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Research Methodological Choice: Explaining Research Designs; Qualitative and Quantitative Sample Size Determination, Sampling, Data Collection, and Analysis Techniques

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Abstract
The main aim of this article is to discuss the factors a researcher should take into account when selecting the appropriate research design or method (i.e. qualitative, quantitative, and mixed-methods). The article also discusses sample size determination and sampling procedures in qualitative and quantitative research. Further, the paper has provided an examination of qualitative and quantitative data collection and analysis methods. The study used online desk research to collect data from online public access scholarly databases such as Google Scholar, ResearchGate, Academia, and many more freely accessible electronic books in research methods. Search terms that were used included, among many, the following: qualitative research, quantitative research, mixed-methods, qualitative and quantitative data collection, qualitative and quantitative data analysis; descriptive and inferential statistics. A wealth of relevant and timely scholarly literature was downloaded, read, and used to write this paper, and draw the conclusion provided.

Keywords: Qualitative Research; Quantitative Research; Mixed-Methods Research; Qualitative Data Collection Techniques; Quantitative Data Collection Techniques; Qualitative Data Analysis Techniques; Quantitative Analysis Techniques; Descriptive Statistics; Inferential Statistics.

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1.1 INTRODUCTION

Choosing the right research design is essential for good scientific research. This decision is based primarily on the nature of existing research processes and their consistency with research objectives. One of the most difficult decisions researchers have to make is choosing between mixed methods, qualitative research, or a quantitative research design (Saunders, Lewis, & Thornhill, 2016). According to Evans, Gruba, and Zobel, (2014), study design provides the rationale from which researchers derive meaning at the end of their study.

Therefore, when designing a particular study, it is important that researchers understand the myriad aspects of study design and understand the purpose, process, determinants, strengths and weaknesses of each design. This requires familiarity with the timings, weightings, and decisions made in each of the various designs. According to Creswell (2009), qualitative, quantitative, and mixed-method designs do not differ from each other because they are primarily viewed as contrasts and should not be considered contrasts. They should be considered as reflecting multiple ends of the range. Therefore, key determinants should be detailed and highlighted when choosing a study design.

1.2 Objectives

The objectives of this theoretical paper are to discuss the:

(a) determinants of qualitative, quantitative, or/and multiple (mixed) methods research design.

(b) qualitative and quantitative sample size determination criteria

(c) qualitative and quantitative sampling procedures

(d) qualitative and quantitative data collection methods

(e) qualitative and quantitative data analysis techniques

2 Methodology

The paper was developed using desktop research of secondary sources of data that were downloaded from scholarly databases and websites such as Google, Google Scholar, ResearchGate, Academia, and many online public access journal articles. The journal articles and electronic books (i.e. in pdf) that were searched and downloaded were in the field of research methodology with a special focus research designs sample size determination, sampling procedures, qualitative and quantitative data collection and analysis techniques.

2.1 Determinants Qualitative, Quantitative, and Multiple (Mixed) Methods Research Design

The three main types of study design are qualitative, quantitative, and mixed approaches, which are all covered in this section. By virtue of their ties to philosophical, research methodology, and strategy, the three are thoroughly analyzed from a more broad position. It is challenging to distinguish between quantitative and qualitative designs using numerical or non-numerical criteria, according to Saunders (2016) in their book. This is due to the prevalence of study designs in business and management that frequently combine quantitative and qualitative elements. The following provides a thorough summary of each of the three research designs:

2.1.1 Determinants Qualitative Research Design

Goertz and Mahoney (2012) claim that the term "qualitative research" refers to a broad range of research techniques that examine behavior, experiences, and interactions without using statistical methods, mathematical analysis, or numerical data processing to address the phenomena under investigation. This method is used, according to Creswell (2014), to learn the meaning that people or groups give to social or human problems. The approach includes formulating questions and processes, collecting data ideally in the respondent's context, inductively analyzing the data to derive general themes from specifics, and the researcher's assessment of the

significance of the data. Investigating this way encourages a way of thinking about research that values an inductive approach and places a strong emphasis on individual

According to McCuster and Ginaydin (2014), qualitative research methodologies are seen as natural since they require the researcher to witness the phenomena in its natural setting in order to provide an interpretation and conclusion (Research employing qualitative, quantitative, or mixed, 2014). When conducting qualitative research, the researcher thus conducts interviews, makes observations, and explains, summarizes, analyzes, and interprets the meaning of the occurrences in their natural situation. One notable fundamental advantage is that qualitative research encourages further investigation (Goertz & Mahoney, 2012).

