

An Overview of Quantitative Research Methods



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ABSTRACT: The phrase "research" refers to seeking knowledge. It is a scholarly and systematic search for relevant knowledge on a specified subject. The Oxford Learner's Dictionaries defines "Research" as "A careful study of a subject, especially to discover new facts or information about it". Research is a philosophy of systematic study that critically investigates several aspects of professional work, including development of prominent concepts that manage a particular process, and development and analyse novel theories. In accordance with Woody (1927), research includes identifying research problem, creating hypotheses, collecting, analysing, and assessing data and making inference. As a result, research is a distinctive contribution that advances the current knowledge via investigation, observation, comparison, and experimentation. To put it in a nutshell, research is the pursuit of knowledge through a methodical approach to problem-solving.

KEYWORDS: Quantitative Research, Research Methodology, Quantitative

INTRODUCTION

It is an essential question to know What motivates people to conduct research? According to Kothari (2004), the following reasons might encourage people to do research however they are not a complete list of the variables that motivate people to participate in research projects.

- To obtain a research degree, as well as the benefits that come with it
- To deal with the challenges the unsolved problems, i.e., apprehension about real-world problems originates research
- To experience the intellectual pleasure of completing some creative task
- To offer a service to society
- To get respectability

The three common approaches for conducting research are a qualitative method, quantitative method, and mixed methods.

Qualitative research involves the quality of data and aims to understand the explanations and motives for actions, and also the way individuals perceive their experiences and the world around them. Qualitative research creates perceptions into a problem's context and provides ideas and hypotheses. Quantitative research seeks to establish a knowledge and understanding of numerous assumptions that have been developed in a study. Thus, during the planning and designing phases, it involves a cycle of consecutive phases of hypothesis formation and creativity, discipline, and patience.

Quantitative research involves quantifying things and asks questions such as "how long," "how many," and "the degree to which." Quantitative research aims to quantify the data and generalize findings from a sample of a study from varied perspectives. It requires collecting data, analyzing, and interpreting quantifiable data to prove the hypothesis produced in a specific study. Quantitative research relies on data collection and data analysis which is based on a logical method with the focus on testing theory, influenced by empiricist and positivist ideologies (Bryman, 2016). Quantitative research describes the specific qualities and rather important differences to generate conclusions in research. Therefore quantitative research creates more consideration about the problem. The key features of quantitative research are as follows:

- Collecting data by utilizing standardized research instruments.
- Findings are based on larger sample sizes.
- Reporting the research because of high reliability.
- Responding to research questions and meeting the research objectives.
- Planning all research phases before data collection.

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- Concerning statistics, reasoning, logic, and an objective viewpoint that researchers use tools such as questionnaires to collect numerical data. It is emphasizing numerical and statical data which will be presented in non-textual forms like tables, charts, figures, or others.
- Identifying characteristics and building statistical models for explaining the observation is the main goal of quantitative research.

1. Characteristics of Quantitative Research

Quantitative or qualitative research is being chosen based on the type of the topic, research questions, and research problem. Then the selected method determines the exact research design and procedures such as the sample of the research, data collection instruments, data analysis, and final result interpretation. According to Creswell (2002) the major characteristics of quantitative research are:

- Describing a problem statement by presenting the need for an explanation of a variable's relationship.
- Offering literature, a significant function by answering research questions, explaining the research challenges, and generating a demand for the research direction
- Creating precise, quantifiable, observable purpose statements, research questions, and hypotheses
- Collecting numerical data from a sample of the study by using instruments
- Using statistical analysis for analyzing patterns, comparing groups, or connecting variables, then finding interpretation by comparing them to previous research and predictions
- Providing the unbiased study report by utilizing standard frameworks and assessment standards, while remaining impartial and unbiased

The researcher in quantitative research selects a study problem based on patterns to clarify the reason something happens. Explaining a trend indicates that the research problem may be addressed when the researcher attempts to identify common tendency of responses from people and to observe the differentiation of tendency between individuals.

In quantitative research, findings can inform how a big population perceives a problem, as well as the diversity of those perspectives. Some quantitative research problems, on the other hand, demand the researcher to describe how one variable impacts another variable. Variables are characteristics of people or attributes that researchers investigate. The quantitative researcher is interested in discovering the influence of one variable on another variable. Generally, the literature review has a significant role in quantitative research by explaining the necessity for the research problem and providing prospective study goals and research questions.

