrary, there are many techniques and methods that are specific for use in the research in the humanities.

Another important difference between humanities and the other categories of subjects is that researchers in humanities focus on using methodologies that are speculative and critical in nature (Gunn, 2011). The speculative aspect of the methods that are used to conduct research in the humanities is based on the need for the researchers to not only predict the future but also rely on the information they have about the phenomenon to describe what changes may occur in the phenomena (Boudon, 2005). Researchers in the humanities focus on criticizing texts and the opinion of others as one of the methods of conducting research. This means that researchers in humanities may conduct research for the sole reason of critiquing what has already been floated by others as opposed to what is the case in the sciences in which researchers are concerned with testing the hypothesis and determining whether the theories that are provided are true or not.

However, it is necessary to state at this stage that the critical nature of the methodologies of conducting research in the humanities does not make them inferior to those that are used in the pure sciences. It cannot be argued that the use of the methodologies means that research in the humanities does not result in new knowledge. In practice, the use of the methodologies gives rise to new knowledge. When researchers carefully critique the works of others as part of the process of conducting research in the humanities, they offer fresh perspectives and new ways of looking at issues. In effect, they contribute to the emergence of new knowledge and ways of examining phenomena. Therefore, it can be seen that researchers in the humanities focus on critiquing texts and providing alternative explanations as some of the primary methods of completing research studies.

Another important and defining aspect of humanities is related to the methodologies that are used to conduct research in these disciplines. In general, researchers who conduct studies in the humanities are required to

use a mixture of methodologies as opposed to what is the case in the other disciplines. For example, researchers in the humanities may be required to use methodologies that combine the qualitative and quantitative aspects of conducting research when completing projects in the humanities (Hayler, 2016). For the other disciplines, it is the norm for researchers to use methods that have been specifically designed for conducting research in the disciplines. For example, researchers who do studies in the pure sciences are obliged to use methodologies that have been specially designed to be used for scientific research. Thus, scientific research, unlike the humanities can be said to be very rigid. However, it is important to remember that research in the social sciences shares this attribute with research in the humanities. As it is the case in the humanities, research in the social sciences may be conducted using a mixture of methods (Gold, 2012). This means that researchers who carry out studies in the humanities may borrow specific methodologies from the pure sciences as well as the pure arts when they are completing their studies in the humanities in contrast to what normally happens when researchers are completing studies in the physical sciences.

In the case of the physical sciences, researchers may only have to use the methods that are specific to the sciences. Scientists who carry out experiments are bound by the methodologies and techniques that have been specially prepared for the sciences. For example, a researcher who is studying the effects of changes in the genetic composition of a crop on its productivity has to stick to strict techniques related to sampling, analysis, and other activities of the research. Moreover, the researcher who is conducting such a study does not have room to use mixed methods in the course of the researcher. However, in a typical research study in the humanities, the researcher may be interested in examining a historical event. In such a case, the researcher may use mixed methods to evaluate the case and provide a fresh interpretation of events. Thus, although the researcher who is carrying out the study in the humanities is supposed to do so by following a broad outline of the best methodology, the researcher is not bound by strict research protocols as is it the case in the sciences. Therefore, researchers who work in the humanities have a lot of leeway in choosing the methods and techniques to use, compared to those who do their work in the pure sciences.

Many researchers have pointed out the fact that researchers in the humanities can use a mixture of methods to complete basic research projects (Boudon, 2005). It is indicated, that for one to carry out a research project in the humanities, the researchers are supposed to focus on examining the subjects of research using techniques and methodologies that are applicable

to the phenomena rather than focusing on frameworks which have been developed specifically for humanities (Hayler, 2016). A good example of how research in the humanities relies on methodologies that are generally used in other disciplines can be seen in a typical study of a literary text. A researcher who is studying a historical text may not only rely on the historical aspects of the case to examine specific attributes of the work but also, the researcher may use methods that are borrowed from many other disciplines such as the arts to evaluate the specific issues of concern that are found in the text. Thus, a researcher who is examining a text not only uses textual criticism but may use many other techniques to examine specific aspects of the text and address it and address the specific research needs.

Similarly, a researcher who is studying a historical phenomenon may not necessarily be bound by the specific techniques that have been developed for use in such situations. The researcher may use any other method and technique that may not be specific to the humanities as long as it helps them to achieve the objectives of their studies. In other words, researchers in the humanities are free to use any technique as they focus on the specific needs of their studies and not on ensuring that they adhere to protocols. Therefore, it is important to emphasize on this attribute of research in the humanities because it is one of the most important distinguishing features between research in the humanities and research in other disciplines.

11.2. OVERVIEW OF THE RESEARCH PROCESS IN HUMANITIES

The process of conducting research in the humanities is similar to what is usually used in other disciplines. The basic approach that is used to carry out research studies in humanities contains all the elements that are also used to complete research studies in the other disciplines. The essence of such a process is that a researcher has to decide on the issue that is to be examined, collect information that is related to the issue and then analyze the information. Also, the basic outline of a research process requires that once a researcher has analyzed the data that has been collected, the researcher should provide answers to the research question. Thus, regardless of the specific discipline in which a research study is conducted, the process follows this basic outline. However, there are subtle and distinctive differences in the way researchers in the humanities carry out their studies that sets this category of disciplines apart from the others. The following is a brief overview of the process that is used to complete research studies in the humanities.

The first step in the process of conducting research in the humanities involves clearly describing the problem or the issue that the entire study is supposed to address. At this stage of the process, the researcher is supposed to provide a detailed and sufficient description of the problem that the researcher intends to examine in the course of the work (Kershaw, 2011). What this means is that the researcher has to not just identify the problem that needs to be addressed, but also to clearly provide all the details of the problem that the entire research is supposed to address. Also, it is important that at this stage of the process, the researcher develops the specific questions that the research will address. Research questions are important aspects of the research process because they provide guidance to the researcher during the research process. It is only when a researcher has valid questions that the researcher can execute a reliable and acceptable research project which specifically provides answers to the questions. Therefore, it is important for a researcher to develop the most appropriate research questions at this stage of the process of conducting research projects in the humanities.

Moreover, it is at this stage that a researcher develops the objectives of the research. The objectives of the research are the specific goals or aims that the researcher pursues in the course of completing the research study. As it is the case in other disciplines, the humanities require that a researcher clearly describes the aims and objectives of the research as one of the preliminary activities of the research process. In many cases, a researcher simply adapts the research questions from the aims and objectives of the research. A research study may have a single aim and several objectives for the given study. The single aim that may be used in any given research usually forms the main purpose of the research while the objectives form the foundation for developing the questions that the whole research attempts to answer. Therefore, at the first stage of the research process, researcher who is conducting the study in the unity carefully describes the problem that they are concerned with, develops the questions that are supposed to be answered by the research, and describes the objectives of the entire research projects. These activities are important because the way that the researcher handles them determines the quality of the whole research (Figure 11.2).

Figure 11.2: Research in the humanities is conducted using a variety of methods.

(Source: Unsplash)

The second stage of the research process in the humanities is concerned with describing the context of the research. The context of the research refers to the issues that are related to the need for the researcher to conduct the research, the general approach and shall be used to complete the research, and the potential benefits of the findings to the stakeholders of the research process (Kershaw, 2011). It is important for researchers in the humanities to provide detailed descriptions of the ways in which the findings of the research will be beneficial to various groups of individuals. It should be remembered that any research project that is conducted regardless of the specific discipline in which it falls is supposed to provide tangible benefits to individuals, organizations, and other stakeholders. Therefore, it goes without saying that a researcher who is planning to carry out a research study in the humanities should show how beneficial the findings of the study will be to its stakeholders.

It is the same case in the humanities in that any good research project has to provide potential benefits to the stakeholders. For example, if a study is conducted to examine the impact historical phenomena and the lives of people in a given society, the researcher who intends to conduct the study must show that its findings will be beneficial to groups of individuals as well as the society in general. Given that such a study is based on examining the past of people and identifying specific issues in the history of the society that needs to be addressed, the findings of such a study may indeed be beneficial to the society and government institutions because it may provide important information about the past of the society. This example shows that there is no research study that is conducted as a pure academic endeavor. In practice, any research study has a direct bearing the lives of individuals in the society

and this forms the basis for the need to conduct the research.

The next step in conducting research in the humanities is related to reviewing literature that is related to the subject of the research. Ideally, any good research process is based on an extensive review of literature that is related to the subject of the study. Literature review is important in research because of various reasons. For example, literature review is necessary because it helps researchers gain a deeper theoretical understanding of the issue that they are supposed to deal with in their studies (Gold, 2012). When a researcher takes the time to evaluate what other researchers have found and published before them, the researcher is able to gain a deeper understanding of the issue that they intend to work on as part of the research process. When a researcher gains a deeper understanding of issues, the researcher is able to conduct the research study more confidently than when they do not understand all the related issues. Therefore, gaining deep and extensive knowledge of the area of study is advantageous to the researcher and enhances the quality of a study that is conducted.

Also, review of literature enables researchers to identify the areas that have not been adequately covered in research (Boudon, 2005). When a researcher develops a research problem, they usually focus on issues that have already been addressed in previous studies, but which can still be investigated in other ways. It is the norm for researchers to avoid duplicating studies by simply investigating issues that have already been the subject of studies in the past. In practice, a researcher can easily identify the issues that have already been covered in previous studies when the researcher takes the time to examine studies that have already been published. It is important for researchers to take into consideration the issues that have already been addressed in past studies so that they avoid duplicating what has already been published. It is because of these reasons that researchers are supposed to conduct credible and detailed review of literature when completing their research studies.

Also, when researchers examine published studies, they can easily identify gaps that exist in the knowledge and base their studies on addressing such gaps. For example, if it happens that a researcher realizes the issue that they intend to research on has already been covered in many previous studies, the researcher may change the subject of the research. Also, if a researcher conducts credible research, the researcher may identify some gaps in the knowledge and fashion their research studies on addressing the problems. In other words, a good and credible research study is one which

is based on areas that have not been adequately covered in previous studies. For a study to have this attribute, the researcher who is conducting it must take the time to review literature of studies that have been done in the past.

The next step in the process of conducting research in the humanities involves developing what is referred to a research design. Research design to a detailed description of the things that have to be done to complete the research and how the things are to be done in the course of the study (Singh, 2010). In general, a research design contains information about the kind of data that will be collected in the course of conducting the research, the tools or methods that shall be used to collect the data, and the overall techniques that will be used to complete the research. Also, good research design contains information about the scope of the research. The scope of a research refers to details about the extent to which the research will examine specific issues and the boundaries that the research will be conducted within. This means that for any research process to be successful, the researcher has to carefully delineate the research and ensure that the entire study is conducted within specific boundaries that have been developed.

