Research Methodologies for Information Professionals: Approaches for Emerging Researchers across Disciplines

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Abstract
This paper discussed the differences in the use of various research methodologies, which often lead to confusion among students, researchers, and other research practitioners. Experience has shown that there is a widespread challenge in appropriately applying research methodology types, research designs and methods, sampling techniques, and data collection instruments many of which are used interchangeably, despite having distinct meanings. The aim of this paper is to clarify the distinctions among research instruments, sampling techniques, research methods, and research designs, particularly in relation to the three major types of research methodology: quantitative, qualitative, and mixed methods. This clarification is necessary because of inconsistencies in the use of these concepts across research literature such as textbooks and journals often depend on the academic disciplines and perspectives of the authors. Such inconsistent usage, especially when the relationships between methodology, design, sampling, and instruments are not clearly defined, contributes to ongoing confusion among learners and researchers alike.
Key words: Research, methodology, Research design, Sampling technique, Research instrument

Introduction
Research is an activity based on the intellectual capability of the individual as a researcher to harness the reality. Kothari (2004); Creswell (2013) describe research as an activity of individual or group that deals with systematic and scientific search of pertinent information on a specific problem or phenomenon to harness the reality. Libraries serve as an avenue for research and study for researchers and students at all level of education. Academic libraries are essential for research because they give users access to a wide range of reliable information sources, such as books, scholarly journals, theses, and online databases.Oyewole (2023) emphasizes that "academic libraries are essential partners in research, serving not only as access points to scholarly knowledge but also as environments that foster inquiry, collaboration, and innovation."

Research Methodology
Research methodology is the systematic procedure that the researcher or researchers follow in conducting a study. Creswell (2014), Leedy and Ormrod (2001), and Walliams (2011) suggest that research methodology is the systematic and holistic process employed by the researcher in carrying

out the research work. It is systematic because it follows certain guidelines such as formulating a relevant and persistent problem, thoroughly defining objectives, analyzing data, and sharing the research findings. Authors in different fields of study have categorized the various types of research methodology into three: quantitative, qualitative, and mixed research methodologies, which originate from research paradigms (Bryman, 2004; Neuman, 2006; Creswell, 2011, 2012, 2014; Leedy & Ormrod, 2010; Wood, 2010; Kamba, 2009; Mehrad & Hossein, 2019).

As a researcher carrying out scientific research, one is expected to be guided by any one of the following types of research methodology, depending on the nature of the problem to be investigated, the objectives of the study, and the population under study. Wood (2010), Creswell (2013), Kamba (2009), and Mehrad & Hossein (2019) note that quantitative research methodology is more scientific than qualitative research, as it offers the researcher ample opportunity to ensure objectivity in the research work.

1. Quantitative Research Methodology: This type of research methodology originates from the positivist and post-positivist assumptions (Positivism paradigm). The positivist paradigm holds that reality exists independently and that it can be known objectively. The researcher, as a social actor, should remain objective and not intervene in the existence of reality. Mehrad and Hossein (2019) point out that quantitative research deals with variables that can be measured objectively. This means that the researcher studies the variables in terms of numbers, which are considered static entities. Randall, Gravier, and Prybutok (2011) also add that quantitative research is based on deductive reasoning, where logic proceeds from the general to the specific, using structured instruments and statistical data analysis. It should be noted that, in quantitative research, the researcher predetermines the instrument used for data collection (Bryman, 2004; Leedy & Ormrod, 2010; Creswell, 2012).

2. Qualitative Research Methodology: This type of research methodology originates from the constructivist and interpretivist assumptions or schools of thought (Constructivism paradigm). This paradigm holds that reality exists, but that the social actor has room to intervene in understanding it. In a nutshell, this methodology allows for partial objectivity in research. Qualitative research is considered less scientific and is best suited for addressing research problems where the researcher has limited knowledge of the variables and needs to explore rather than explain them (Creswell, 2012). Qualitative research, in simple terms, deals with the subjectivity of the researcher in uncovering reality. In this methodology, the researcher tends to be flexible in selecting the instruments used for data collection.