Justifying the research problem entails using the literature to demonstrate the significance of the topic under consideration. So, quantitative researchers are supposed to search the literature to discover some research to identify the investigated topic and then reference these literatures in the introductory parts of a report.

To acquire measurable and observable data about variables, quantitative researchers should ask particular and restricted questions to identify a few variables. A tool to measure, monitor, record quantitative data that includes particular options for questions and answers that the researcher designed is an instrument. The survey, standardized exams, and checklists are examples of research instruments that researchers could use for conducting research and collecting data in the format of numbers.

In quantitative data analysis, the researcher uses mathematical techniques known as statistics to analyze the data. These analyses entail segmenting the data for answering the research questions. Using statistical techniques, like groups comparison, offer data to help answer hypotheses and also research questions. The research findings must be interpreted. The researcher should interpret the analysis to explain not only the research finding but also in what way the result support or reject the study's anticipated predictions.

2. Objectives of Quantitative Research

The research goal is finding responses to problems and questions via using scientific techniques. However, each research project has its particular aim. Kothari (2004) classifies research objectives into the following general categories:

- Exploratory or Formulative Research: To become acquainted with a phenomenon or to acquire novel insights about it
- Descriptive Research: To correctly depict the qualities of a certain individual, group, or situation

Quantitative research is classified into four types:

1. Experimental Research
2. Correlational Designs
3. Descriptive Research
4. Causal-Comparative/Quasi-Experimental Research

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2.1. Experimental Research

Experimental research comprises of a hypothesis and variable, which can be measured, calculated, and compared in a controlled environment. The purpose of experimental research is to discover a correlation and relationship between the dependent variable and independent variable. Data in an experimental study must be quantifiable or measured. It is also known as intervention research or group comparison research. It is a technique used in quantitative research to assess if an activity or materials affect participant outcomes. The researcher measures the effect by assigning a single set of actions to one group, which is called intervention, and denying the set of actions to the other group.

Developing a set of methods to test a hypothesis means experimental design. A successful experimental design necessitates a thorough grasp of the system under study. The first step will be started with considering the variables and their relations. In the second step, the researcher will make explicit and testable predictions. Third step will demonstrate not only the level of details but also the external validity of findings base on how precisely the researcher modifies independent variables. In the fourth step, the internal validity of the experiment will be determined by the researcher's decisions on randomization, experimental controls, as well as between vs. within-subjects designs.

2.2. Correlational Designs

The purpose of correlational research is to identify variables that have a connection in a way that a change in one affects a change in the other. In this type of design researcher examine two variables to demonstrate if there is a statistically considerable relationship between them without manipulating them, for example, the relationship between diet and anxiety. Unlike experimental research, which is fully based on scientific technique and hypothesis, this sort of study is descriptive. There are three forms of correlational study as:

- Positive correlational research
- Negative correlational research
- No correlational research

The direction of a correlation can be either positive or negative.

2.3. Descriptive Research

In nature, descriptive research could be either quantitative or qualitative. This kind of research involves quantitative data that can be collated in numerical form, like test scores or the amount of times an individual use a specific feature of a multimedia program, or it can explain categories of data, like gender or patterns of communication while using technology in a group setting.

According to Hopkins and Weeks (1990) quantitative research describes the specific qualities and rather important differences to generate conclusions in research. Therefore quantitative research creates more consideration about the problem. Descriptive research aims to accurately describe a population, situation, and phenomenon and the characteristics which are more concerned with "what, where, and when" rather than "why" something has happened. Because before researching why something happens, there is a need to understand how, when, and where it happens.

According to Gall and Borg (1989) descriptive studies are intended to discover "what is". Therefore, for collecting descriptive data, observational and survey methods are frequently being used. It frequently uses visual aids like either graphs or charts to assist the audience in comprehending the data distribution. The reason is that the human brain is incapable of extracting a large quantity of original data so descriptive statistics data is reducing to digestible and manageable format. In contrast to experimental research, the researcher does observation and measurement and does not manipulate the variables.

The best technique for discovering characteristics, frequencies, trends, and categories is descriptive research. For having a valid and reliable result it is essential to have a developed research design. Descriptive research can be carried out using particular data collection methods and it provides a comprehensive understanding of a research problem. The advantage of the descriptive method is that it allows the study to be performed in the respondent's natural context that not only certifies high-quality data but also represents data collection from a large population. The three main types of descriptive research are:

- Survey
- Case study
- Observation.