Therefore, it can be seen that the process of developing a research design is very critical for the success of the entire process of conducting a research study in the humanities. It need to be mentioned at this stage that the process of developing a research design is used in all research studies. Even in the sciences, a researcher has to carefully decide on the design that has to be used. It is important to remember that scientific research is based on the various research design frameworks that have already been developed and that the work the researcher is to choose the right framework that suits the needs of the specific study that is to be carried out. Similarly, in the arts, a researcher has to develop specific research designs that suits the needs of the as with the preferences of the researcher.

The next stage of conducting research in the humanities involves the actual collection of the data that is to be used in the study. The data collection stage of any research process is critical because it determines the extent to which the research process is successful (Gunn, 2011). If a researcher fails to collect the right kind of data, it is obvious that the quality of the entire research process will be strongly undermined. Similarly, if a researcher collects enough amounts of data but gets the data that is not needed for the research process, then the researcher may not be able to deliver high-quality research findings. It is the duty of the researcher in any research endeavor to access relevant data and in the right amount.

There are many methods that researchers can use to collect data that they use in their research studies. One of the most common methods that are used involves the administering of a questionnaire. A questionnaire is a special tool that researchers use to collect data by asking individuals who participate in the research to complete the questions that are contained in the questionnaire. Currently, researchers can deliver the questionnaire to the respondents physically or online via mail. The respondents are then required to fill in the questionnaire before returning the document to the researcher. Regardless of the method that is used to deliver the questionnaire, the basic principle of using this method of collecting data is that the researcher relies on the knowledge of the respondents to ensure that they get accurate data.

However, it should be noted that for any method of collecting data to be successful, the researcher has to carefully choose the method by considering the specific needs of the research. It is not necessary for a researcher to stick to a method of collecting data that does not match the other aspects of the research (Hayler, 2016). For example, in the humanities, it is normal for researchers to use methods that are focused on collecting qualitative data. The reason for this form of bias towards using these kind of tools is because, in humanities, the focus is on using qualitative data as opposed to the practice of using quantitative data in the sciences. The nature of the study, the kind of data to be collected and the expertise of the researcher are the three most important factors that dictate the kind of method that is used to collect data for the research. Therefore, the process of collecting data is one of the most critical parts of the entire research process in the humanities as well as in other disciplines.

The next step in the research process in the humanities is for the researcher to analyze the data that would have been collected as part of the research. This is an important step in any research process because it is only after the researcher analyzes the data that the researcher can provide answers to the research questions and determine whether the objectives of the research have been achieved. In humanities, researchers conducting a research study has to collect the data and then analyzes it using suitable methods and techniques. It is common for researchers in the humanities to use qualitative methods to analyze the data because the data that is used in such studies is qualitative in nature.

Qualitative methods of analyzing data cover and varied range of techniques that are used to convert nonnumerical data into forms that can be analyzed statistically. In some cases, researchers have to, first of all,

describe the data by dividing it into specific categories. The categories are normally based on the questions that are used in the research or the objectives of the research that have to be achieved. After the researcher has divided the data into specific categories that address matching needs of research, the researcher may be required to convert the data into forms that can be analyzed statistically (Godl, 2012). In some cases, it is not necessary for the researcher to code the data but rather to examine it using a thematic approach. Thematic approaches to analyzing qualitative data are popular because they provide a means for the researcher to carefully examine textual content based on specific themes. Moreover, this approach allows researchers to analyze data that is contained in the text by referring to pre-selected themes and determining the extent to which the themes are covered in the text (Hayler, 2016). This is a form data analysis that is commonly used in humanities because it is suitable for the kind of data that is used in this category of disciplines. Moreover, the method has been said to be effective in helping the researcher active all the objectives of the research in the humanities (Gunn, 2011).

After the data has been analyzed, the data and information that has been found have to be communicated to the stakeholders. The last step of the process of conducting research in the humanities involves communicating the findings of the research to the people who are interested in learning about it. At this stage, research is concerned with presenting the information or the findings of the research fellow researchers or any other person or institution who or may be interested in their findings. The state of presenting data is actually the final stage of the research process because instead, the researcher makes public all the findings and the methods that have been used to complete the research study.

From the foregoing, it can be seen that research in the humanities is conducted using an approach that is similar to what is used in many other disciplines. However, it needs to be mentioned that there are specific attributes that are used to define the process of conducting research in the humanities and which may not be found in the other disciplines. For example, a researcher who is conducting a study in the humanities may not go through all the complicated processes that are related to collecting scientific data as they are used in scientific studies. Also, a researcher who is conducting research project in the humanities may stick to using qualitative methods of analyzing the data as opposed to using the quantitative ones which are commonly used in the sciences. Moreover, a researcher who is conducting a study in the humanities may have room to used mixed methodologies unlike

what usually happens in scientific research studies. Therefore, it can be seen that as much as the process of conducting research in the humanities is conducted in a way that meets the basic criteria of general research process, the process is unique in that the researcher may use specific techniques that are not commonly used in the other disciplines.

11.3. CHARACTERISTICS OF RESEARCH IN THE HUMANITIES

There are many characteristics that define research in the humanities. The following is a brief examination of the some of the most important features of research in the humanities. In the first place, research in the humanities is described or defined by the level of attention that the researchers pay to the quality of the text. It has been pointed out that ideally, research in the humanities is text-driven (Boudon, 2005). This observation means that researchers in the humanities are concerned with analyzing the quality of the text as opposed to what occurs is in the other forms of research in which the researchers concentrate on the concepts that are included in the work. The central place that the quality of text plays in research the humanities is seen for example in the way a researcher who is analyzing a historical text concentrates on the quality of the writing. In such a case, the researcher may take the time to analyze the kind of writing that the person who developed the text uses as opposed to what the case would be if the research would be in another discipline. For example, if it were in the social sciences, the researcher would be concerned with the concepts that are included in the text as opposed to evaluating the quality of writing that is used in the text. Similarly, the arts, the researcher would be interested in critiquing specific aspects of the research as opposed to attempting to create new knowledge from the work as it is the traditional duty of research in the sciences.

Therefore, it can be seen that textual analysis plays a critical role in the research process in the humanities and that it defines the methodology that a researcher uses to complete the research study. Moreover, textual analysis is critical in the research process because it is regarded as the basis for any research that is conducted in the humanities. Hence, it can be argued that research the humanities is unique because of the level of importance that textual analysis is given in the process. This approach is in stark contrast to the data-driven approach that is used in the sciences.

Apart from the way research and humanities is focused on textual analysis, another important characteristic of this form of research is that it is

largely individual-based. Another way of describing his important attribute of research in the humanities is that in this kind of research, the specific style and approach of the researcher determines the quality of the research. This is important because, in other disciplines, the approach of the team and preparation of individuals who participate and research is an important aspect that is used to define the approach that is used to complete research studies. It is common to find research projects that have been conducted by teams of researchers in the other disciplines than it is in the humanities. In the humanities studies conducted by individuals as opposed to what happens in other disciplines. Therefore, it can be seen that the humanities, researchers to complete studies as individuals and deliberately avoid collaborating with others in the course of carrying out research studies. The individualistic nature of research in the humanities is seen in the way it is used to define the quality of research studies. When analyzing research studies, other researchers focus on describing the style of individuals who complete the studies as opposed to focusing on the concept that are included the research in general (Hayler, 2016). Therefore, research in the humanities is characterized by the way researchers focus on completing research studies by analyzing the impact of the style of the individual over the actual content that is used in the studies.

Another important characteristic of research in the humanities is that the researchers are normally focused on criticizing existing knowledge as opposed to creating new knowledge. Criticizing existing knowledge as an approach that is used in the humanities means that researchers are usually focused on identifying faults and strengths in the knowledge that has already been developed as opposed to attempting to develop new forms of knowledge in the process (Gold, 2012). This approach is in sharp contrast with what normally takes place in the sciences because, in such disciplines, researchers are focused on testing the hypothesis and then proving whether the hypothesis is true or false. If the hypothesis is true, and the researchers would accept the hypothesis as a theory that is valid and has been proven.

However, if the researchers find that the hypothesis is false, then they have to accept the alternative hypothesis. In the humanities, researchers do not focus on testing hypothesis but rather on identifying specific issues in the theory that has already been developed and providing new perspectives or different ways of looking at the issues at hand. There are many reasons as to why research in the humanities is focused on criticizing existing knowledge as opposed to creating new forms of knowledge. For example, the focus of research in the humanities is that the process is conducted in a

nonlinear method. The essence of the nonlinearity of the methodologies that are used to complete research studies in the humanities is seen in the way the researcher may change the course of a research study whenever a need to do so arises. It is common for researchers in the humanities to repeatedly move forwards and backward when completing their research studies (Gold, 2012). The activities that the researchers conduct and the way in which they do them is largely determined by the specific needs of the study at any given time and not the frameworks that have already been developed. Thus, a researcher may change the course of the research drastically when they realize or when they accept new forms of knowledge that are important to the current research process.

Thus, a researcher who is conducting a study in the humanities has a lot of freedom to change the course of the study and to examine the text in various ways. Therefore, research in the humanities is based on the need of the researcher to examine any existing theory or body of knowledge, and critically examine all the faults and strength of the knowledge based on the approach of the researcher. Therefore, these characteristics is related to the previous one in which research in the humanities is said to be focused on evaluating the style that individual researchers use to complete research projects.

Another important characteristic of research in the humanities is that it is mostly focused on addressing the needs of the society as opposed to what the case is in other types of research. It should be remembered that the category of humanities it is a branch of disciplines that are related to the social sciences. The focus of studies that are conducted in the social sciences is on addressing the needs and concerns of people in the society. Therefore, it follows that researchers in the disciplines have to focus on identifying the problems that affect the society and developing concrete solutions to the problems. In other words, researchers in the humanities do not work on projects for the sake of their academic interests but rather for the sole purpose of solving the problems of the society. More so, it should be noted that researchers in the humanities are concerned with developing practical solutions to the issues that people in society face as part of the research mandate. This is in sharp contrast what normally takes place in the pure sciences in which researchers conduct research studies for the sole aim of developing knowledge but not necessarily for the sake of providing practical solutions to the problems that people in the society face. It is observed that research in the humanities is defined by the focus on influencing the society that is exhibited by the researchers who carry out the studies (Kershaw,

2011). Researchers in this field focus on finding solutions to complex social problems that can be used to influence the society in various ways (Figure 11.3).