3. Mixed Research Methodology: This type of research methodology originates from the dual or pragmatic school of thought (Pragmatism paradigm). Mixed research methodology combines both quantitative and qualitative assumptions. Creswell (2012) defines mixed research methodology as an inquiry process that involves collecting both quantitative and qualitative data, integrating the two forms of data in the analysis and interpretation, to gain a more comprehensive understanding of the research problem than would be possible using only one method. Quantitative research is based on the measurement and quantification of the phenomenon under study. In other words, it is data-based, making it more objective and widely used. In contrast, qualitative research is based on the subjective assessment of attributes, motives, opinions, desires, preferences, behaviors, etc. Research in such situations relies on the researcher's insights and impressions.

Research Designs and Research Methods

Research designs are the specific procedures involved in conducting research to collect and analyze data. It is called a "design" because it serves as the researcher's blueprint, outlining how data will be collected and analyzed (Kamba, 2009). In contrast, **research methods** refer to the techniques used by the researcher to gather information. Common methods used in the social sciences include interviews, surveys, and observations (Creswell, 2012).

When selecting a research design, the researcher must be guided by the methodology adopted in the study. The research design serves as the **roadmap** that directs the study, and is chosen based on whether the researcher adopts a **quantitative, qualitative,** or**mixed methodology**. This is because one of these methodological approaches underpins every research design. Creswell (2012) emphasizes that research designs are the specific procedures involved in the research process, including data collection, data analysis, and the reporting of major findings. Kamba (2009) notes that while **all research designs are research methods, not all research methods are research designs**. The design defines the structure of the research study, whereas the methods identify the procedures for data collection.

Based on Creswell (2013), Leedy and Ormrod (2010), and Kamba (2009), the following research designs sometimes referred to as methods are commonly used in **quantitative research methodology:**

Experimental Research Design: Also referred to as a **group comparison study**, this design allows the researcher to test whether an educational practice or idea makes a measurable difference for individuals (Creswell, 2013). Many educational researchers use experimental designs to determine whether specific activities or materials have an effect on participant outcomes. The experimental research study can be:

i. **Pre-experimental research design**: Groups, or various groups, are kept under observation after You can break down pre-experimental research further in three types: One-shot Case Study Research Design, One-group Pretest-posttest Research Design, Static-group Comparison

ii. **Quasi-experimental research** shares similarities with the traditional experimental design or randomized controlled trial, but it specifically lacks the element of random assignment to treatment or control (Leedy & Ormrod, 2010). Quasi-experimental designs typically allow the researcher to control the assignment to the treatment condition, but using some criterion other than random assignment (e.g., an eligibility cutoff mark).

iii. **True experimental research design**: True experimental research relies on statistical analysis to prove or disprove a hypothesis, making it the most accurate form of research. Of the types of experimental design, only true design can establish a cause-effect relationship within a group.

Research Designs and Research Methods

Survey Research Design: This is a non-experimental research design within the quantitative methodology that focuses on identifying trends in attitudes, opinions, perceptions, behaviors, or characteristics of a particular group of people (Creswell, 2013). In this design, the researcher typically administers a questionnaire sometimes referred to as a survey to a small group of people known as a sample, selected from a larger population. Subtypes of survey research design include:

i. **Correlation Research Design:** This type of research establishes the existence of relationships between two or more variables. It uses statistical tools such as Pearson's Product-Moment Correlation to show the degree and direction of association among the variables.
ii. **Descriptive Research Design:** This design focuses on explaining or describing existing relationships between variables. Unlike correlational research, which establishes that a relationship exists, descriptive research aims to explain the nature or details of that relationship.
iii. **Cross-Sectional Survey Research Design:** This design allows the researcher to collect data at a single point in time. It is useful for analyzing conditions or trends within a population during a specific timeframe.

According to Kamba (2009) and Creswell (2013), the following are commonly used research designs or methods within qualitative research methodology:

1. **Narrative Research Design:** This design involves a descriptive analysis of events and occurrences related to a particular phenomenon. Creswell (2013) and Riessman (2008) describe it as a humanistic inquiry that studies the lives of individuals by asking them to share stories about their experiences.
2. **Ethnographic Research Design:** In this design, the researcher acts as a social observer studying a cultural group in its natural setting, including their behaviors, languages, and interactions as they develop over time. Creswell (2013) notes that ethnography originates from anthropology and sociology and requires long-term engagement with the culture being studied.
3. **Grounded Theory Research Design:** This design focuses on the formulation, testing, and refinement of propositions until a theory emerges. It is widely used in qualitative research to inductively examine real-world issues through ongoing data collection and analysis (Stark & Brown, 2007).
4. **Phenomenological Research Design:** Creswell (2013) and Giorgi (2009) consider this design suitable for describing the lived experiences of individuals regarding a specific phenomenon. This approach has strong philosophical foundations and typically uses interviews as the primary data collection instrument.