2.3.1. Case Study

This kind of research includes a detailed analysis of a person or group of people. Case studies can lead the researcher not only to test hypotheses but also investigate unusual phenomena. Case studies should not explain cause and effect because of limitations in making reliable predictions.

If a scholar studies a particular phenomenon coming from a distinct entity, a single-case study is required and allowing for deep learning of the single phenomenon and requiring the collection of multiple various forms of data. Various case research study

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enables a scholar to gain a deep understanding of the cases by drawing a comparison between similarities and differences of the individual cases embedded inside the quintain. The confirmation from multiple-case studies is stronger and more trustworthy than confirmation from single-case studies because it demonstrate a more in-depth examination of research questions and the development of theories (Stake, 2013).

2.3.2. Observation

All research includes some form of observation, which might be quantitative or qualitative. A quantitative observation requires data collection in numerical form and should be interpreted in terms of a number. In quantitative observations, statistical survey data is being used for analysing. Researchers observe participants in a naturalistic environment from a distance. Because the sample of the study is in the natural environment, the observed characteristics are enriching and provide additional information. Additionally, it produces more ecological validity than in comparison to laboratory observation. The extent to which research may be used in real-world circumstances is referred to as ecological validity. Before developing testable hypotheses, models, or theories, the researcher needs to observe and describe the subject under study systematically.

2.3.3. Survey

Survey research is a quantitative approach in which the researcher distributes a series of questions to a sample of research. It is especially beneficial when a researcher wants to describe the characteristics, attitudes, behaviors, and opinions of a large population. The analysis phase interoperates statistical data to conclude proving or disproving hypotheses. Respondents reply through questionnaires, surveys, or polls in survey research. Research to collect precise and effective data should have the proper survey questions with open-ended and close ended-questions. The survey method can be used either online or offline with enormous sample size. In a survey, a sample is a subsection of people chosen from a population. Therefore, the researcher studies the sample then searches to communalize the results to the population. One of the advantages of using a survey is that the researcher can collect data from a sample of respondents from a large population. Analysis of large datasets properly represent the population's diversity and rather data collection can be generalized to the larger population with more reliability than the data collected through a case study. The two forms of survey that can be used based on the time and the type of data are:

- Cross-sectional survey
- Longitudinal survey

2.3.3.1. Cross-sectional Survey

These kinds of surveys are observational surveys that apply when the researcher plans to collect data from a sample of the target group at a specific time. A quantitative researcher can assess several variables at a specific time. In a cross-sectional survey data collection is from individuals who show similarity in all variables except those chosen for study. Multiple samples can be analyzed and compared by conducting a cross-sectional survey. Longitudinal surveys are the inverse of cross-sectional studies. In cross-sectional studies data collection will be from many subjects at once, on the other hand, in longitudinal studies data collection will be continued from the same subjects throughout time, generally concentrating on a smaller group of individuals with similar feature.

2.3.3.2. Longitudinal surveys

Longitudinal surveys are called observational surveys in which researchers evaluate the same individuals continue to discover any changes that may occur over time. This kind of survey is substantially used not only in the area of medicine and applied sciences but also in the market trend for analyzing customer satisfaction or gathering feedback on products or services. Longitudinal studies are a type of correlational research. In this kind of study, the researcher observes and collects data on several variables without trying to influence them which can be found in the economy, social or medical sciences. Figure 2 shows the differences between these two types of surveys.

2.4. Causal-Comparative/Quasi-Experimental Research

This kind of research attempts to identify cause-and-effect relationships between the variables which are extremely similar to actual experiments but with few important distinctions. Therefore an independent variable is discovered but not modified, and the independent variable's effects on the dependent variable are being assessed. The groups are not being assigned randomly; the researcher needs to use naturally formed or pre-existing groups. The control groups will expose to the treatment variable then will be studied and compared. After analysing and making conclusions, determining causes must be done carefully, because known and unknown variables can affect the results.