The method that places a strong emphasis on looking into and understanding the significance attached to a circumstance (Creswell, 2014, p. 4; McCuster & Ginaydin 2014). In order to establish a perspective on problems, this strategy, according to Goertz and Mahoney (2012), requires looking at them in their many contexts and the meanings that individuals give them. It places a focus on finding meaning in the experiences and perspectives of others.

This is a testament to how this methodology in research respects independence and, despite being inherently subjective, provides timely and broad content and context.

2.1.2 Determinants of Quantitative Research Design

In quantitative research, phenomena are usually studied systematically and empirically using statistics, mathematics, and processing of numerical data. Research data are usually analyzed in numerical form (Basias & Pollalis, 2018). According to Almalki (2016) it is seen as a logical method based on an independent objective world. This theory asserts that reality can be understood by breaking it down into smaller and more manageable pieces, and that it is within these smaller subdivisions that observations are possible and hypotheses about the relationships between variables can be tested and reproduced. (Rovai, Baker, & Ponton, 2014). This style of research involves the use of statistically-oriented approaches to data collection and analysis, with a focus on collecting numerical data and generalizing it across groups of people (Almalki, 2016).

Key determinants of quantitative research design include the type of research philosophy, approach to theory development, characteristics, and research strategy a particular study employs. Quantitative research is commonly associated with positivism, but it can also adopt realistic and pragmatic philosophies (Saunders, 2007). Furthermore, it is strongly associated with the deductive approach and rarely with the inductive approach. This approach explores relationships between variables that are numerically measured and analyzed using various arithmetic and graphical techniques. Data collection techniques include single-method quantitative studies and multi-method quantitative studies.

This entails that when research aligns with the salient features highlighted above, then the design of choice should be quantitative.

2.1.3 Determinants of Multiple (Mixed) Methods Research Design

Mixed methods research designs have exceptional philosophical assumptions and research methods. Philosophical assumptions are used as a methodology to provide guidance for collecting and examining data from multiple sources in a single study (Dawadi, Shrestha, & Giri, 2021). McCuster and Gunaydin (2014) argue that mixed-

method designs can offer practical advantages when investigating challenging research questions. This is because qualitative data allow a complete understanding of responses and quantitative data facilitate statistical analysis and allow a complete assessment of response patterns. In view of this, Maxwell (2016) correctly states that methodology provides a logical foundation, methodological flexibility, and comprehensive knowledge of phenomena.

According to Creswell, the difference between qualitative and quantitative research is characterized by the use of words (qualitative) as opposed to figures (quantitative), or by the use of closed-ended questions (quantitative hypotheses) as opposed to open-ended questions (2014). (Qualitative questions for interviews). He continued by saying that a more in-depth understanding of the gradations of differences between them can be seen in the fundamental philosophical assumptions researchers bring to the study, the types of research strategies generally used in the research, and the specific methods employed in conducting these strategies.

Dawadi (2021) noted a paucity of literature on mixed methods study designs that may help early-stage researchers to choose the best design for their study and to understand its goals. The study also revealed that researchers may not be equally proficient in using both qualitative and quantitative approaches. This can cause many problems when organizing research.

Some important requirements for using a mixed method approach are as follows:

- **(a)** When a combination of quantitative and qualitative data provides a deeper understanding of your study problem than either type of data on its own.
- **(b)** When qualitative or quantitative research alone is insufficient to resolve the research problem or provide the information required to make a decision.
- **(c)** Optimism: a variety of viewpoints, objectivity and subjectivity, practicality, and bias.
- **(d)** To include a qualitative component in a mostly quantitative study.
- **(e)** Creating an instrument following qualitative research that was carried out as part of a study.

To obtain more specific information, continue a quantitative investigation with a qualitative one. 2012 Creswell;2008 Creswell)

In essence, all three techniques are supported by an organized and careful investigative process that seeks to define phenomena and to create and evaluate explanatory hypotheses and concepts. Finally, as a contribution to the existing knowledge base, it is important to emphasize that strategy selection is not based on quality hierarchy. This is because multiple research methods are appropriate to address different research questions. Qualitative and quantitative studies have certain strengths and weaknesses, but the mixed methods approach takes this into account. On the other hand, important factors such as the researcher's personality, mindset, and cultural background influence the choice of method to choose. Additionally, the philosophical underpinnings of a particular study can influence whether its methods are used. In particular, constructivism and post-positivism for quantitative and qualitative research, respectively. A positive pragmatism for a hybrid approach

3.1 Sample Size Determination Qualitative and Quantitative Research Designs

Kaur (2017) argues that choosing an appropriate sample size is a critical step in research methodology. Demonstrations of selecting the number of viewers or replicas to remember as measurable examples will be

evaluated for the accuracy of the ratings generated. The quality of evidence-based studies can be improved by determining sample size.