In line with Creswell (2011), Kamba (2009), and Greene (2007), the following research designs are commonly adopted when using mixed methods research methodology:

1. **Exploratory Research Design:** This design is used when the researcher prioritizes qualitative data at the initial phase to explore a phenomenon, followed by quantitative data to expand upon the findings. The study typically begins with a small group to understand insights that are later generalized to a larger group. Creswell (2012) notes that exploratory designs begin with qualitative inquiry before progressing to the quantitative phase.
2. **Explanatory Research Design:** In this design, the researcher collects quantitative data first, followed by qualitative data to further explain or interpret the initial results. It focuses on using quantitative data to explain patterns within a large group and then contextualizing those patterns with qualitative insights. Creswell (2012) defines this as an explanatory design because the follow-up qualitative data helps to explain the quantitative findings.
3. **Concurrent or Convergent (Triangulation) Research Design:** In this design, both qualitative and quantitative data are collected simultaneously and given equal emphasis.

Creswell (2012) describes the convergent parallel design as a mixed methods approach in which the researcher merges both data types to provide a more comprehensive understanding of the research problem or phenomenon.

The above research designs are also referred to as research methods. However, there is ongoing debate among scholars about which approaches qualify as designs and which methods are strictly. For instance, Kamba (2009) classifies case study, historical, and action research as research methods rather than designs in qualitative research. He explains that they involve in-depth studies of specific research problems, rather than broad, statistically representative surveys or large-scale comparative inquiries. In contrast, Creswell (2013) includes **case study** as a research design due to its detailed analysis of a case such as a program, process, activity, or group of individuals.

Population and Sampling Frame

The next element in the research process, after choosing the methodology, design, and methods, is defining the population and sampling frame. The concept of population remains the same across both quantitative and qualitative research methodologies; it refers to the targeted audience or group under investigation.

However, the sampling frame is shaped by the chosen methodology. The methodology adopted quantitative, qualitative, or mixed determines the type(s) of sampling techniques used in the research. Quantitative studies often use probability sampling methods (e.g., random, stratified), while qualitative studies may rely on non-probability techniques (e.g., purposive, snowball sampling).

Sampling Frame or Technique and Sample Size in Research Methodology

After identifying the population in research, the next element is sampling frame or technique. Sample is the smaller representation of a larger whole. Sampling technique in research is the list of all elements in the study from which the sample will be drawn. Hameed (2016) explains that sampling technique must be representative of the population. Sampling is used to make inferences about a population to make generalization in relation to existing theory (Hameed, 2016). In essence, this depends on the choice of appropriate sampling technique in the study.

The type sampling techniques in research is selected or chosen considering the type of research method or design employed in the research study. Scholars like Yin (2003), Wilson (2010); Kamba (2009); Cresswell (2013); Hameed (2016) categorized the sampling technique in to quantitative and qualitative research methodology:

1. **Probability sampling or random sampling technique (It is applicable to quantitative research methodology):** In this type of sampling technique every member of the population has an equal chance of being selected. It gives equal chance for every individual or item to be selected.Wilson (2010), Creswell (2012), Hameed (2016) mentioned the following sampling techniques as the type of probability sampling where the quantitative researcher is expected to employ any one or two, depending on the nature of the research problem, objective of the study and population of the study. The sample techniques are;

i. **Simple random sampling technique**: means that every case of the population has an equal probability of inclusion in sample. Disadvantages associated with simple random sampling include (Ghauri and Gronhaug, 2005): a complete frame (a list of all units in the whole population) is needed; in some studies, such as surveys by personal interviews, the costs

of obtaining the sample can be high if the units are geographically widely scattered; the standard errors of estimators can be high.