3. Problem Statement

A research problem refers to a definite and concise statement concerning a source of problems that need to be remedied, challenges that need to be eliminated, or questions that exist in scholarly literature, theory, or existing practice and indicates the need for clear comprehension and purposive investigation (Bryman, 2007). The purpose of a problem statement is to present the

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significance of the topic being researched, suggest a clear statement on the purpose of the study, create a framework for reporting the findings. In quantitative research, a research problem needs to measure variables, determine the effect of these variables on a result, examine theories, and apply the findings to a large population. After identifying the research problem, the researcher needs to write problem statement part comprises (Creswell, 2002):

- Research topic
- Research problem
- Research problem authenticity as discovered in the previous studies should be justified
- Research gap in current knowledge concerning the research problem
- Research audiences who will advantage from a research problem

The researcher can simply comprehend introductions to research projects by identifying these five aspects.

4. Research Objectives

In any research project, a crucial task is to define the core objectives. In quantitative research, a research objective defines the aims and goals that the researcher intends to attain and it is the result of the research project after its implementation. It should be closely related to the problem statement and provide direction to the performance of the research. Before developing research objectives, the researcher should be updated in the research area and identify the knowledge gaps that need to be filled.

The focus of the quantitative research objective is concise, narrow, and measurable. The quantitative researcher needs to have a distinctly defined research question where answers are sought. The methodology of quantitative research should describe how each objective will be achieved. The research objectives should be directly connected to the problem statement, resulting in clear and attainable objectives. Research objectives act as a guide to determine suitable research design, problem statement, data collection procedure, analyze and interpret data and variables of the study. Therefore the research objectives need to be specific, measurable, achievable, realistic, and time-constrained. When the researcher can explain in simple terms what the research is about and why it matters, it shows the aims and objectives are concise and clear. There are some differences between the aims and the objectives of the research as:

- Sims of research describe what the researcher hopes to achieve, on the other hand, the objectives detail how the researcher intends to achieve aims.
- Sims of the research are relatively broad; on the other hand, the objectives are specific.
- Aims of a research focus on a project's long-term results; on the other hand, objectives focus on immediate and short-term outcomes.

The aim of the research is being followed by a series of statements explaining the research objectives, which indicate the research topic and problems in details.

5. Purpose Statement

A purpose statement states the research's purpose, scope, and direction that directly addresses the problem and closes the stated gap. It notifies the reader what to anticipate from the study and what the precise focus will be. The researcher needs to write the purpose statement in a single phrase and start it with keywords like "The purpose of the study ...". In this phase, the researcher should state how the theory will be tested. In the purpose statement, the words relate, compare, or describe should be used to show the relationship between variables. The researcher should specify not only the independent and dependent variables but also a sample and participants. Research objectives and purpose are being created by problem statement and the research gap. The purpose statements need to be clear and concise, flow from the problem statement and address the proposed problem, match the methodology, and answer the question 'Why the researcher is doing this research?'

6. Theoretical and Conceptual Framework

Quantitative researchers examine if the independent variable affects on the dependent variable because previous researchers indicate that this relationship exists. Some researchers discovered a theory that predicts how the dependent variable would be affected by an independent variable. The concept of probable causation states that rather than proving the relationship, researchers seek to demonstrate a cause-and-effect relationship between variables. In quantitative research, a theory predicts and describes the possible relationship between dependent variables and independent variables. For instance, the researchers investigate the relationship and effect of peer groups on teenagers. This connection is put to the test regularly basis, such as with religious organizations, middle schools, or high schools. Constantly the connection of a constructive and beneficial impact has been proven true. Eventually an individual labels this relationship and connection as a theory and determines a name (Creswell, 2002).

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By reviewing literature, the researcher will immediately realize that the problem statement of the research has its origins in a variety of theories that have been established from various views. The researcher is supposed to obtain data from different resources and sorts them under main theories. The foundation of the research problem is the conceptual framework which derived from the theoretical framework and regularly emphasizes the foundation of the study. While the theoretical framework includes theories or problems wherein the research is linked, the conceptual framework defines the components of the theoretical framework that the researcher chose to serve as the foundation of investigation. Consequently, the conceptual framework develops from the theoretical framework and is linked to the particular problem statement (Kumar, 2018).