Though similar to quantitative research, but not using the same methods, qualitative research requires a sample size to be determined. This is because insufficient sample sizes can lead to false conclusions (Oribhabor & Anyanwu, 2019). Sample size is important when quantitative research aims to make good statistical generalizations of research results around the world.

In qualitative studies, the term "saturation" is frequently used to describe sample size, but it is used inconsistently. In contrast, quantitative research designs can objectively generate a sample using statistical methods.

In this section, we'll talk about important factors that affect sample sizes for mixed-method, quantitative, and qualitative research designs. The following are the details of these:

3.2.1 Sample Size Determination Qualitative Research Design

There is no consensus on the procedures and guidelines that researchers should follow when determining the exact size of an appropriate sample (Daniela, 2020). However, Van Rijnsoever (2017) argues that determining the sample size to reach theoretical saturation depends on the research topic, the question the research must answer, its complexity, the theoretical framework, the epistemological tradition, the approach adopted, the The methods used, the structure of the study population and access to it, and the resources and time available to conduct the study. These factors can also be broken down into her two categories: Functions related to realistic research considerations and functions related to epistemological and methodological issues.

Due to the nature of qualitative research and the nature of the data collected, there are no "hard" guidelines on the number of units that should be included in the study sample, nor general numerical recommendations on sample size (Kindsiko & Poltimae, 2019; Vasileoiu et al. , 2018). Moreover, research (Sim et al.) shows that many formal statistical directions do not guide sample size estimates. 2018; Marshall et al., 2013). The optimal sample size is from Sandelowski (1995, p. 179). A "judgment" based on the phenomenon being studied.

However, a large number of studies found that factors related to the research project, such as funding agency recommendations and expectations, research reviewer recommendations and expectations, and accessibility to the research population, outweighed practical considerations and other factors claim to be important. Determining sample size factors (Kinsiko & Poltimae, 2019; (2010) Lichtman)

According to Boddy (2016), the environment and the scientific paradigm used in the study influence the choice of sample size to some extent. For example, positivist qualitative research requires a larger sample than in-depth qualitative research to obtain a representative image of the entire community under study. Boddy says theoretical saturation can also serve as a design principle for qualitative research. Practical research has shown that 12 samples can represent a situation where the population is relatively homogeneous and the data is saturated. In contrast, Malterud (2016) argues that the term 'saturation' is often misused, even though it is closely related to certain methodologies. Malterud argued that the term 'information power' should be used instead to determine the appropriate sample size for qualitative research.

Having 'information power' suggests, as an additional explanation, that; The sample contains more information that is relevant to the actual study the fewer participants are required. In a similar vein, the size of a sample with adequate information power is determined by the following factors: the specificity of the sample, the application of well-established theory, the quality of the dialogue, and the method of analysis (Malterud, Guassora, & Siersma, 2016). When selecting a sample size, all of these factors should be taken into account.

3.2.2 Sample Size Determination in Quantitative Research Design

Quantitative researchers must pay close attention to choosing the ideal sample size. According to Kaul (2017), this allows for good analysis, desirable precision, and validity of significance tests. A sufficient sample size is the number of people required to statistically detect differences (Burmeister & Aitken, 2012). According to Burmeister and Aitken, effect size, sample homogeneity, and risk of error are considerations depending on the research topic and are also factors that determine sample size in quantitative study designs.

Furthermore, Ajay and Micah (2014) pointed out that reasonable statistical power and cost of data collection should be considered when choosing a sample size. The study also suggests that: The three options for choosing sample size are; i) Cost basis: Contains items that can be easily obtained or collected. ii) Dispersion criteria: Get an estimate from the sample using the target deviation. iii) Statistical Performance Criteria: Use the power objective of the statistical test to use after the samples have been collected.

According to Smith (undated), there are many ways to calculate sample size, from statistical formulas to electronic sample size calculators. However, in each of these cases, researchers must first establish details about the target population before determining the required sample size. The key considerations include the following:

(a) Size of population: How many people fall into your demographic in total?

(b) Confidence Interval (margin of error): Since no sample is perfect, a researcher must decide how much room for error to allow. The confidence interval determines how much you are willing to allow your sample mean to deviate from the population mean.