ii. **Systematic sampling** is where every nth case after a random start is selected. For example, if surveying a sample of consumers, every fifth consumer may be selected from your sample (Hameed, 2016). The advantage of this sampling technique is its simplicity. Selecting by the researchers at numbered intervals, e.g. every one person in five in the target group

iii. **Stratified sampling** is where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup. A subgroup is a natural set of items. Subgroups might be based on company size, gender or occupation, departments or faculties in tertiary institutions. Stratified sampling is often used where there is a great deal of variation within a population (Kamba, 2009). Its purpose is to ensure that every stratum is adequately represented. In stratified sampling, we divide the population into relatively homogenous groups called strata. Then we select a sample using simple random sampling from each stratum. There are two approaches to decide the sample size from each stratum, namely, proportional stratified sample and disproportional stratified sample. With either approach, the stratified sampling guarantees that every unit in the population has a chance of being selected.

a. **Proportional Stratified Sample**: If the number of sampling units drawn from each stratum is in proportion to the corresponding stratum population size, we say the sample is proportional stratified sample (Wilson, 2010).

b. **Disproportional Stratified Sample**: In a disproportional stratified sample, sample size for each stratum is not allocated on a proportional basis with the population size, but by analytical considerations of the researcher such as stratum variance, stratum population, time and financial constraints etc. For example, if the researcher is interested in finding differences among different stratums, disproportional sampling should be used.

iv. **Cluster sampling** is where the whole population is divided into clusters or groups. Subsequently, a random sample is taken from these clusters, all of which are used in the final sample (Wilson, 2010). Cluster sampling is advantageous for those researchers whose subjects are fragmented over large geographical areas as it saves time and money. The stages to cluster sampling can be summarized in choosing cluster grouping for sampling frame, such as type of company or geographical region, number each of the clusters, select sample using random sampling from each cluster

v. **Multi-stage sampling** is a process of moving from a broad to a narrow sample, using a step by step process. However, this sampling technique mostly involve as one of the typeof cluster sampling technique

Note: In random sampling, members are selected based on randomization method such aslottery procedure, tossing a die method, throwing of coin or by designing any appropriate procedure that ensure the objectivity in sampling the respondents.

2. **Non-probability sampling technique** (it is applicable to qualitative research method)is often associated with case study research design and qualitative research. With regards to the latter, case studies tend to focus on small samples and are intended to examine a real life phenomenon, not to make statistical inferences in relation to the wider population (Yin, 2009). It is the sampling technique that deals with subjectivity of the researcher. It gives

no equal chances of the every member or item in the population. Yin (2003, 2012); Creswell (2013); Hameed (2016) point out the following non probability sampling that thequalitative researcher is expected to select any or two in selecting the representation of the population in his/her research work. The techniques of non-probability sampling are:

i. **Convenience Sampling:** Convenience sampling is used because it is quick, inexpensive, and easy to implement. It requires very little planning, as researchers simply select participants who are readily available at the moment. The process is informal and significantly simpler than random sampling (Yin, 2003). Unlike random sampling, which requires a well-defined population, a list of population members, and a random selection process, convenience sampling requires minimal effort and no formal structure.

ii. **Purposive Sampling:** Also known as **judgmental**or**expert sampling**, purposive sampling allows the researcher to use their judgment in selecting individuals who are most likely to provide relevant and meaningful data. Participants are chosen based on predefined criteria that align with the objectives of the study or target population.

iii. **Snowball Sampling:** Snowball sampling involves building a sample through referrals. The researcher begins with one participant who then refers another, and so on. This method is especially useful for accessing hard-to-reach or hidden populations. It is metaphorically described as a football game, where each participant (like a player) passes the opportunity to the next, helping the sample grows progressively.

iv. **Event Sampling:** Event sampling takes advantage of specific events such as conferences, workshops, or public gatherings to identify and recruit participants. It is often used when the event aligns with the research topic or target group, providing a convenient setting for data collection.

v. **Time Sampling:** This method involves collecting data at specific times or during specific days that are considered relevant to the study. Time sampling acknowledges that behaviors or patterns may vary depending on the time of day, day of the week, or season of the year, and thus adjusts the sampling accordingly.

vi. **Quota Sampling:** Quota sampling is widely used in market research. In this method, participants are selected based on specific characteristics such as age, gender, geographic location, education, income, or occupation. The goal is to ensure that various sub-groups of the population are represented according to preset quotas. Klenke, Martin, and Wallace (2016) emphasize that although **stratified random sampling** shares a similar goal of subgroup representation, it should not be confused with quota sampling. In stratified sampling, participants are randomly selected from each subgroup, while in quota sampling; the interviewer must fulfill a fixed quota without using random selection.