Figure 11.3: One of the hallmarks of research in the humanities is that it is usually focused on individual efforts of the researchers.

(Source: Unsplash)

From the foregoing, it can be seen that research in the humanities is defined by various characteristics. For example, it is clear that research in the humanities is based on the individual airport has imposed on teamwork that is seen in other research forms. Also, it can be seen that research in the humanities is best on analyzing texts as opposed to examining a variety of concepts. Moreover, it has been clearly identified that research in the humanities is focused on addressing the needs of people in the society as one of its core mandate. Therefore, these characteristics are important because they show the deep main differences between research and humanities and free search the other disciplines such as the sciences and the arts.

11.4. RELATIONSHIP BETWEEN HUMANITIES RESEARCH AND OTHER DISCIPLINES

There are many differences between humanities, social sciences, and the pure or physical sciences. These differences are seen in not only the objectives of conducting research in, but also in the motivations that determine how researchers carry out studies in these disciplines. Also, there are many differences among these disciplines which are result of the way the researchers handle the activities of the research process. Therefore, the way in which a researcher who is doing a study in the arts or social sciences conducts the research process may vary significantly from what a researcher who is doing a study in the pure sciences may use. Also, the methodology that a researcher in the humanities uses may vary significantly from that which another researcher who is conducting a study in the social sciences relies on. The following is a brief discussion of the differences between these three categories of discipline on social sciences, humanities, and pure sciences.

The first difference between research in the humanities and others is that there are fundamental differences between social sciences humanities and the physical sciences is seen in the primary interests or motivations of conducting research and their studies. In the case of pure sciences, and primary motivation of the researcher is to provide credible and evidence-based explanations of natural phenomena that are being examined. Also, in the pure sciences, the researcher is concerned with making predictions of natural phenomena. This means that a scientist may be concerned with explaining why things are the way they are in the physical world or providing information on what is likely to happen regarding the physical phenomena in the world in the future.

A strong focus on explaining natural phenomena predicting what may happen in the future which defines research in the sciences contrasts sharply with what is the case in the social sciences. In typical social science research, the researcher is concerned with explaining social processes or phenomena and not physical aspects of life in the universe. Therefore, unlike what happens when a researcher in the pure sciences conducts a study, any research in the social sciences is normally based on addressing specific social issues that affect human life. However, it is important to point out here that as much as research in the pure sciences is concerned with explaining and predicting phenomena, also research in the social sciences is concerned with explaining and predicting phenomena that are not scientific.

An example of how social sciences can be used to explain phenomenon may be understood by considering and typical study in sociology to examine the effect of poverty on crime. In such a study, the researcher may be concerned with establishing what nature of crime in our society is and explaining how the economic status of people in the society may affect the levels of crime in the community. In such a study, it can be seen that the social scientist explains social phenomena and also provides predictions on what is likely to happen in the future.

These attributes of social science and pure science research vary considerably with what is the primary interest in humanities. In any typical research in the humanities, the focus of the researcher is on providing a deeper and more detailed explanation of issues, processes, and aspects that affect the lives of people in the society in relation to their cultural practices (Hayler, 2016). What this means is that at the center of any research process in the humanities is the issue of culture. Culture defines how people organize their lives and pieces the center need for research in the humanities. Hence any research in humanities is important because it focuses on providing an understanding of how people interpret and appreciate specific aspects of their lives and their community. This is an important issue because it marks a clear difference between the motivation of researching in the pure sciences, in the social sciences, and in humanities.

Another important difference between research studies conducted in the humanities and that which is connected to the social sciences or pure sciences lies in the way the researcher approaches and executes the research project. In general, research in the sciences is conducted using the experimental method. The experimental method is defined by the distinct level of control that the researcher has over some variables as a primary means of testing the relationship between variables that are used in research. Also, the experimental method is defined by the level of control that the researcher exerts on the research environment has a way of ensuring that the findings of the research are credible and valid. Therefore, in studies that are conducted in the pure sciences, the researcher is focused on conducting the study within an environment that is strictly controlled and by following a process that is clearly defined. In other words, a researcher does not have the chance to exert their influence over the aspects of the research when the researching the pure sciences.

The high level of control and the need to follow the procedure that defines experimental methods of research in the sciences is not seen in the research

studies that are conducted in the social sciences. In social science research in general, the focus of the researches is on collecting information by observing the behavior of people or the subject of the research. Also, the researcher is interested in collecting information by conversing with interviewees the people from the data is supposed to be collected (Godl, 2012). This means that the method that is used to collect data in social sciences research varies considerably from that which is used to connect data in the natural or pure sciences. Whereas the pure sciences are defined by the need of a researcher to use highly refined methods of collecting quantitative data by observing material subjects, social science research is defined by the need for the researcher to talk to the individuals who are the source of the data that is supposed to be used in the study. Also, researchers who are doing studies in the social sciences or the humanities focus on observing the behavior of their subjects in the course of the research.

Similarly, in humanities, the researcher does not have to exert strict control on the research process. Also, the researcher who is carrying out a study in the humanities may not have to focus on strict methodologies when collecting data. It is also important to remember that as it is the case in the social sciences, researchers in the human sciences mainly focus on qualitative data. However, it should be noted that sometimes researchers in social science may focus on using qualitative and quantitative data to answer the questions of the research. However, in the humanities, and focus of the researcher is on criticizing or evaluating the other works that have already been published. Therefore, this means that the researcher may rely on secondary sources of information to get the data that they need to complete research studies as opposed to what usually takes place in research in the sciences.

Another important difference between research in the social sciences and the humanities is related to the benefit of the findings of the research studies to the economy. It has been indicated that research in the sciences is very important and beneficial to the economy because of its relationship to industry. It is common for researchers in the sciences to carry out studies whose findings have a direct consequence of the lives of people in the society. For example, a study that is focused on developing a new method of handling a situation or treating an illness may be directly beneficial to the society. The findings of such a study help to alleviate human suffering and reduce the expenses of managing the problem. Similarly, research in the social sciences may be beneficial to the society because it may provide solutions to the social problems which are being faced in the society. For

example, research that is based on levels of crime in the society may be beneficial because it may help to form the basis for developing practical solutions to the problem. Therefore, it can be seen that in both the social sciences and the pure sciences, research studies are carried out to help address specific problems in the society.

In the case of humanities, the findings of the research may not be directly beneficial to the society. The relationship between the findings of humanities research and those of the social sciences to the needs of the society may be attributed to the fact that in humanities, researchers do not favor collaboration as a way of completing studies. However, in the social sciences as well as pure sciences, researchers may have to collaborate with one another for them to produce work that is credible and have positive impact on the society. Moreover, researchers in humanities research prefer to work in solitary conditions as opposed to what the case is in the other two categories of disciplines. Therefore, it is important to indicate that the findings of studies that are conducted in the pure sciences or in the social sciences tend to be very beneficial to the society than those which are based on the humanities.

An important difference between research in the humanities and research in the pure sciences, as well as the social sciences, lies in the level of importance that is attached to the concept of ethics. Ethics is an important aspect of research because it determines the way that researchers conduct their research studies. Also, ethics is important in research because it influences the way a researcher interacts with other people in the course of completing a research project. The relative importance of ethics in research studies is seen in various ways. For example, in the natural sciences, research is conducted in such a way that the researcher has to understand the implications of the actions of the research of the lives of people or the subjects of the study. This does not mean that research in the sciences does not take into consideration ethics.

On the contrary, research in the sciences takes into consideration important ethical principles which determine the way the researcher completes the entire study. However, it is in the case of humanities and social sciences that the researcher is more conscious of ethical principles. Also, the need for a researcher to be very conscious of ethics when completing a study in social sciences and humanities arises from the fact that the social sciences and humanities research studies are based on human behavior and their interactions in the society. Therefore, for a researcher to complete a

study in the human sciences or social sciences, they are supposed to interact with people in the cause of collecting data. Also, a researcher who is doing a humanities-based study is supposed to report on the lives and interactions of people in the findings of the study. Therefore, because research in the social sciences and humanities is based on human behavior and interactions in the society, researchers doing studies in these disciplines are bound to observe ethical principles and process.

11.5. IMPORTANCE OF RESEARCH IN THE HUMANITIES

There are many ways in which humanities research is important to the society and other stakeholders. First and foremost, research in the humanities helps to foster human cohesiveness because it helps individuals to understand the culture and other aspects of life so other people in the society. It has already been indicated that research in the humanities is focused on studying all the cultural aspects of human life in the society. In practice, researchers in the humanities focus on analyzing cultural aspects of different societies in the world. This means that growth of knowledge in the humanities can help individuals learn about the cultural aspects in the society and can enhance the extent to which people appreciate the differences between their cultures those of others. Therefore, as a result of humanities research, people can learn about the lives, religion, politics, and other aspects of life that have been practiced by others and learn how to respect cultural differences between different societies in the world. Therefore, it important to point out that research in the humanities helps to foster global peace and cohesiveness.

Another important benefit of research in the humanities is related to the concept of democracy. Democracy refers to the system of governance that is based on universal suffrage and the use of other concepts such as the rule of law and separation of powers. In a democratic society, leaders are elected through a transparent and credible election process. Moreover, the elected leaders are supposed to be accountable to the people. Thus, the underlying philosophy of democratic practice is that real power lies in the people. Although not all countries in the world can be said to be democratic, it is important to indicate that the majority of countries in the world are based on the political system that enhances democratic practices. This means that many countries desire to be fully democratic and ensure that they implement all the basic pillars of democratic practices in their societies. For this to happen, the countries focus on implementing specific programs that address

issues such as the rule of law, unity of the people, transparency in the political process and many others. It should be remembered that humanities research is based on studying various aspects of social lives of people in the society. To this end, research studies in the humanities are concerned with issues of religion, literature, philosophy, and many others which is central to the process of building a highly democratic society (Gold, 2012). Therefore, it shows that humanities can be beneficial to the society because it can help a society improve its democratic principles and become fully democratized in the course of time. It is for this reason that research in the humanities can be said to be beneficial to the society because it helps to enhance the overall process of democratization in the society.

Another important benefit of research in the humanities is related to the nature of humanities as a category of academic disciplines. It is argued that studies in humanities are important because humanities play very important roles in helping people and society to be happy and satisfied with the social arrangement (Hayler, 2016). Studies in subjects that form humanities such as literature, religion, ethics, and philosophy are important because they help people to understand human society better. Also, such studies help people to understand various cultures and attributes of the lives of other people. This aspect of understanding many other aspects of various cultures helps to foster cross-cultural communication and interaction. It follows that when researchers conduct studies in the humanities, they identify specific issues that can be used to enhance the lives of people in the society. Also, when people read about the findings of research studies and humanities, they are able to learn more about issues that affect their lives, and this makes them happier. It is for this reason that it has been argued that humanities are beneficial to the people and the society because it helps people learn more about their lives as well as the lives of others society. Therefore, research this is beneficial to individuals as well as the society in general.