(c) Confidence level: How certain do you want to be that the actual mean will fall within your confidence range?90%, 95%, and 99% confidence are the most frequently used confidence intervals.

(d) Standard Deviation: How much variation do you anticipate between the responses?

Determining the size of the quantitative sample size is evaluated based on the strength of a hypothesis test and the quality of produced estimates (How to Ensure You Get the Correct Sample Size, n.d.). As a result, a researcher ought to be aware that the five study design parameters typically determine the primary determinant of sample size in a quantitative design: the significance criterion, the effect size (or minimum expected difference), estimated measurement variability, desired statistical power, and whether one- or two-tailed statistical analysis is intended.

3.2.3 Sample Size Determination in Mixed Research Design

Graff (n.d.) pointed out that when preparing samples for mixed-method designs in the quantitation phase, researchers often want to obtain samples that are representative of the entire population. On the other hand, when constructing a qualitative sample, researchers usually try to construct a sample that is informative on multiple levels of meaning. Therefore, when using mixed-method designs, researchers strive to select and establish sample sizes that are representative and provide useful information.

This is accomplished by including the crucial elements in determining sample size in both quantitative and qualitative designs.

4.1 Sampling Procedures in Qualitative and Quantitative Research Designs

According to Collins, Onwuegbuzie, & Jiao (2006), sampling is an important part of the research process because it helps the researcher determine whether or not the conclusions they draw from the underlying findings are valid. For quantitative, qualitative, and mixed research designs, researchers must decide the number of participants to select (the "sample size") and how to select these participants (the "sampling scheme"). For qualitative, quantitative, and mixed-method research designs, the steps involved in sampling are outlined in detail below

According to Collins, Onwuegbuzie & Jiao (2006), sampling is an important part of the research process, helping researchers determine whether the conclusions they draw from the underlying results are valid. Quantitative, qualitative, and mixed research designs require researchers to decide how many participants to select (the “sample size”) and how to select those participants (the “sampling scheme”). For qualitative, quantitative, and mixed methods study designs, details of the sampling procedures are provided below.

4.1.1 Sampling Procedures in Qualitative Research Design

Govindan (2014) states that qualitative research design uses the theoretical requirements of the research to urgently select clear and reflective informants with specific types of experience. Convenience, snowballing, goal-oriented, and theoretical sampling methods are the most common types of sampling. These are described below in a thematic approach.

4.1.1.1 Convenience sampling

A convenience sample, also called an arbitrary sample in qualitative research, is sometimes used by qualitative researchers or used as a starting point. Volunteer samples may be used especially in situations where researchers need potential volunteers to come forward and identify themselves.While convenient, they typically involve a high level of subjectivity It should be noted that This is because participation is based on availability, not on the value that a particular topic brings to the phenomenon under study.

4.4.1.2 Snowball sampling

Snowball sampling is a non-probabilistic sampling method in which sample characteristics are difficult to determine. This sampling method uses recommendations from real subjects to determine the sample size needed for research studies (Statistical AID, 2017). For example, if you are researching customer satisfaction of members of a well-known country club, primary data unless one member of her club speaks directly to you and agrees to provide contact information for other members. Getting the source is very difficult. club member.

Primary data sources identify additional potential data sources that can participate in research studies using this sampling technique. This sampling technique is common in business research (Explorable.com, 2009). Snowball sampling is often used when populations are unknown and rare, making it difficult to select participants for use as research samples. Like a growing snowball (in this case, sample size), this sampling strategy will be used indefinitely until researchers have enough data to evaluate and draw firm conclusions to help inform organizational decision-making.

Types of snowball sampling:

(a) **Linear Snowball Sampling:** When one subject shares data with only one other subject, the process of creating a sample group begins and the chain of recommendations grows with each additional subject. This procedure is performed until there are enough subjects in the sample.

(b) **Exponential non-Discriminative snowball sampling**: This type begins with the adoption of the first subject, after which many recommendations are made. Additional referral information will be provided with each subsequent referral once there are enough subjects in the sample.

(c) **Exponential Discriminative Snowball Sampling**:In this method, each subject provides multiple referrals, but only one subject is recruited from each subject. The type of research study influences the choice of new topics.

4.4.1.3 Purposive sampling

The majority of qualitative studies eventually adopt a purposive or purposeful sampling strategy, which entails selecting specific cases from which the study can derive the greatest benefit.