Instrumentation

In the case of instrumentation or the instrument use for data collection, the quantitative is different from the qualitative researcher in the sense that, the quantitative researcher is predetermined while the qualitative researcher is flexible in choosing the suitable data collection tool or tools used in the collection of data depending the nature of the research problem and objective of the study. Instrumentation deals with the research tools or devices used by the researcher(s) in data collection considering the type of research methodology, research design or method adopted in the study. Basically they are two types of data collection or mode of inquiry. Researchers like Kamba (2009); Klenke, Martin and Wallace (2016); Creswell and Guetterman (2019) classified the mode of inquiry in to two:

1. **Structured mode of inquiry**: In this mode of inquiry, the researcher follows a predetermined process, typically using a questionnaire as the main instrument for data collection. While the form of the questionnaire may vary across disciplines, its primary purpose is to generate quantifiable data suitable for statistical analysis (Kamba, 2009). This approach is commonly associated with quantitative research methodology. The questionnaire may include open-ended, closed-ended, or a mix of both question types to ensure better precision in drawing inferences

In designing questionnaire, the researcher is expected to either personal develop, adapt or adopt the questionnaire.

- **i. Personal Development of Questionnaire:** This is the process where the researcher breaks down their main research questions into several specific, meaningful questions to construct a questionnaire aligned with the study's objectives.
- **ii. Adaptation:** This involves modifying parts of an existing questionnaire to better suit the researcher's study. When adapting, the researcher must acknowledge the original creator by properly citing the source to avoid plagiarism.
- **iii. Adoption:** Adoption refers to using someone else's questionnaire in its entirety, with permission and proper ethical considerations, including giving full credit to the original author.

2. **Unstructured Mode of Inquiry:** In the unstructured mode of inquiry, the researcher has the flexibility to choose any suitable instrument or tool for data collection (Klenke, Martin & Wallace, 2016). This mode is primarily aligned with qualitative research methodology, which emphasizes exploration and understanding over rigid measurement. It includes:

i. **Interviews** are the most commonly used data collection tool in qualitative research. They can be conducted with individuals or groups and may be administered face-to-face or remotely through telephone, email, letters, or social media. Interviews vary in structure: structured interviews follow a fixed set of questions; semi-structured interviewsinclude core questions with flexibility to ask follow-ups; and open-ended interviews allow participants to speak freely and at length (Antoniadou, 2017). This tool helps researchers capture in-depth personal experiences and perspectives.

ii. **Focus groups** involve guided discussions where participants share their attitudes, beliefs, and views on a specific topic or issue. These discussions are often structured around guiding questions but remain open enough to capture spontaneous interaction and dialogue. The method is valuable for exploring shared experiences, generating new ideas, and understanding group dynamics. Focus Group Discussions (FGDs) typically

involve people with a shared interest or expertise and allow the researcher to observe both individual responses and collective behaviors (Muijs, 2011).

iii. Observation is a method of collecting data by watching people, events, or situations and systematically recording what is seen. It can be direct or non-participatory, where the researcher observes without involvement, or participatory, where the researcher becomes part of the observed setting. This method is useful for understanding real-life behavior, context, and social interactions as they naturally occur. According to Antoniadou (2017), observation helps capture details that participants might not express in interviews or surveys.

Other instruments used in qualitative research include checklists, documentary sources, archival records, and artifacts, among others. This is because the researcher, within this methodology, has the flexibility to select one or multiple instruments appropriate for the study's context. Depending on the research objectives, the researcher may choose to personally develop, adapt, or adopt existing instruments for data collection.

Conclusion

Despite the differences among various research methodologies, there is a general consensus among many scholars regarding the**three main types of research methodology: quantitative, qualitative,** and **mixed methods.** There is also broad agreement on the use of **sampling techniques and research instruments** across these methodologies. However, the most significant variations tend to occur in the **research designs and methods** employed within each type.

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