Another important benefit of research in the humanities is related to the effect the research has on knowledge in the disciplines. In any area of study, research is important because it helps to improve the existing knowledge in the area. Researchers work by developing, testing, and reporting new theories or frontier of knowledge. As it is the case in many other disciplines, research helps to improve knowledge in the areas of study because the researchers criticize or develop new perspectives of looking at the existing knowledge. For example, if research is conducted in the field of Religion, the researchers may not necessarily create new knowledge, but they may make an impact by examining or criticizing the existing knowledge by

looking at it in different ways. In the same vein, research studies that may be conducted in literature may not necessarily generate new knowledge, but they may be helpful because they may provide more ways and approaches of looking at the existing texts. In other words, researching humanities is beneficial because it enhances their existing knowledge by providing fresh perspectives and ways of evaluating the knowledge. Therefore, it has been argued that research studies in the humanities are beneficial for their sake.

Another important benefit of research in the humanities is related to the economic benefit of the findings of studies in the humanities. Research in the humanities may be focused on developing new cultural or religious aspects, criticizing existing knowledge, or simply examining values that are held by the society. Although these aims may not have direct benefits to the society, they may be beneficial in the long-term and in various forms (Gold, 2012). For example, research in the humanities ensures that the society develops specific cultural sites which can become beneficial to the entire society. This usually happens as a result of studies to identify specific religious or historical artifacts and the role that they played in ancient civilizations. However, it can be pointed out that when it comes to economic benefits, research in the social sciences is far much better than that which is carried out the humanities. Also, it can be indicated that research in the sciences is more beneficial in terms of economics than that which is conducted in humanities. A good example of how research in the sciences direct economic benefits in the society may have is seen when researchers successfully develop a new breakthrough technology or drug. In such a case, the new drug or technology is beneficial to the society because of the industry that may emerge from its discovery. Similarly, in the case of the social sciences, the development of new approaches to addressing social problems may have direct benefits to the society.

However, these observations do not mean that it is not necessary for researchers to conduct research in the humanities. On the contrary, there has been a lot of clamor for more researchers focus on addressing the humanities aspect of life in the society (Boudon, 2005). Nowadays, researchers are being encouraged to carry out more studies on various aspects of human life than it was in the past. What this observation implies is that it is important for researchers to focus on aspects of society such as religion, literature, ethics, anthropology, archaeology, and other subjects that form the bedrock of humanities. In summary, it has been seen that research in the humanities is beneficial in various ways. In the first place, research in the humanities provides fresh perspectives of looking at important aspects of human life and

the society. Also, research in the humanities contributes to the generation of new knowledge because of the way the researchers are supposed to criticize existing knowledge and develop perspectives of looking at issues which are of concern to them and the society. Moreover, it has been pointed out that research in the humanities may be beneficial to stakeholders in that it helps to shed light on past events. Historical studies, which form an important example of research in the humanities, can be helpful because they provide a means by which researchers can reexamine events that happened in the past. Thus, researchers can use them to question the official accounts of past events and develop fresh interpretations of such events.

In conclusion, introductory information on the issue of research methodology in the humanities has been presented in this chapter. It has been indicated that humanities are distinct from the sciences as well as the social sciences because of their focus on the cultural aspects of human life. Also, it has been indicated in this chapter that research in the humanities is conducted by following a research process which is similar to that used in the other disciplines. Moreover, it has been indicated that research in the humanities is important because it enhances intercultural communication in the society, supports the establishment of democratic processes and enhances knowledge about the religious, cultural, philosophical, and historical aspects of communities. The next chapter in this book contains detailed information about the historical methodology of conducting research in the humanities.

12
CHAPTER

HISTORICAL METHODOLOGY

'History will be kind to me for I intend to write it'.

—Winston S. Churchill

CONTENTS

This chapter is about historical methodology, which is one of the most important methodologies that are used to complete research studies in the humanities. The chapter presents details about the definition of historical methodology, the need for the use of historical methodology, and the importance of using the historical methodology to complete studies the humanities. Also, the chapter contains information about the way data is collected, treated, and analyzed when researchers are using this form of methodology to complete studies in the humanities. Additionally, the chapter contains information about the benefits and risks that are associated with completing studies using this approach. Therefore, the purpose of this chapter is to provide a detailed description of how historical methodology is used to complete research studies in the humanities.

12.1. DEFINITION HISTORICAL METHODOLOGY

Basically, the historical methodology is defined as an approach to completing research in which historical data and information are applied to address the specific cultural needs of the society. It should be remembered that the humanities can be defined as a group of disciplines which are based on addressing the cultural aspect of human life. Therefore, it follows that historical methodology, as it is applied to research in the humanities, is an approach in which the researcher focuses on interpreting and issue by addressing its historical context. Therefore, historical research, in general, is a systematic evaluation of phenomena by following or examining its historical context (Hayler, 2016). The historical context of the issues that are examined as part of the research relates to time and period. Time refers to the period in which an event occurred while the location refers to the geographical, historical or cultural setting in which an event or process took place (Chand, 2003). It is important to point out that the facet of the historicity of phenomena is important because it determines the nature of the event or process as well establishes the approach that the researchers use.

In a nutshell, for researchers to get accurate information about the location of an event of the type of process that they are interested in, they have to use specific techniques which collectively form the historical methodology for researching in the humanities.

There are many reasons for conducting research in the humanities using historical methodology. One of the main purposes of using this methodology is to provide an accurate description or interpretation of the events that happened in the past (Ekko, 2008). Researchers in history may examine past

events or processes with the sole purpose of interpreting those events and establishing the things that occurred at the time. The researchers may study the past carefully to determine facts related to the event or process that forms the subject of a study. The second reason for conducting research using the historical method is related to interpreting past events using new evidence. At times researchers have to revisit past events for the sole purpose of interpreting them because there is new evidence. New evidence may change the narrative, and researchers have to guide this process by conducting recent studies related to events that occurred in the past. Researchers also may conduct historical studies for the sole purpose of examining the sequence of events that occurred in the past. This may be necessary if there is credible doubt related to the official account of processes of events that occur. From the preceding, it can be seen that whole methodology provides the right framework for researchers to examine past events, re-evaluate historical interpretation of features, and interpret past processes by relying on new evidence.

12.2. CHARACTERISTICS OF HISTORICAL METHODOLOGY

One of the major characteristics of the historical method of conducting research in the humanities is that the method requires a researcher to have a high level of imagination. Imagination within the context of research in the humanities means that the researcher is supposed to portray a high level of understanding of the subject in which they are carrying out a research study. It is observed that for a researcher to successfully use the historical method, the researcher is supposed to show a deeper understanding of the field in which they are conducting a research and the specific aspect that they are investigating (Smith, 2009). The reason for this observation is that it is only when the researcher understands the concepts which form the subject of the research well, that the researcher can utilize the tools which are provided the historical method to address the objectives of the research.

Also, it is necessary to understand basic concepts of related subjects when conducting a research study in the humanities because any research studies in the humanities require an application of knowledge from a wide variety of subjects. Therefore, it can be seen that it is important for a researcher in the humanities to have a deeper understanding of the subject of the research as well as many other subjects for the researcher to carry out a research project successfully. A good example of the importance of

imagination on the part of the researcher in relation to completing research projects in the humanities is seen in an example in which a researcher who is working on the historicity of an object may use various concepts in the process. For example, it may be necessary for the researcher to use specific methods to approximate the date of artifacts as well as to analyze other aspects that are related to the research study. Therefore, imagination means that a researcher should not rely on the knowledge that they have in relation to the subjects but should also be able to use various other tools from related subjects to ensure that they achieve the objectives of the research.

Another important characteristic of the historical methodology of conducting research the humanities is related to the need for the researchers to identify and evaluate relationships and significance of the subjects of the research studies. The use of historical methodology is not just based on establishing facts about issues that happened in the past. Moreover, research within this context is not bound by the need only to identify information that may have been misrepresented in current studies. Rather, research that utilizes this methodology within the context of humanities is usually based on the need for the researcher to unveil complicated relationships that may exist between phenomena. For example, a researcher may be motivated by the need to analyze and evaluate the relationship between events which occurred in the past. Similarly, a researcher may have to focus the attention of the entire study on identifying and evaluating the relationship between environments which formed the context of setting for various events or processes (Figure 12.1).

Figure 12.1: Traditionally, historical studies are concerned with ancient events.

(Source: Unsplash)

Another important characteristic or feature of the use of historical methodology to complete research studies in the humanities is related to the context in which the studies are conducted. In general, the environment in which an event occurred is very important to a researcher who is completing a study in the humanities using the historical methodology. The environment of an even that may be of interest to a researcher is defined by various things. For example, the environment is defined by the physical attributes or aspects which formed the setting or context for the event. Also, the environment may be described regarding the time frame in which the specific event that the researcher is interested in took place.

Another important issue that is related to the environment and which can be used to describe the use of the historical method in research in the humanities is social insight. Social insight is defined as the aspect of the historicity of events determines the relationship between an event and others as well as the environment. A simple way of understanding or describing the concept of social insight is by considering the kind of relationships that may exist among events.

Basically, events may be related in various ways. One of the most common ways in which events may be related to one another is in the form of causality. In some instances, small occurrences may result in another series of similar events. A good example of how events that happened in the past may be seen by considering the First and Second World Wars. The wars were triggered by small and unrelated events which happened in different parts of the world at different times. Interestingly, it was because of the effect of one event that led to the compounding of many other related occurrences in various parts of the world thus resulting in a global war. If the historian may be interested in learning about the effects of some small events in contributing to the escalation of violence, the historian may as well be using the concept of causal relationships in the process. Even when a historian is examining events that happened in the ancient times, the historian may still examine whether the events or processes were related in a way. Therefore, this form of relationship is important because it indicates whether one event can snowball into many other unrelated but consequential events.

Another important form of relationships among events that may be examined by historians is correlation. Within the context of historical research, events that happened in the ancients or recent past may be regarded as having a correlative relationship if they affected each other. For example, a historian may be interested in examining the effect of the bubonic plague

on the religious beliefs of the people who were affected by the disastrous outbreak. Thus, the researcher may be interested in evaluating the various ways in which the plague may have affected the religious beliefs of people in the society at the time. Also, the researcher may be interested in evaluating the possible impact of the religious beliefs of the people at the time of the spread of the disease.