4.4.1.4 Theoretical sampling

This is a method of collecting data for the purpose of developing a theory. In this method, the analyst collects, codes, and analyzes all of his data together. The analyst then decides what data to collect next and where to find them in order to advance his theory as it emerges. In contrast, the three primary traditions also emphasize the qualitative sampling method. e.g., grounded theory, ethnography, and phenomenology. A phenomenological researcher will typically use a sample size of ten or fewer people, whereas a grounded theory researcher will typically use a theoretical sampling of twenty to thirty people.

4.4.2 Sampling Procedures in Quantitative Research Design

Probability sampling is typically used in quantitative research designs (McCombes, 2022). Every member has a chance of being included in the sample through probability sampling. Consequently, it is the most reliable method of sampling if a researcher wants to draw valid conclusions from their findings and ensure that they are representative of the entire population.

Probabilistic sampling is commonly used in quantitative research designs (McCombes, 2022). Each member may be included in the sample through probability sampling. Therefore, if researchers want to draw valid conclusions from the results and ensure that they are representative of the population as a whole, this is the most reliable sampling method.

The four primary sampling techniques are discussed below:

4.4.2.1 Simple Random sampling

With simple random sampling, each person in the population has approximately the same chance of being selected. The entire population should be included in the sampling frame. Completely random techniques or tools such as random number generators can be used to do this type of sampling.

4.4.2.2 Systematic sampling

Systematic sampling is similar to simple sampling, but usually slightly less difficult. Every person in the population is given a number. However, rather than randomly assigning numbers, specific individuals are selected on a regular basis. However, when researchers use this method, it is important to ensure that the list does not contain hidden patterns that could skew the sample.

4.4.2.3 Stratified sampling

In stratified sampling, the population is divided into subpopulations that are significantly different from each other. This method allows researchers to draw more accurate conclusions by ensuring that each subgroup is well represented in the sample. Researchers need to divide the population into subgroups (called strata) based on related characteristics. Gender, age group, income class, function. Samples are then randomly or systematically selected from each subgroup.

4.4.2.4 Cluster sampling

Cluster sampling also involves dividing a population into subgroups. However, each subgroup should have characteristics comparable to those of the sample as a whole. Instead of randomly selecting individuals from each subgroup, we randomly select entire subgroups.

Practically, all individuals from all sampling clusters could be included. If the clusters themselves are large, you can also select individuals from each cluster using one of the above methods. Multistage sampling is the name.

This approach is useful when dealing with large and dispersed populations, but it is more likely to introduce sampling errors as there can be large differences between clusters. The primary purpose of sampling is to obtain a representative sample or small collection of units or cases from a larger collection or population so that researchers can study smaller groups and generalize accurately to larger groups. That's it. However, it is difficult to guarantee that the sampled clusters are representative of the entire population. Therefore, researchers need to understand and focus on specific methods to generate highly representative samples (Taherdoost, 2016).

4.4.3 Sampling Procedures in Mixed Research Design

The term "mixed-methods" refers back to the procedure of mixing quantitative and qualitative studies designs (Onwuegbuzie & Collins, 2007).Understanding the sampling techniques utilized in each quantitative and qualitative studies is essential for mixed-methods approach sampling (Graff, n.d.).As changed into noted earlier, blended techniques provide some of advantages, inclusive of the designs complementing one another, stepped forward theoretical insight, incrementality or continuity, elevated validity, and the cappotential to rectify variations or inconsistencies in results (Govindan, 2014).The study's studies designs affect sampling in blended techniques studies (Teddlie & Yu, 2007).

Govindan pointed out, mentioning Green and Caracelli (1997), that aspect designs and incorporated designs are the 2 foremost styles of sampling techniques. e.g., sampling techniques which can be each probabilistic and non-probabilistic. Quantitative research usually appoint opportunity sampling techniques, which contain randomly choosing a big wide variety of gadgets from a populace or precise subgroups (strata) of a populace in order that the opportunity of inclusion for every member of the populace may be determined (Dawadi, Shrestha, & Giri, 2021).Additionally, fundamental blended approach sampling techniques, sequential blended approach sampling,

concurrent blended approach sampling, and multilevel blended approach sampling had been recognized with the aid of using Teddlie (2007) as 4 prototypes of blended techniques sampling.

Purposive and probability sampling are both present in mixed method sampling. The table below lists the most important methods of sampling that are used in mixed research designs.