7. Research Questions

As the name suggests, research questions are frequently grounded in research. Quantitative research questions are clear and include the sample of the study, dependent and independent variables, and the research design. They are typically completed at the beginning of the research (Berger, 2015). Research questions narrow the purpose statement to precise questions which need to pursue to find a response. The research question should begin with "how", "what", and "why". For demonstrating the type of the variables, the researcher needs to use words like describe, compare, relate. Quantitative research has three methods of research question:

- Descriptive questions
- Relationship questions
- Comparison questions

7.1. Descriptive Questions

This type of question is used by the researcher to find out the answers of the samples of the study to a particular question. Descriptive questions typically begin with "what."

7.2. Relationship Questions

A relationship question is used by the researcher to identify the relationship between two or multiple variables.

7.3. Comparison Questions

Comparison question helps to discover what differences exist between two or more groups of an independent variable in terms of one or more result variables.

8. Quantitative Hypotheses

One of the most essential phases in designing quantitative research is defining the research hypothesis. In quantitative research, hypotheses are specific, clear, and testable statements in which the researcher state a priori expectation about the result of research for example predicting the relationship between variables. A hypothesis is more than only a random guess; it should be founded on current theories, information, and knowledge. A hypothesis needs to be testable, which implies that the researcher must be able to support or disprove it by using scientific procedures such as tests, observations, experiments, and statistical data analysis.

In quantitative research, hypotheses restrict the purpose statement and offer a researcher's prediction about expected findings (Creswell, 2002). The variables should be stated in the following order:

- First position: Independent variable
- Second position: Dependent variable
- Third position: Control variable

Hypotheses are classified into two types:

- Null hypotheses
- Alternative to null hypotheses

8.1. Null Hypothesis

The null hypothesis predicts that there is no relationship between the independent and dependent variable. For instance, "There is no difference between" groups or "There is no relationship between (or among)" variables might be used to start a null hypothesis.

8.2. Alternative Hypotheses

If the null hypothesis is rejected, the alternative hypothesis is true as it suggests a relationship or a modification based on findings from previous studies, or a description or theory described in the literature.

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9. Literature Review

The literature review is the backbone of all types of research which includes a comprehensive summary of previous research on a topic. It should be enumerated, described, summarised, objectively evaluated, and clarified. Writing a quantitative literature review contains critically analyzing relevant research and publications. It needs to be started by searching for relevant literature, then evaluating the resources. After finding the gap, the researcher should outline the structure and finally write a literature review. By conducting a literature review the researcher demonstrates how the research adds to the current body of knowledge. At the beginning of a quantitative study, researchers discuss the literature to justify and emphasize the significance of the problem and give the rationale for the study's goal, hypotheses, or research questions. The literature needs to be used at the end of the research for confirming, disconfirming, contrasting, and comparing with past research results. According to Kumar (2018) the literature review can the researcher in four ways:

1. Make the research problem clearer and more focused
2. Develop the research methodology
3. Expand the knowledge base in the field of study
4. Contextualize the results

10. Research Designs

The particular processes involved in the research process are known as research designs. The research design serves as the "blueprint" for the research investigation. These procedures include collecting data, analyzing data, and writing reports. Saunders research onions provide a comprehensive explanation of the steps of a research procedure. It demonstrates an efficient procedure for developing a research methodology. Saunders, Lewis, and Thornhill (2007) view the research process as the unwrapping of an onion layer by layer. The outer layers need to be unwrapped to view the inner layer. Accordingly for achieving objectives, the right steps have to be taken, it applies that the first step needs to be covered before proceeding to another step.

The researcher needs to know the significance and application of variables in order to develop purpose statements, research questions, and also hypotheses. In statistics and research, variables are items that the researcher can measure, observe, manipulate, and control. The value of a variable might vary either between groups or over time. For instance, if an individual's eye color is the variable in an experiment, its value can vary from brown to blue to green from person to person.

The term variable has a root that is linked to the word "vary," which should help to grasp what variables are. Variables are objects, things, or factors that have the ability to change, like the temperature, weight, and mood of a person. Variables might have varying values depending on the circumstances or for different persons. The major kinds of quantitative research are:

- Independent variables
- Dependent variables
- Sample variables.
- Extraneous variables

10.1. Independent Variable (IV)

An independent variable has a unique feature that cannot be changed by the other variables. For example, age is an example of an independent variable because the living place, the foods they eat will not affect their age. Independent variable has the potential to affect other variables. In a cause and effect question, independent variables are the variable that causes the effect.