From the preceding, it can be seen that there are specific features that define the use of the historical methodology in research in the humanities. It should be noted that for researchers to successfully complete their research projects in humanities, they need to focus on unraveling the complex relationships among events and the environment that exist. Also, it should be noted that any researcher who seeks to complete a research project in the humanities by using the historical methodology should focus their attention on using social insight as a framework of interpreting past events. Thus, the researchers need to be ready to examine relationships within the context of time and geographical boundaries. Also, the researchers should be prepared to evaluate historical events by identifying and analyzing possible relationships among various events, processes, and other aspects of importance to them.

12.3. DATA IN HISTORICAL METHODOLOGY

For researchers in the humanities to complete research studies, they need access to sources of data. Sources of data in historical studies can be categorized into two classes: primary and secondary sources. Primary sources can be described as documents, stories, or accounts which originate from individuals who witnessed events that occurred in the past. The most important aspect of primary sources of data is that they are used in research in the humanities is that they arise from direct accounts of eyewitnesses or people who understand what actually took place in the past.

There are many examples of primary sources of data that are normally used by researchers who are conducting studies in humanities using the historical methodology. One of the main examples of sources of data which are primary is the original documents related to the event or process that occurred in the past. For example, a researcher who is using this methodology may gain access to a document that was authored when the event occurred. Also, and other may access other supporting documents that may have been written and published a long time ago, but which can be used to shed light to a process or event that a researcher is supposed to examine in the research

process. Therefore, original documents are very important primary source of data for researchers who are carrying out research studies in the humanities using the historical method.

Apart from the original documents, another important form of the data source for researchers who are carrying out studies using this methodology is artifacts. An artifact is a material that has historical significance to the researcher. A researcher may decide to use a relic or artifact because such historical objects normally contain critical information that may be used to analyze specific processes or events that occurred in the past (Kothari, 2004). It is common for researchers who are working on the history of humanity to focus on specific stones, caves, or any other physical thing that they believe contains the key to unlocking historical information about the origin and development of the human species. Therefore, as it is in typical historical studies, researchers who are conducting studies in the humanities by using the historical methodology may be required to focus on looking for specific relics or other historical objects and use them to study any given process or event that happened a long time ago (Figure 12.2).

Figure 12.2: Relics such as this ancient piece of a written document can be important sources of information in historical research.

(Source: Unsplash)

Another important primary source of data for researchers who are conducting studies in the humanities by using this methodology is composed of the official records of events or processes. For every event or process, it is common for authorities or any other historian to give a credible and reliable account of what happened. Researchers rely on such records to get accurate and reliable information about the account of events as part of the research process. It should be mentioned that when researchers use official records of accounts as a source of data, they are open to possible interpretation of the information that is contained in the records. It is important to point this

out because one of the functions of using the historical methodology to conduct research is that the researcher can accurately raise issues related to the subject of the study. A researcher does not just carry out a historical study for the sake of recounting events but rather does so with the aim of finding possible discrepancies in the official record of events and providing alternative explanations of events that occurred in the past. Therefore, A researcher who decides to use official records as a source of information usually does so with an open mind and with the intention of providing alternative explanations to what happened in the past as opposed to what may be contained in the official historical records.

In other cases, researchers who are carrying out studies in the humanities may rely on the accounts of individuals who were witnesses to the events or processes that the researchers are interested in. In such a case, the researchers are supposed to find the eyewitnesses and collect information from them as part of the process. Therefore, the accounts of eyewitnesses are regarded as credible and reliable because they are the individuals who were present when the events of processes occurred (Ekko, 2008). However, it is important to indicate that researcher still have to subject the accounts of the eyewitnesses to the basic tests of standards to determine whether the accounts are reliable or not. If the accounts are found to be unreliable, it may be necessary for researchers to use alternative sources of information to complete their studies.

Apart from primary sources, there are secondary sources of data which are used by researchers when conducting studies in the humanities using a historical methodology. One of the most common secondary sources of information that can be used by researchers is related to published sources. It is important to use published sources of information because their sources are regarded as credible and reliable. In this case, researchers may use textbooks, credible reports, and any other material that has been published and can be accessed. Therefore, the use of such material is akin to the use of secondary materials in other forms of research. Using such materials is an ideal approach when researchers are focused on conducting desktop-based research studies that do not involve the actual collection of primary historical data.

From the preceding, it can be seen that researchers can access data that they use for their studies from either primary or secondary sources. Also, the choice of the source that the researchers decide to use to complete their studies depends largely on the availability of the source as well as

the nature of the study. In some cases, researchers may have to access the primary sources of information for them to complete the study successfully. In others, researchers may only rely on secondary sources of information to complete the research process successfully.

12.4. OVERALL PROCESS OF HISTORICAL METHODOLOGY

There is a clear connection between the process that is used to complete research using historical methods as well as other research processes that are carried out using alternative methods. The connection lies in the fact that in all these processes are conducted using a basic framework. For any research endeavor, the researcher has to decide what they have to research on, access data that is related to the subject of research, and then evaluate the data based on the needs resources. Also, in any research work, a researcher is supposed to report on the findings as the final part of the research process.

All studies that are conducted in the humanities using the historical method are based on this general framework. However, there are other specific aspects of the process that are carried out by a researcher which may not necessarily be similar to what is done in other research processes. In the first place, the researcher has to decide or choose the subject of the study. Choosing the subject upon which the study will be based is one of the most important steps in the research process because it determines the shape of the entire study (Pickering, 2008). As it has been pointed out, a researcher has to identify a problem that the entire research study is supposed to be based on. Within the context of historical studies, it is the work of the researcher to decide on an issue that is of interest and which they can handle comfortably. Suffice to say that research in historical subjects is supposed to be of primary significance to the society. It then follows that a researcher is supposed to choose a subject which may be beneficial to the society in one or another way. Therefore, a researcher is not supposed to choose a subject of research because the researcher is interested in the issue. Rather, any researcher is guided by the basic principle of ensuring that the findings of the research in the humanities that is conducted have a direct bearing on the social well-being of the people in the society.

Once a researcher has chosen the subject of the research, the researcher supposed to focus there are ft on finding sources which available to the subject. It has been indicated that there are many sources for that can be used by researchers working out studies in the humanities using the historical

method. What matters is the importance of every source to the subject that the researcher is interested in. For any good research to be conducted, the researcher is supposed to ensure that they get sources which are credible, accessible, reliable, and which can lead to the subject of questions that are used in the research. It is at this stage at the researcher may decide to use primary sources of data, or secondary ones which are accessible to them at that given time. However, regardless of the choice of the researcher in relation to the kind of data also thing 10 to use, the bottom line is that a researcher 6 to use a source that is credible accessible and informative.

The next stage of the process of conducting research using this method involves the actual analysis of the information that is contained in the materials that are used. It is necessary for the researcher who is using this methodology to take the time and study the sources that have been identified and collected for the study. This stage coincides with what normally takes place in other forms of research when the researcher has to collect data for that is to be used in the research. In this case, it should be remembered that the data that the researcher uses is normally accessed from the primary or secondary sources. This means that for example, if a researcher is working on a religious text, the researcher has to fast access the text and then take the time to read through it. The process of reading through the text is usually conducted in such a way that a researcher can identify the specific themes, issues, arguments or contentions that are contained in the text and which are of relevance to the research questions. These means that a researcher does not merely read a text for the sake of it, but rather reads the text through the lens of the framework and needs of the research that they are conducting.

In the same way, if a researcher is working on an empirical event, the researcher may have to access the official record of the event as part of this process. After the researcher has accessed the original or official account of the event, the researcher has to take the time and read through the account in line with the needs of the research that they are conducting. Also, at this stage, a researcher may be required to look at any other supporting documents or sources of data that can be used to shed light on the work that they are doing. Therefore, what is important to note from the foregoing discussion, is that the process of evaluating a historical source of data is usually iterative as opposed to a linear and carefully planned process. A researcher may move forwards and backward during this process by reading through a document several times and referring to many other documents to clarify issues or identify gaps that warrant further examination.

If a researcher identifies issues that need to be clarified at this stage of the process, the researcher can easily stop the entire process and seek clarification. In fact, it is this level of freedom that researchers in the humanities enjoy that distinguishes this kind of research from what is undertaken in the sciences. Whereas in the sciences researchers are supposed to follow very strict protocols, in the arts and humanities, researchers are allowed to use the iterative approach when carrying out their research studies.

The next important step in the process of research in the humanities which is based on the historical methodology involves careful evaluation of the sources that are used. Evaluation of the sources is conducted by the researcher as part of the research process. The reason for the importance of evaluation is that the researcher can adequately address the specific questions or hypotheses of the research. During the evaluation, the researcher is supposed to focus on the contentious issues that are found in the source of information (Smith, 2009). If a researcher is using a primary source of information in the form of a person who actually witnessed an event that occurred in the past, then the researcher is supposed to ensure that the process is conducted in the most credible way and that a researcher can address all the issues that are not clear in the narrative.

While evaluating the sources of information that they use, researchers usually focus on the determining the credibility of the sources. The credibility of sources of historical data can be determined by considering what other researchers say about the source. Researchers who use this method may deliberately seek the opinion of other experts about the sources before they decide to use the sources in their studies. By referring to what other experts say about the sources, the researchers manage to reduce the chances of working with a document that is not considered reliable.

After a researcher has gone through all the stages of conducting research in the humanities, the researcher is supposed to communicate the findings of the research. Communicating the findings of the research is, therefore, the last stage in the whole research process. Researchers communicate the findings of the research studies for various reasons. First of all, when researchers communicate findings, then they can pass the information to the people who need it. The audience of any researcher may be comprised of fellow researchers, come from institutions and the public in general (Kumar, 2010). All these individuals and institutions may need their research findings for various reasons. Because it is only a researcher who has direct access to the findings of the research, eat makes sense for the researcher to communicate

the findings of the research to the audience to facilitate the audience to use the findings in various ways.

Another reason for sharing the findings of the research by researchers relates to the need to share data and other important information. Although research in the humanities is not clearly organized as a form of practice that requires researchers to collaborate, it is still necessary for researchers who work in this field to share the findings of these studies with their peers and anyone who may be interested in the findings. In some cases, students may need their findings of the research to use them for their other studies (Gold, 2012). Researchers normally share findings for the sole reason of helping fellow researchers or individuals who may be interested in reading the findings of the studies. Another reason for sharing information is that it facilitates researchers to advance their careers. If a researcher is regarded as prolific, they are supposed to publish in peer-reviewed journals consistently. Therefore, consistent publishing of findings of studies is a sure way of advancing the careers of professional researchers.