Sampling Techniques	Description	References
Probabilistic Sampling		
Simple random sampling	Involves selecting elements at random from a sampling frame that lists all of the elements. The probability of selecting a subject in the sampling frame is independent of each other for each subject	(Collins, Onwuegbuzie, & Jiao, 2006); Govindan, 2014; Teddlie & Yu, 2007
Stratified random sampling	Sampling frame divides the population into relatively homogenous subgroups from which elements are selected at random.	(Collins, Onwuegbuzie, & Jiao, 2006); Govindan, 2014
Cluster sampling	Multistage sampling is another name. Cluster sampling is the process of selecting successive random samples from larger to smaller units using either stratified or simple random methods	(Collins, Onwuegbuzie, & Jiao, 2006), Govindan, 2014
Systematic sampling	Selecting individuals or cases from a list by selecting each member of the Kth sampling frame, where K is the typical population divided by the desired sample size. The researcher determines the sampling interval, which is the standard distance between the selected elements, by dividing the population size by the desired sample size.	(Collins, Onwuegbuzie, & Jiao, 2006); Teddlie & Yu, 2007; Govindan, 2014
Multistage Random	Selecting a sample from a random sampling scheme in numerous phases	(Collins, Onwuegbuzie, & Jiao, 2006), Govindan, 2014
Non-Probabilistic Sampling		
Convenience sampling	Utilizing the individuals who are most easily accessible as study participants is known as convenience sampling. A random sampling is another name for it	Dawadi, Shrestha, & Giri, 2021; Govindan, 2014, Onwuegbuzie and Collins, 2007
Snowball sampling	It is also known as chain sampling or network sampling. This method asks early sample members to find and refer additional people who meet the eligibility requirements	Govindan, 2014; Onwuegbuzie and Collins, 2007
Quota sampling	A quota sample is one in which the researcher determines the necessary number of participants from each population stratum and identifies population strata	Govindan, 2014; Teddlie & Yu, 2007
Purposive sampling	Additionally known as judgmental sampling, itIt is based on the idea that the researcher's understanding of the population can be used to select individuals for the sample. "Particular settings, people, or events are deliberately selected for the important information they can provide that cannot be gotten as well	Dawadi, Shrestha, & Giri, 2021; Govindan, 2014; Teddlie & Yu, 2007;

	from other choices," can further be defined as a type of sampling known as "purposive sampling."	
Relationship between QUAL and QUAN samples		
Identical sampling	The same members participate in quantitative and qualitative phases of the study	Govindan, 2014; Teddlie & Yu, 2007
Parallel sampling	Member who participates get drawn from the same population while the samples obtained are for quantitative and qualitative study phases	Dawadi, Shrestha, & Giri, 2021; Govindan, 2014; Teddlie & Yu, 2007
Nested sampling	A subgroup of the whole sample participates in an supplementary study	Govindan, 2014; Teddlie & Yu, 2007
Multilevel sampling	Two or more samples taken from the population of interest at various levels.	Govindan, 2014; Teddlie & Yu, 2007

5.1 An Analysis of Qualitative Data Collection Methods

The main qualitative data collection methods are highlighted in the table below:

Methods	Brief Explanation	References
Observation	The researcher observes (with or without participation) study subjects in order to understand whether or not they act as they say they will and gain tacit knowledge of the subjects.	Joffe and Yardley (2003); Kabir (2016)
Interview	This entails in-depth questioning, listening to and recording of individual or group responses in a structured, semi-structured, or unstructured format.	Govindan, 2014; Kabir (2016)
Focus group discussions	Focused, interactive session that is guided by a set of questions and has a group that is small enough for everyone to have a chance to talk and large enough to have a variety of opinions.	Kabir (2016)

5.2 Quantitative Data Collection Methods

According to Kabir (2016), data collection is the deliberate and systematic process of obtaining and analyzing information about relevant variables in order to answer a specific research question, test hypotheses, and evaluate results. Methods vary by industry, but ensuring true and accurate collection remains important. All types of data collection aim to analyze large amounts of data and collect high-quality evidence that can be used to create strong reasons to answer questions.

Data for quantitative research designs come from two distinct sources: secondary and primary data. The researchers first collect primary data, and secondary data is gathered from other sources.

As per Kabir (2016) normal strategies for gaining quantitative information incorporate:

(a) **Experiments:** Typically carried out in controlled settings.

(b) **Questionnaires:** uses structured questionnaires that have been prepared in advance. The respondent is required to select one of the specific, in-depth questions. The best example is a closed-ended questionnaire in which respondents are asked to answer with "Yes," "No," "True," or "False."