10.2. Dependent Variable (DV)

The dependent variables are impacted by the independent variables as they are the outcome of the impact of the independent variables, so it is a variable that receives the intervention. For example, a grade on an exam is a dependent variable as it depends on factors such as how long you studied. Because studying time affects test score on the other hand test score does not affect test score.

10.3. Quantitative Variable

A quantitative variable represents a measure and it is numerical like height, distance, or number of items. Quantitative variables are divided into two types:

- Discrete variable
- Continuous variable

10.3.1. Quantitative Discrete Variable

A quantitative discrete variable is any numerical variable that can be counted, as a number of children per family or the number of teachers in a school. It cannot be broken into fractions and decimals. For example, you cannot buy half a ticket.

10.3.2. Quantitative Continuous Variables

Quantitative continuous variables is numerical variables that cannot finish counting, like time, temperature, weight. It can be broken down into fractions and decimals.

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11. Reliability and Validity of Instruments

The conceptualization of reliability and validity employed to assess the research's quality shows the accuracy of a methodology in measuring something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure. While the researcher develops a research design, planning methodology, and outlining the findings, it is critical to consider reliability and validity.

Reliability refers to a method which consistency measures something. If consistently the same findings are achieved by utilising the same method, the measurement is reliable.

Validity refers to a method which precisely measures something. A high validity research provides findings that correlate to genuine features and variances in either the physical or social reality. High reliability represents a measurement is valid or not and if a method is not reliable, it probably is not valid.

11.1. Assessing the Reliability and Validity

Reliability can be determine by comparing several versions of the same measurement. It is more difficult to assess the validity but it can be determine by comparing the findings to other accurate theory and data.

11.2. Types of Reliability

Reliability refers to the consistency of a measure which includes three main types:

- **Test-retest** evaluates the consistency of a measure over time
- **Interrater** evaluates the consistency of a measure among observers
- **Internal consistency** evaluates the consistency of the measurement

11.3. Types of Validity

Validity is described as the degree that a concept is precisely measured and evaluated in quantitative research which includes three main kinds of validity as:

- **Construct:** The conformity of a measure to established theory and knowledge of the concept being evaluated.
- **Content:** The extent to which the measurement encompasses all features of the concept being measured.
- **Criterion:** The extent to which a measure's outcome conforms to other valid measurements with the same concept.

12. Sampling Design

The method of selecting the sample size has a major impact on the accuracy of findings. The goal of sampling in quantitative research is to make conclusions about the group the researcher collect a sample in an unbiased way through randomization which represents the population from where it is selected (Kumar, 2018).

A quantitative researcher is led by a predefined sample size depending on available resources, research style, and the possible use of the results. The large sample size is highly valued in research that aiming to create policies, to assess the relationship, or to establish impact evaluations because a larger sample size encompassing different backgrounds and ensuring that the sample is demonstrating the research population. According to Kumar (2018), the sampling design can be categorised as:

- Random/probability sampling designs
- Non-random/non-probability sampling designs
- Systematic/mixed sampling design

Every component in the population needs to have an equivalent and independent probability of being selected in the sample in **random sampling or probability sampling designs**. The most common methods for selecting a random sample are (Kumar, 2018):

- Fishbowl draw
- Computer program
- Table of randomly generated numbers

Non-random or non-probability sampling designs is employed when the number of components in a population is unknown or cannot be exclusively recognised. The most common methods for selecting a non-random sample are (Kumar, 2018):

- Quota sampling
- Accidental sampling
- Judgemental sampling or purposive sampling
- Expert sampling
- Snowball sampling

Systematic/mixed sampling design has the features of random and non-random sampling designs. In this type of design, the sampling frame needs to be distributed into segments called intervals. Then, the SRS approach is used to choose one element from the first interval. The arrangement of the element selected in the initial interval determines which subsequent elements are

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chosen from other intervals. If the fifth element is used in the first interval, it will also be used in the fifth interval after that. The selection of an element from the first interval is made randomly, but the selection of elements from succeeding intervals depends on the selection from the first and cannot be regarded as a random sample (Kumar, 2018).