For researchers to share the findings of the studies with their audiences, they need to use formal channels for the process. Many formal channels can be used to communicate the findings of research studies. The most common channel that is used by researchers is through peer review journals. Many peer review journals are published in various fields in the world currently. Researchers may choose the journals that they feel reflect their professional ethos for them to publish their research in them. Also, researchers may use textbooks as a channel for communicating the findings of the research. In other cases, researchers may be required to publish formal reports of the findings of the research studies. In such a situation, the researchers may be required to hand over their report on the findings of their studies to the individuals who would have funded their studies. From the preceding discussion, it is clear that the last stage of the research process, which is communicating the findings of their research studies, is equally important.

12.5. CHALLENGES OF HISTORICAL METHODOLOGY

There are many challenges that are associated with the process of conducting research in the humanities using the historical method. The following is a brief discussion of some of the most important challenges that researchers normally encounter when they use this method to conduct studies in the humanities. First, the most important challenge that researchers face relates

to the way they formulate the problem that they try to address. Problem formulation is one of the most important activities that are undertaken as part of the research process in general (Hayler, 2016). If a researcher fails to clearly identify what the problem is supposed to be examined in a research endeavor, then the chances of the researcher completing valid research are significantly reduced. What this observation implies is that if a researcher cannot clearly define the problem that they intend to address, and the researchers may not be able to use their techniques and knowledge to deliver a credible research report at the end of the process. It happens in some cases that some researchers fail to identify and describe the problem that they intend to solve in their research studies. In some cases, the research problem may be too broad that it fails to address the specific needs of the stakeholders. In other cases, the research problem may be too narrow that to meet all the needs of the stakeholders. Also, if a research problem that is used in a research project is very narrow, the problem may limit the options of the researcher when the researcher is completing the study. From the preceding, it is clear that a researcher has to clearly define a problem and ensure that all the basic elements of the issue that need to be researched on are fully covered in the research problem.

The second challenge that researchers in the humanities face when they use the historical method to complete studies relates to the amount of data that they have to collect. The amount of data that researchers have to collect may be very important because it determines the effort that the researchers have to put into the research process on the one hand, and the quality of the findings on the other (Kershaw, 2011). If researchers use inadequate or inaccurate information, they may not be able to get high-quality results because the evaluation process will be limited by the scope of data that they use. On the other hand, if researchers are forced to use a large amount of data in the research process, they may end up spending a lot of time analyzing the data. If researchers spend excess time analyzing unnecessarily large quantities of data, they may not produce reliable results at the end of the process. In the end, the quality of the final findings will be severely undermined if the researchers use large quantities of data in their research work. Therefore, what is important to note is that a researcher has to use enough information or data for them to get accurate and reliable results.

A researcher has to accurately judge the amount of data that they need for their studies by weighing the needs to produce the desired results against the amount of effort that is needed to access and process data (Gunn, 2011). However, it is important to the point that the decision on the amount of data

that a researcher uses is highly subjective. In some cases, researchers rely on their previous experience when deciding on the amount of data they need for their research studies. In other cases, researchers may decide on the amount of data that they need for their studies by simply considering the nature of the study. As it is the case in the sciences, in the humanities the decision on the amount of data that is needed largely depends on the nature of the subject. If a researcher is examining a very complicated subject, the researcher may need to use a lot of data to get answers to the research questions. If the researcher is only handling the small assignment, the researcher may only use equally small amounts of data to get their required answers. Therefore, it is evident that the amount of data that is used in any given research is determined by the judgment of the researcher and the nature of the study (Figure 12.3).

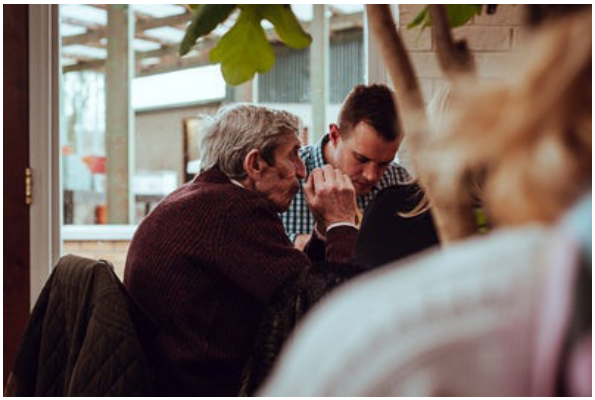

Figure 12.3: Eyewitnesses can be important sources of information for historical researchers.

Source: Unsplash)

Another important challenge that researchers were conducting studies in the humanities using the historical method is related to the way they balance their reliance on primary and secondary data. It should be mentioned that when researchers conduct studies, they have to balance their use of primary and secondary data (Boudon, 2005). If researchers emphasize on using primary data at the expense of secondary data, they may end up producing results which are not credible as they are required. Similarly, if researchers fail to sufficiently use primary data, they may produce results which are not credible because of the bias towards one form of data at the expense of the other. This means that it is important for researchers to ensure that

they use both primary and secondary data when completing studies. If a researcher relies on secondary data, then the researcher may produce a research document that not meets the set standards. It has repeatedly been shown that researchers in the humanities tend to focus more on secondary data at the expense of primary data.

In the typical example that has been provided in this section relating to a researcher who is examining a historical event, it is clear that the researcher may only focus on using secondary data for the research. In such a case, the researcher may deliberately ignore all forms of primary data that may be available to them. Whereas the reasons for researchers to avoid working with primary data when completing research studies in the humanities remain varied; what is clear is that some researchers prefer using secondary data because of its availability (Singh, 2010). Secondary data exists in a form that can be very useful to researchers. In a bid to minimize the time that may be spent getting primary data, some researchers deliberately choose to use secondary data. Therefore, it is important for a researcher to balance between primary and secondary data but the researcher and am focusing on only one form of data, it is obvious that the findings of the research will be undermined. More so, it should be borne in mind that the challenge of over-relying on secondary data that normally occurs in the process of researching the humanities is a common one that needs to be tackled by any researcher who conducts such as study.

Another important challenge that researchers face when they are using this approach to conduct studies in the humanities is related to the way to evaluate the data. Evaluation of data is a critical part of the research process because it determines the kind of findings that the researchers present their audiences at the end of the process. If research fails to evaluate data properly, the end results of the entire research project may be questionable. Also, if a researcher spends a lot of time on other activities of the research process but spends less time on the process of evaluating the data, then the researcher may not get accurate results (Boudon, 2005). Therefore, it is important for researchers to understand how to evaluate their sources of information that they use for their research purposes.

It is important to indicate that all the sources which are used in this kind of studies are associated with specific methods that can be used to analyze them. If a researcher fails to analyze a specific source, then the researcher may not be able to provide credible findings. For example, if a researcher does not understand how to analyze a specific historical text,

then the researcher may not be able to complete the research process successfully because the researcher may not get the right answers to the research questions. In the same vein, if a researcher does not understand how to analyze or evaluate a secondary source of information, then the researcher may not be able to address the specific questions of the research because of this problem. Therefore, it is important for a researcher to select their sources of information that they understand how to evaluate properly.

Also, it is, therefore, the duty of the researcher to take some time and evaluate the source of data that they intend to use. The process of evaluating the kind of data that researchers would like to use in their studies is based on the need to ensure that researchers use the best sources for their studies. To this end, it is necessary for researchers to weigh the advantages and disadvantages of using specific sources of data as the core process of evaluating sources. Therefore, researchers supposed to determine all the benefits that they may get by using specific sources for their studies. Also, it is necessary for researchers to find out all the negative aspects that are associated with using specific sources in their research studies. Apart from basing their evolution on the benefits and consequences of using some sources, may refer to the needs of their studies while evaluating the potential usability of their sources. Given that every study has its specific characteristics, it is necessary for researchers to ensure that their sources they choose to use meet all the criteria that are associated with their studies. It happens that at times some researchers fail to effectively evaluate the quality and usefulness of the sources they intend to use. If this happens, it is clear that the researchers may end up using inappropriate sources for their research. It is because of these reasons that it is recommended that researchers take time to evaluate property the sources that they intend to use in their work.

Another important problem that is faced by researchers who use this methodology to complete research studies in the humanities is that they may fail to properly select the sources that they use in the research process. Source selection is a very important aspect of the process of conducting research in this field because it determines how the researcher approaches the entire research project (Gold, 2012). If a researcher fails to get the right kind of sources that are relevant to the needs of a research problem, then the researcher may not get accurate answers to the research questions that are used in the It is because of this reason that every researcher should ensure that they get the right kind of information from the most reliable and appropriate sources that are available.

In this chapter, detailed information about the historical methodology of researching in the humanities has been presented. It has been argued that this methodology is unique because of its focus on the historicity of events. While conducting a research study using this methodology, researchers are supposed to focus on providing fresh perspectives on events that occurred in the past. This method is ideal for researchers who are interested in evaluating or interpreting past events or processes. It has also been indicated that there are fundamental characteristics that define this approach to research. Some of the most important characteristics of the historical method include the focus on using historical records, the need to read and interpret events within the context of the environment, and the focus on providing alternative explanations to events. It has also been indicated that when researchers use this method, they face various challenges. The most important challenges that researchers face when conducting historical-based studies include the inability to evaluate sources properly as well as a failure to get sources which are relevant to the subject of the research. The next chapter in this book will examine content analysis as a methodology for conducting research and humanities.

13
CHAPTER

CONCEPTUAL ANALYSIS

"Research is formalized curiosity. It is poking and prying with a purpose."

——Zora Neale Hurston

CONTENTS

This chapter presents detailed information about the subject of conceptual analysis in humanities. The main purpose of this chapter is to present all the information that is related to conceptual analysis as a method of research in the humanities. One of the issues related to conceptual analysis that is handled in this chapter is the definition of this methodology. Also, in this chapter, a detailed explanation of the process of conceptual analysis is presented. This is followed by a description of the steps that researchers take when they use this method to complete research studies. Also, information about the advantages and disadvantages of using conceptual analysis as a methodology of research in the humanities is presented in this chapter of the book.

13.1. DEFINITION OF TERMS

In general, conceptual analysis can be defined as a research process in which the researcher focuses on defining specific concepts that are used in texts (Ekko, 2008). Also, conceptual analysis can be defined as a special procedure for conducting research in which the researcher focuses on defining specific concepts and elaborating how the concepts interact with each other. It can be seen that conceptual analysis is based on the need for researchers to evaluate the meanings of concepts and determine the various ways in which these meanings have an impact on other related concepts. Also, it means that conceptual analysis enables a researcher to unravel the complex meanings of concepts that are used in the arts and humanities and describe their subtle relationships. Thus, conceptual analysis is one of the most important research methodologies that are used in the humanities.