(c) Utilizing management information systems to obtain pertinent data: electronic record and data sets

(d) **Surveys:** When collecting data from large groups of people, where consistency is crucial, surveys are a popular choice. A rating on a scale (for example, rate a statement from "agree" to "disagree" on a scale of 1 to 4), a list of options (for example, choose from potential partner institutions with which a program could partner), or estimates of the amount of time participants might spend participating in an activity (for example, the percentage of time spent on teacher-led instruction or cooperative learning) are all examples of responses.

There are several factors to consider when choosing the best method for collecting surveys. Question difficulty, resource availability, project schedule, and other factors were considered. Web-based surveys, for example, are attractive for several reasons. First, collected data can be entered directly into the database, reducing the time and steps between data collection and analysis. Then you can incorporate checks to prevent out-of-range answers from being entered.

If you need to interview a large number of people or have specific questions answered, surveys are often the best option. Polls are a useful tool for gathering information on various topics when you don't want detailed scrutiny of the answers. They are suitable for both formative and summative applications. On a regular basis, the same surveys are often used to monitor progress along dimensions and changes in behaviour over time.

6.1 Qualitative Data Analysis Techniques

Green and Thorogood (2009) state that common methods for analyzing qualitative data include narrative analysis, evidenced theory, thematic content analysis, and frame analysis. The purpose of qualitative data analysis is to derive conclusions, judgments, and recommendations from findings using value statements, criteria, and criteria. The most common approaches to data analysis are outlined below.

6.1.1 Thematic content analysis

Thematic analysis is a powerful and flexible method for analyzing qualitative data that can be used in a variety of paradigmatic or epistemological orientations.

According to Kiger & Varpio (2020), this method of analysis is suitable for those who want to understand experiences, concepts, or behaviors across collections of data. Topics are actively constructed patterns (or meanings) formed from collections of data that address research problems, as opposed to simple summaries or code taxonomies. These themes can be created using inductive or deductive approaches.

The most widely used framework for topic analysis describes the 6-step process as follows:i) create provisional code; ii) find a topic; iii) rate the topic; iv) Define and name your topic. v) Write a report. 2003, Joffe and Yardley).

Post-positivist, constructivist, and critical realist research methods can use thematic analysis. According to Braun & Clarke (2006), paradigmatic views do not prevent him. When applying topic analysis to different research paradigms, the method should be tailored to the desired results. Brown and Clarke (2006) also argue that post-positivists use thematic analysis to focus on people's meanings and experiences, gaining insight into the outside world, thereby promoting the development of speculative knowledge about reality. In many interpretivist schools,

such as constructivism, thematic analysis can likewise highlight the social, cultural, and structural contexts that influence an individual's experience.

This enables the development of knowledge that is constructed through interactions between the researcher and the research participants and reveals the meanings that are socially constructed.

Thematic content analysis therefore examines the content of the data to find common themes. Data is analyzed and coded until new patterns begin to emerge. Furthermore, this approach could be considered by researchers interested in gaining understanding of phenomena by analyzing their content and identifying themes.

6.1.2 Grounded theory

Coding frameworks are built following a cyclical process of collecting and analyzing data. Additional data can be collected until a saturation point is reached. Therefore, method design and execution must be iterative.

6.1.3 Narrative analysis

Is the study of the craft of storytelling in terms of how it is constructed, how it uses language and cultural materials, and how it convinces the audience that it is true.

7.1 Quantitative Data Analysis Techniques

There are many statistical techniques for analyzing quantitative data. Descriptive statistics describe trends in data in an easy-to-understand way (Carroll & Rothe, 2010). In most cases, descriptive results are further analyzed and hypotheses are tested using inference techniques. On the other hand, the relationship between independent and dependent variables is the focus of univariate analysis methods (Collins, KM, 2018). Collins argues that analytical techniques can also be used to predict the effect of independent variables on dependent variables. Multivariate statistical analysis looks at many independent variables and many dependent variables to see if there is a correlation between them.

Quantitative data can be analysed using parametric and nonparametric statistics. Parametric statistics require data to adhere to strict assumptions so that variables can be measured on interval or ratio scales. Nonparametric statistical analysis, on the other hand, uses ordinal and nominal data and does not rely on the same assumptions as parametric statistics.

Furthermore, quantitative analysis is supported by statistical analysis methods. The statistical methods used fall into two main branches:

Descriptive and inferential statistics. A study may use only descriptive statistics or a combination of both, depending on what you are looking for. Therefore, it depends on the research question, goals and objectives.