13. Data Collection

“Research tool” or “Research instrument” is a means of collecting data in research, like questionnaires, interviews, and observation. The quantitative process of data collection includes:

- Defining the participants or sample of research
- Getting authorizations from organizations or individuals
- Determining what type of data to collect
- Selecting research instruments
- Directing the data collection procedure

14. Select a Statistical Program

Quantitative researchers typically utilise statistical programmes that are accessible as laptop or desktop software or on university computers. It is suggested to search for a programme that has the statistics that are suitable to answer research questions and research hypotheses. A lot of websites provide extensive information on the several statistical analysis computer applications that are available.

15. Data Analysis

In the process of analyzing quantitative data, multiple interconnected processes are employed.

The first stage is organizing the data for analysis. It includes choosing in what way give numerical scores to the data, evaluating the categories of scores, taking statistical software, and entering the data into the computer.

The second stage is analyzing the data. Typically, a descriptive analysis of the data reports the measurements of central tendency and also variance. Subsequently, more complicated inferential analysis is performed to test the hypotheses and evaluate confidence intervals and effect sizes.

The third stage is reporting the research outcome not only through tables, figures but also through discussing, summarizing, and comparing the results with previous theories and literatures. It should be ended with the limitation of the research and recommendation for future research. After preparing and organizing the data, the data needs to be analyzed to address all questions and hypotheses of the study (Creswell, 2002).

15.1. Descriptive Statistic

A descriptive statistic is utilized in research to investigate the essential characteristics of the data by summarizing the samples and measurements. Descriptive statistics are used to convert complicated quantitative information into bite-sized explanations. It allows the researcher to present the data and interpretation in a comprehensible and meaningful way. Descriptive statistics include (figure 6):

- Distribution refers to the frequency of each value.
- Central tendency refers to the averages of the values (mean, median, and mode)
- Variability (spread) refers to how spread out the values are (standard deviation, variance, minimum and maximum variables, kurtosis, and skewness)

15.2. Inferential Statistics

In inferential statistics, the researcher collects the data from a sample of the study and make a prediction that affects the results on a large population. The researcher uses inferential statistics to achieve results that are beyond the immediate data. Although descriptive statistics can just describe the characteristics of a sample, on the other hand, inferential statistics utilize a sample to make accurate estimates about the wider population. When using inferential statistics, it is necessary to employ random and unbiased sampling procedures. If the sample does not represent the population, then having valid statistical inferences is not possible.

16. Reporting, Evaluating and Conclusion of Research

A research report is a conducted research that details the following steps:

- Investigating and exploring of problem
- Identifying research questions
- Collecting data
- Analysis and interpreting data

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As the report is combined for different audiences, it differs in length and format and varies for quantitative and qualitative research. Reporting research entails selecting an audience, organizing the report in a compatible arrangement with target audiences, and subsequently preparing the report. For each audience, the arrangement of the research report will differ, ranging from a formal and official arrangement for writing project paper and dissertations to a casual arrangement for writing school reports (Creswell, 2002). Researchers have to be courteous in all sorts of reports and avoid using terminology that distinguishes sexual preference, gender, ethnicity, and racial background. The audiences will also have their criteria for assessing and evaluating the value of the study. Assessing research is analyzing the value and quality of research through of standard educational criteria that are proposed by individuals. According to McNabb (2017) the researcher is supposed to report all following steps while reporting the findings of quantitative research:

- Data collection, statistics, and relevant finding to problem statement needs to be explained.
- Unexpected incidents during data collection needs to be reported. The researcher is supposed to clarify why missing data does not undermine the validity of the analysis.
- A rationale for using statistical procedure needs to be provided.
- When a researcher use inferential statistics, provide the descriptive statistics, confidence intervals, and sample sizes for each variable as well as the value of the test statistic, its direction, the degrees of freedom, and the significance level.
- Using tables provide exact values and utilising figures convey global effects. the reader needs to be concise what to look for in tables and figures. The researcher encouraged to use graphic representations of confidence intervals.

The researcher is supposed to ending the research by giving a summary of the topic and providing a final comment and evaluation of the research. The summary of findings, recommendations, and future research needs to be included (Nenty, 2009).

CONCLUSION

In the study of Hall, Ward, and Comer (1988), a team of judges assess 128 educational quantitative papers and concludes that the researcher needs to consider rigorous reliability and validity in data collection techniques, strengths in research designs, appropriate research design for the problem, reasonable sampling, clearly report the findings of analysis, appropriate methods to analyze data, clear writing, clearly stated assumptions, and clear data collection methods to have a quality quantitative research.

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