It has also been indicated that the essence of conceptual analysis is to provide detailed descriptions of abstract concepts that are used in the disciplines (Smith, 2009). Conceptual analysis is important because it enables researchers to examine abstract concepts, write the various ways in which the concepts relate with one another, and examine the internal structure of the concepts. It is based on conceptual analysis that researchers can effectively identify some of the most complicated concepts that are included in the works of arts and humanities and managed to provide adequate descriptions of the concepts and the implications of their meanings.

In practice, researchers rely on various principles when using conceptual analysis as a method of researching in the humanities. One of the most important principles that are used by researchers when conducting conceptual analysis forms of research in the humanities is the principle of

pragmatism. In general, pragmatism means the extent to which a concept can be applied in real life situations. There is a broad difference between theory and practice as far as research in the humanities is concerned. Conceptual analysis is based on the need to provide an accurate definition of the concepts that are used in humanities studies. However, it is for researchers to provide explanations on how theoretical concepts can be applied in real life situations. Therefore, it is because of this need that the researcher may pay attention to the principle of pragmatism when using conceptual analysis method of research. For researchers to achieve the objective of ensuring that the concepts they define and elaborate on how practical relevance, seek to describe various ways in which the concept can be applied outside scholarship. Therefore, it is important to note that when researchers use this approach to conduct research studies in the humanities, they seek to show the various ways in which the theoretical that concepts that they can apply to real life (Figure 13.1).

Figure 13.1: It is important for a researcher to follow a set sequence of activities when conducting a conceptual analysis form of research.

(Source: Unsplash)

An example of how the logical principle determines the nature of the relationship among concepts that are presented in the work of the researchers is seen in the way researchers focus on providing accurate descriptions of all the concepts that are used in their studies. For example, if a researcher is

conducting a study that is based on a philosophical subject, the researcher may have to provide accurate and detailed definitions of all the concepts that are analyzed in the study. Also, in the case of a researcher who is doing a study on the concept of self-identity, it will be necessary for the researcher to take the time and provide a detailed description of the concept. Thus, in all conceptual analysis studies, the emphasis is put on providing accurate definitions of the concepts.

The second principle that is used by researchers who conduct research studies using this methodology is the logical principle. The essence of the logical principle is that it is the duty of the researchers who are using this methodology to ensure that all the relationships among the concepts which are portrayed in their studies are coherent. Coherence is defined as the way the concepts and relationships among the impact research work in line with general principles of logic (Smith, 2009). For example, endeavors to compare and contrast concepts as part of their research work, the researcher has to ensure that the comparisons and contrasts are clearly outlined. Hence, research to be regarded as valid, theories, and the researcher to maintain coherence by comparing and contrasting the concepts that are analyzed in the research work.

The third principle that is used in conceptual analysis studies is the epistemological principle. In general, epistemology is defined as the systematic study of knowledge, and the meanings of concepts. Epistemologists are concerned with defining abstract aspects such as the truth, knowledge, and meaning. In the case of research in the humanities, epistemology is seen in the way researchers who are using the conceptual analysis methodology may be required to identify and describe the concepts of truth and meaning. The epistemological principle means that researchers need to clearly define the concepts that they analyze in their studies for the studies to be regarded as valid (Ekko, 2008). Also, the principle means that it is important for researchers to clearly show how the concepts that they use in their studies are different from each other. What it means is that for any research study in humanities that is based on conceptual analysis to be regarded as of high-quality, the concepts that are used in it must be identified, defined, and outlined in specific ways.

In the preceding discussion, it can be seen that conceptual analysis is one of the primary methods that are used to carry out research in the humanities. It can also be seen that conceptual analysis is based on various principles. It is upon the researcher to ensure that the research meets all the basic principles

of conceptual analysis research for the study to be regarded credible. It is common for all research studies that are conducted using this methodology to be in line with the basic principles of the methodology. Thus, all studies should not only meet the criteria for logic, but also be based on the need to provide detailed and sufficient definitions of the concepts that are analyzed in them. Moreover, these principles are important for research studies that are conducted using the conceptual analysis methodology because they are unique for the humanities.

13.2. CONCEPTUAL ANALYSIS PROCESS

The following is a detailed discussion of the procedure that is followed when conducting research that is based on the conceptual analysis. The first step in the process of conducting research using conceptual analysis is the selection of the concepts. Selection of the concepts is important because it forms the foundation for the entire research process. There are several things that a researcher should take into consideration when selecting a concept that will be used and analyzed in the research. First, the researcher is supposed to ensure that the concept that is selected for analysis is abstract. Abstraction, in this case, is referred to as the process of ensuring that a concept that is used in the research is independent of its context (Hayler, 2016). For example, abstraction is evident in the case of a teacher who identifies a concept that needs to be analyzed in the course of delivering lessons in a classroom. In such a case, the teacher, who also acts as a researcher, may realize that students are experiencing a specific kind of problem when addressing their studies. If the researcher discovers that students do not understand the concept of self-identity, then the researcher may base the research project on analyzing the concept of identity.

In this example, the concept of identity may be regarded as abstract because it can be carefully analyzed even when it is removed from the context of the classroom. This means that for the researcher to analyze any concept properly, the concept must be in such a form that it can be comfortably handled outside its original context. Any other researcher who is interested in analyzing the concept can do so without necessarily referring to the context of the classroom. Therefore, it can be seen that it is necessary for researchers to ensure that the concepts which they analyze are abstract and that they can stand alone from there context.

Another important consideration that researchers have to adhere to when selecting the concept that is to be analyzed in their studies is related

to the enhancement of theoretical knowledge. As it is the case in many other research studies, it is necessary for researchers who are using the conceptual analysis method for humanities research to ensure that their research that is enhanced knowledge. In other words, researchers are supposed to ensure that the findings of their research are beneficial to other stakeholders. In this case, it is important for researchers to make sure that the analysis of the concepts that they carry out is beneficial because it enhances theoretical knowledge.

Given that conceptual analysis is based on theoretical aspects of knowledge, it is important for researchers to analyze concepts in ways that increase the knowledge in the related areas of interest to the researchers. The third consideration is that researchers are supposed to ensure that the concept they choose to analyze significant to the research problem. It makes sense for researchers to analyze concepts that are relevant to the problems of the research. Other words, the concept that is analyzed should be one that is directly connected to the questions that are used in the whole research.

The next step in the process of conducting conceptual analysis research is the formulation of objectives. Research objectives are the aims of conducting the research that guide the researcher in the process. Any research study is anchored on specific aims and objectives (Ekko, 2008). In this case, it is necessary for the researcher to take into consideration a few important principles. For example, it is important for the researcher to ensure that the objectives that are formulated are in line with their academic interests. It should be remembered that when a researcher is choosing a concept to analyze, the researcher is supposed to ensure that a concept is within their area of interest and can enhance knowledge in their fields. Similarly, objectives that are formulated as part of research that is based on conceptual analysis methodology are supposed to show that a concept that is to be analyzed not only enhances knowledge in a particular field but also is based on the interests of the researcher. Moreover, the objectives that are formulated as part of the process of conducting conceptual analysis form of research are supposed to be based on describing the concept that is to be analyzed. It is common for researchers to include an objective that is based on the need to adequately describe all the features of the concept that is to be analyzed. For example, a researcher who is working on analyzing the concept of identity, as it has been indicated in the example before, will use an objective that is based on the need to define the concept.

Also, researchers who use this methodology normally develop their

objectives based on the need to identify and characterize relationships between the concepts that they analyze and other related ones. It is common for researchers to develop objectives that seek to identify the various ways in which the concept that they analyze are related to others. Therefore, be objective enables researchers to identify and describe the causal relationships among the concepts that they analyze. It can be seen that the process of developing the objectives of the research is important in conceptual analysis studies because it provides the basic framework that the researchers use to complete their studies (Kershaw, 2011). Researchers may use objectives that are founded on the need to define the concepts that they use as well as show how abstract the concepts are as it is supposed to be in all conceptual analysis studies.

The third step in the process of conducting research using conceptual analysis method involves describing the characteristics and uses of the concepts that are analyzed. The characteristic of the concepts that are analyzed as part of the conceptual analysis research are some of the most important attributes of the concepts. Every concept has the unique features that help it stand out from the others. It is the work of the researcher to identify all the features that characterize the concepts that they intend to analyze. Therefore, describing the features of the concept that has to be analyzed is important in this form research.

Researchers usually rely on an extensive literature review to describe the concepts that they analyze. Literature review refers to the practice of studying published works to identify what other researchers have already published in relation to the concepts. It is normal in conceptual analysis research for the researchers to take the time to examine the findings of published studies with the aim to gain further theoretical knowledge related to a concept. In the context of conceptual analysis, a researcher takes time to evaluate published works with the aim of comparing and contrasting important information that can be used to identify the features of the concepts. A researcher normally takes notes, goes back to the work to read again, and compares various opinions in a bid to develop a comprehensive description of the features of the concepts that they analyze.

It is also at this stage of the process that a researcher usually provides a detailed description of the uses of the concepts that they analyze. In the case of the example of the teacher-researcher that has been indicated in this chapter of the book, it may be necessary for the researcher to identify the various uses of the concept of identity at this stage of the research process.

The researcher may have to visit published works to evaluate what other researcher say about the uses of the concept of identity. The researcher may then use the opinion of other researchers as a source of inspiration for the current research project.

Thus, it is clear that as it is the case with describing the features of the concepts, a researcher is supposed to rely heavily on a literature review to identify the various uses of the concepts that they analyze. Reliance on literature review helps researchers to identify and analyze the various ways in which other researchers have treated and used the concepts that they intend to analyze in the research studies. Therefore, it can be seen that the activity of identifying and describing the features and uses of concepts is important for the success of any conceptual analysis research endeavor (Gold, 2012).

The next step in the process of conducting conceptual analysis research is identifying the causes and consequences of the concept. Every concept that is analyzed has its causes and consequences. The causes or antecedents of concepts are the factors or conditions that exist before the concept emerges. In other words, these are the conditions that must exist for the concept in question to develop. Therefore, a researcher is concerned with identifying the most important factors that determine the emergence of a concept. Similarly, a researcher is interested in identifying and describing the results of the existence of a concept. Some factors arise from the existence of a concept are referred to as the consequences of the concept. Any researcher who is conducting a study of conceptual analysis is interested in describing the issues that are caused by the concept. Therefore, in common practice, researchers have to identify and fully describe the antecedents and consequences of the concepts that they analyze in their research studies.