Descriptive Statistical Research

Descriptive statistics is a data analysis term that helps describe, present, or summarize data in a meaningful way so that patterns can be revealed from the data, for example. However, descriptive statistics cannot draw conclusions about the data you analyze or the hypotheses you set. They are simply ways of describing the data.

Descriptive statistics are very important. This is because it is difficult to imagine what the data is telling you by simply presenting the raw data. Especially if you have a lot of data. Descriptive statistics can therefore present the

data in a more meaningful way and make the data easier to interpret. For example, if you have 100 coursework results from students, you might be interested in the overall performance of those students. We are also interested in the distribution or spread of grades. Descriptive statistics make this possible.

There are two general types of statistics commonly used to describe data:

Measures of central tendency: :

These are ways of describing the center position of the frequency distribution of a set of data. In this case, the frequency distribution is simply the distribution and pattern (from lowest to highest) of grades obtained by 100 students. Many statistics can be used to explain this central position, including mode, median, and mean.

Measures of Spread/Measures of Dispersion:

These are ways of summarizing groups of data by describing how the scores are distributed. For example, the average score of 100 students might be 65 out of 100 for her. However, not all students achieve 65 points. Rather, those points are distributed. Some will be lower, some will be higher. A measure of variance helps summarize how these values are spread out. There are many statistics at your disposal to describe this spread: range, quartiles, absolute deviation, variance, standard deviation, etc. When using descriptive statistics, it makes sense to summarize the data set using a combination of tabular descriptions (such as tables), graphical descriptions (such as graphs and charts), and statistical commentary.

Inferential Statistics

As noted already, descriptive statistics provide information about immediate datasets. For example, calculating the mean and standard deviation of 1000 students' test scores provides valuable information about her group of 1000 students. A group of such data that contains all the data of interest is called a population. The population can be small or large as long as it contains all the data of interest. For example, if you are only interested in the exam grades of 1000 students, 1000 students represent the population. Descriptive statistics are applied to populations. Population properties such as mean and standard deviation are called parameters because they represent the entire population (that is, all people of interest).

However, in many cases, we do not have access to the entire population we want to study, but only a limited amount of data. For example, suppose you are interested in the exam scores of all Zambian students.

Since it is not possible to measure all exam scores for all students across Zambia, we measure a small sample of students (e.g. 1000 students) used to represent a larger population of all students in Zambia. need to do it.

Sample properties such as mean and standard deviation are called statistics rather than parameters. Inferential statistics are techniques that use these samples to allow generalizations about the population from which the sample was drawn. Therefore, it is important that the sample accurately represents the population. The process of achieving this is called sampling (sampling strategies are detailed on our sister site here).

Inferential statistics arise from the fact that samples are not expected to perfectly represent the population, as sampling errors naturally occur when sampling. Inferential statistics methods include (1) estimating parameters and (2) testing statistical hypotheses.

8.1 CONCLUSION

The purpose of this article was to highlight the factors that determine how study designs are used, to analyse the methodological strategies used in the three study design continuum, and to discuss aspects of methodological strategies.

It worth noting that there are three main study design methods. Qualitative, quantitative and mixed method designs. The philosophy behind the research, investigator direction, time limits, and budget constraints all influence investigators in deciding which design to use.

Additionally, it can be theoretically and empirically be concluded that a research design is a methodical strategy or concept utilised in a variety of research study activities. Understanding the research design is essential for the researcher to perform their task correctly. A well-thought-out research design helps to make sure that a researcher's methods are in line with the study's goals, that high-quality data are collected, that the right kind of analysis is used to answer research questions, and that trustworthy sources are used.

Understanding the concepts behind a research project is essential for researchers. This is because a strong study design provides detail at each stage, identifies relevant major and minor tasks, and enables researchers to make informed decisions at each stage. , to make research more interesting and effective.

Researchers can quickly define the goals of their research work, complete their research goals within a specific time frame, and use research designs to facilitate finding the best solutions to their research problems. The results also indicated that study design is a methodological approach or concept used to conduct various research activities. Ultimately, we deliver research that is accurate, reliable, and consistent. Understanding research design is essential for researchers to do their jobs correctly. A well-thought-out study design ensures that the investigator's methods are consistent with the study's goals, that high-quality data are collected, and that the appropriate type of analysis is used to answer the study's question. and that reliable sources are used. .

Understanding the concepts behind a research project is essential for researchers. This is because a strong study design provides detail at each stage, identifies relevant major and minor tasks, and enables researchers to make informed decisions at each stage, to make research more responsive to the business, socio-economic and political needs and challenges of individuals, society and the country at large.

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