Defining the antecedents and consequences of a concept is important for various reasons. In the first place, a detailed and factual explanation of the consequences and antecedents of a concept enhances the overall level of theoretical understanding of the concept (Gunn, 2011). It should be remembered that one of the basic needs of conducting conceptual analysis research is to increase the level of understanding of a concept that is already in existence. When a researcher carefully describes the conditions that precipitate concepts as well as the factors that arise from the concept, the researcher would have gone a step further to increase theoretical knowledge of the concepts. Moreover, the researcher can improve the level of understanding of the features of a concept by describing the antecedents and consequences of the concept. This means that if a researcher carefully

describes what arises from concept and the factors that precipitate the concept, research would have provided a detailed description of the features of the concept. Thus, it is important for a researcher to examine and describe the factors that cause and those that arise from the concepts that they analyze in their studies.

In the preceding discussion, it has been indicated that the process of conducting conceptual analysis research in the humanities involves several steps. Using the example that has been provided in this section of the chapter of the book, it has been seen that the researcher has to identify the concept that they are interested in evaluating. In the example that has been provided in this section of the book; it can be seen that the researcher who is also a teacher may identify the concept of identity from their professional work. Once the researcher has identified the concept of self-identity as part of the conceptual analysis process, the researcher is then free to carry out all the other activities of the research process.

The next important stage in the process of conducting conceptual analysis research involves analyzing the data. Basically, the data analysis process that is conducted in this kind of studies is based on the use of specific coding patterns. Codes are used to identify the approach that is to be used to analyze the concept. The choice of the codes usually depends on the level of expertise of the researcher and the kind of the study. In some studies, the researcher is supposed to use codes to guide them on how to identify the concepts that are to be analyzed. The coding scheme is used to determine whether the analysis is to be based on the frequency of occurrence of specific words that represent the themes that the researchers are interested in. In other cases, the coding scheme is used to define the level of analysis that the researcher subjects the concepts to. It is common for the researcher to focus on analyzing concepts at a very deep level by determining their relationships with one another, meanings, consequences, and antecedents. All these issues are usually addressed by the researcher in the course of preparing for the study. From the foregoing, it can be seen that the process of conducting research using conceptual analysis is based on the overall framework that is used to conduct research studies in the humanities. Basically, the researcher has to clearly define the problem that they intend to deal with in their studies. The researchers then have to clearly identify the methods that they intend to use to address the research problem. Once the researcher has identified the problem that needs to be solved and the techniques that should be used, the researcher is supposed to analyze the concept using the techniques.

13.3. ADVANTAGES AND DISADVANTAGES OF CONCEPTUAL ANALYSIS

Using conceptual analysis poses various advantages and disadvantages to the researchers. A brief analysis of the advantages and disadvantages that are associated with this method of research in the humanities. One of the most important advantages of using conceptual analysis to research in the humanities is that the method allows researchers to distinguish defining and non-defining attributes of concepts. The defining attributes of concepts are the most important characteristics of the concepts whereas the non-defining ones are important but do not determine the nature of the concept (Boudon, 2005). Conceptual analysis helps a researcher to identify and describe all the attributes of the concepts clearly. By doing so, a researcher can identify what the most important characteristics of a concept are and then communicate them to the audience effectively. Therefore, conceptual analysis is important because it enhances the ability of the researcher to define concepts in general.

The second importance of using conceptual analysis to complete research studies in the humanities is related to the description of uses of the concepts. The conceptual analysis provides the researcher with an opportunity to describe all the various uses of a concept that is analyzed (Gold, 2012). A researcher can do these by studying literature to identify all the various users that the concept is subjected to. Therefore, using conceptual analysis is beneficial to the researcher because it is the only means by which the researcher can identify the various uses of the concept. This is possible because the researcher carefully includes the need to describe the uses of the concept in the objectives of the research.

The third benefit of using conceptual analysis to conduct research in the humanities is related to the relationships that exist among concepts. It has been stated that there are two types of relationship: causal and consequential. Consequential relationships exist as a result of the effect of the concepts on other factors. On the other hand, many other factors may cause the concepts that are being investigated or evaluated in a research. Therefore, a researcher who uses conceptual analysis method can deliberately identify and describe the relationships among the various concepts. For example, a researcher can identify the factors that caused the existence of the concept that is being evaluated in the research. Also, a researcher can use this method to identify the factors that arise as a result of the concepts that are being investigated.

Another important benefit of using conceptual analysis method of research is that it enables a researcher to model the concept that is being investigated.

Concept modeling is an important aspect of conceptual analysis because it enables the researcher to devise the scope of the concept and draw boundaries in relation to the issues that can be described as part of the concept and those that are not related to the concept. In actual research studies, the work of modeling concepts is important because it helps researchers to delineate all the aspects of the concept. Therefore, using this methodology to complete research studies in the humanities can be beneficial to the researcher and all the other stakeholders because it helps the researcher to model the concept properly.

Many other disadvantages are associated with the use of conceptual analysis as a methodology for conducting research. One of the most important disadvantages of this method is that it does not provide the means of generating new concepts or ideas. As its nature dictates, conceptual analysis is a method that is based on the need to analyze existing concepts but not to generate new ones. Unlike many other methods of conducting research studies in the humanities, the conceptual analysis does not provide the resources that a researcher may need to identify and test new concepts. Therefore, this method is not suitable for a researcher who intends to introduce or test new concepts for practice (Figure 13.2).

Figure 13.2: One of the major disadvantages of conceptual analysis method of research is that the researcher has to spend a lot of time reviewing literature.

(Source: Unsplash)

Another important disadvantage of conceptual analysis is related to the method that is used to identify and evaluate the concepts. Unlike many other

methods of conducting research, original analysis is based on the need for the researcher to evaluate concepts by reading the work that has been done before (Smith, 2009). Although literature review is one of the hallmarks of all basic research processes, in the case of conceptual analysis, literature review takes a lot of time that is used in the entire research. For example, a researcher who is at the stage of identifying the concepts that are to be analyzed in the research is supposed to spend a lot of time evaluating published works that are related to the concept. Also, a researcher who is working on a project by using this method is supposed to re-evaluate literature many times for the researcher to identify the characteristics of the concepts and relationships that a concept has with other related words. When this is compared to what normally takes place in other research projects, it is clear that our research project that is based on conceptual analysis requires that a researcher does a lot of reading and analysis of the secondary text. They have secondary text analysis forms the bulwark of the work that is done by the researcher as part of the process of implementing the research.

Another important disadvantage of conducting research using conceptual analysis is that the process is associated with oversimplification. In general, processes are characterized by the nature of the practice and the complex methodologies that are followed. For example, research in the sciences is characterized by the need for the researcher to follow procedures and test all the variables that are used in the research process. The researcher who is doing a typical research study in the sciences is supposed to use complex random designs. Also, the researcher is required to administer complex treatments to the samples, collect the results and analyze them. Similarly, in the research in the social sciences, a researcher is supposed to follow a specific process and ensure that the all the objectives of the research are achieved at the end. However, in the case of research in the humanities that is based on conceptual analysis, the researcher focuses on the achievement of the objectives as opposed to the procedures that are supposed to be used (Gunn, 2011). Therefore, the emphasis on the outcome of the research process at the expense of the methodology may make research findings that are conducted using conceptual analysis to be regarded as oversimplified. It is because there are no detailed and strict rules that are supposed to guide a process of doing research using conceptual analysis that some observers believe that a process is usually oversimplified.

13.4. FACTORS THAT DETERMINE THE QUALITY OF CONCEPTUAL ANALYSIS

Several factors determine the quality of conceptual analysis research. The following is a brief discussion of some of the most important determinants of the quality of the outcome of conceptual analysis research. The first important factor that influences the outcome of conceptual analysis research is the level of analysis that a researcher uses. The level of analysis refers to the extent to which the researcher examines specific concepts in the work that is the subject of the research. In typical conceptual analysis research, the researcher has to choose between the option of analyzing specific words and that of analyzing phrases that are contained in the work (Ekko, 2008). If a researcher chooses to analyze words that are found in the text, then the researcher is supposed to read the text and identify the words which represent specific concepts. However, if the researcher chooses to analyze specific phrases, the researcher has still to read the work and examine the meanings of the phrases and how they represent concepts. Therefore, the level of analysis that is used determines the quality of the outcome in this kind of research.

The second important determinant of the quality of research is a kind of analysis that a researcher chooses to use. On the one hand, a researcher may choose to use a method that is based for determining the frequency of occurrence of specific concepts in our work. On the other hand, a researcher may choose to analyze text by considering the mere existence of a concept in work. If a researcher works with the frequency of occurrence concept in a work of art, then the researcher is supposed to count the number of times that the concept occurs in the work. In such a case, the higher the number of times the concept occurs in the work, the higher the level of importance and meaning the researcher attaches to the concept. On the contrary, if a researcher works by considering the appearance of a concept in the work, then the researcher may not be interested in determining the number of times a specific word or phrase occurs in the work.

Another important determinant of the quality of conceptual analysis research is the kind of definition that is used on the concepts. It has already been stated that it is important for the researcher to define the concepts that are used in the analysis. It is when the researcher clearly defines the concepts that are used in the research that the researcher can easily complete the research process. If a researcher fails to define the concepts that are used in the analysis clearly, then the researcher may not be able to achieve the

specific objectives of the research (Smith, 2009). For any given research, must decide on the level of generalization that is to be used. The level of generalization refers to how the researcher considers and defines some specific concepts before they categorize the concepts that they analyze. Also, it is when a researcher decides on the level of generalization that is to be used in the research that the researcher manages to differentiate between important and relevant aspects of concepts in research. Therefore, it can be seen that the kind of definition that are researcher uses for the concepts in the research work interment the overall quality of the outcome of the research.

Another important factor that determines the quality of the outcome of conceptual analysis research is the kind of coding that is used. It is necessary for a researcher to use a coding scheme that meets all the basic needs of the research (Pickering, 2008). Also, it is necessary for researchers to implement the coding scheme uniformly when analyzing the concepts that are found in the research. By doing so, the researchers ensure that they conduct the analysis process consistently.

This chapter has presented all the basic details that are related to the methodology of conceptual analysis. It has been indicated that conceptual analysis is one of the most common methodologies that are used to carry out research in the humanities. It has also been shown that when researchers use this approach, they focus on identifying specific concepts in the works that they analyze and then establishing the various ways in which the concept is related to the others. Also, researchers who conduct this form of study seek to describe all the basic features of the concepts that they use. The basic features are usually separated from the less important ones.

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