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Quantitative Research Designs, a Review of Extant Literature

Riungu Festus Kinyua

Thika Technical Training Institute

*Corresponding author's Email: riungufk@gmail.com

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Abstract

Most students find it difficult to identify appropriate research design as they undertake their research. The objective of this study was to review extant literature by defining quantitative and qualitative research designs and then focusing on quantitative research starting with general definitions of quantitative research design, delineating the generic quantitative designs including survey, experimental and ex post facto designs. It furthers looks at the subgroups in detailing their definitions and characteristics. The Methodology adopted by the paper is extant literature review which permits review of existing literature on the topic in question. This paper will help researchers and scholars to make the right choices of research design depending on different parameters which are of interest to the researcher. The review found out that survey design is the friendliest because of its ability to handle large samples from the population with ease of generalizing the findings. Those with limited time should opt for cross sectional studies which would save on time and cost. For panel, cohort and retrospective studies, as much as they are quantitative in nature they would fit more in a qualitative type of study because at one point in time, there would be a lot of reflection and emotional involvement. Finally, the review of this literature leads to the recommendation that experimental, quasi experimental and ex post factor studies would be useful in the social sciences context but more useful in the medical and other scientific disciplines which rely much on laboratories settings.

Key words: Research design, quantitative, Qualitative, Survey

1.0 Introduction

This paper reviews existing literature differentiating quantitative and qualitative research designs, then concentrates on typologies of quantitative research designs. The review was guided by the realization that graduate and undergraduate students are not able to differentiate succinctly the research designs and when to use them in research.

1.1 Methodology

Shona (2019) defines literature review as survey of scholarly sources on a specific topic providing an overview of current knowledge, identify relevant theories, methods, and gaps in the existing research. Hannah (2019) opines that effective and well-conducted literature review creates a firm foundation for advancing knowledge and facilitating theory development. She argues that literature review is useful when conducted to evaluate the state of knowledge on a particular topic like identifying gaps in research or discussing a particular matter. Baumeister et al (1997) indicate that literature reviews serve a vital scientific function as compared with empirical reports, because reviews tackle broader and more abstract questions where little extant literature exists. The current study adopted literature review methodology aiming at reviewing literature on definitions, the broad typologies of quantitative research designs.

Definition of Research Design

Scholars have attempted to define the concept of “research design” but there is not coherent definition agreed on. Kirumbi (2018) argues that research design is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem. Pierre et al (2018) argue that the design of a study defines the study type (i.e. descriptive, correlation, semi-experimental, experimental, review, meta-analytic etc.). Kerlinger (1973) opined that a research design is the plan of action adopted by the researcher for purposes of obtaining answers to the research questions setting out the framework or the blueprint for the researcher. Orodho (2003) says research design is a method of collecting and getting information by interviewing and administering a questionnaire to a sample of individuals. Therefore, research design is a general strategy which incorporates all aspects of the research and guides the researcher on navigation from the beginning of the research to the end. It includes the general layout of the research from the study type, data collection methods and data analytical methods employed by the researcher.

2.0 Types of research designs

Existing literature points the existence of three broad types of research designs inclusive of quantitative, qualitative and mixed methods research designs. Abutabenjeh (2018) posits that, there exists multiple approaches of a research design, but researchers and students find it a

source of confusion because there is lack of clarity about the approaches to research design, research methods, and research methodology in the social sciences. This paper reviews literature on the broad quantitative research designs and further looks at the sub divisions in each to remove ambiguity. Abutabenjeh (2018) argues that other scholars such as (Forrest (2017) point out the importance of providing clarification regarding the ambiguity of the concept “quantitative research design”.

2.1 Qualitative Designs

According to Rutberg et al (2018), qualitative studies look at the social aspect of research where researchers maximize on the utility of open-ended questions focusing on interviewing the subjects in a semi-structured method in natural setting or a quiet environment. Qualitative research is often adopted when the problem is not well understood and there is existing desire to explore the problem thoroughly. A rich narrative from participant interviews is generated and analyzed in qualitative research to answer the research question. Many questions will be used to uncover the problem and address it comprehensively. McGregor (2019) argues that Qualitative Research Designs involve changing tactics over the course of the study because they seek to highlight the meaning and subjective experiences together with understanding the processes and structures.

2.2 Quantitative Designs

McGregor (2019) argues that quantitative research uses a predetermined, fixed research plan based on reconstructed logic which organizes, standardizes, and codifies research into open rules, formal procedures, and techniques so others can follow the same linear plan and reconstruct the study. Quantitative research designs are meant for studies which deal with measurable numbers. The researcher decides what to study by asking specific, narrow questions leading to collection of quantifiable data from a large number of participants and uses statistics to analyze the data and explain a phenomenon.

This research design aims at discovering how respondents think, act or feel in a specific way hence large sample of respondents concentrating on the quantity. This explains the reason why the respondents are treated to the same standardized questions. The emphasis of quantitative research is deductive reasoning moving from the general to the specific. The validity of conclusions is shown to be dependent on one or more premises (prior statements). In this design the researcher does not access all the members of target population but

generalize their findings from the sample to the target population. It is presumed that the results of the sample under study reflects the real-life situation. Sukamolson, (2007) opines that it isn't easy to identify how many research types are there due to different criteria used by researchers. This paper is interested in quantitative research design which Sukamolson (2007) identified as dividable into the following subgroups; survey research design, experimental research design and ex post facto research design.

2.2.1 Survey Design

Survey is quantitative research design that uses sample questionnaires to measure characteristics of the population with statistical precision. It looks for generalizable answers to questions of "How" and "why" people behave in a certain "way" (Sukamolson 2007). It gives a directional logic of peoples' attitudes to certain phenomenon. Researchers may survey many individuals, then follow up with a few of them to obtain their specific attitudes about the topic understudy, (Creswell 2003). Survey research allows the use of many methods to get to the participants, get the data, and using a variety of instruments. Survey research design can use quantitative research strategies (questionnaires with numerically rated items), qualitative research strategies (open-ended questions), or both strategies (i.e., mixed methods). (Ponto 2015). In the recent past, survey research has developed into a rigorous and thorough approach using scientifically proven strategies that explain the representative sample of the target population that the survey is inclusive, timing the survey and reduction of errors in the responses, making sure that the research is of high-quality. Surveys can further be divided into longitudinal or cross-sectional survey

Longitudinal Survey

Caruana et al (2015) argue that longitudinal surveys employ continuous or repeated measures for individuals over prolonged periods of time often years or decades. They posit that longitudinal studies are mostly observational, with quantitative and/or qualitative. The researcher does not interfere with survey participants but repeatedly distributes questionnaires over time to observe changes in their, behaviors, or attitudes (QuestionPro website 2021). Duncan et al (1986) posited that collection and analysis of several large-scale, representative, longitudinal studies have made researchers to learn more because they provide more reliable information on changes in the objective and more detailed information than cross-sectional studies and have been viewed as better sources than cross-sectional studies. The repeated

nature of longitudinal studies makes the data more realistic and reliable than cross-sectional studies mostly done in a limited time. Longitudinal surveys can further be categorized into the following sub categories.

Panel study:

Panel survey involves a sample from a more significant population and is conducted at specified intervals for extended period. Researchers collect data from the same sample at different points in time. Panel survey is a longitudinal study that measures the behavior of people over time, their thoughts, feelings, and emotions. (Survey monkey 2021). Survey respondents may include people who provide valuable insights to an issue under study. Most panel studies are designed for quantitative analysis though they may be used to collect qualitative data. It may be concluded that panel surveys use observations repeated many times over a period using the same sample of persons (a panel), collecting data from a sequence of interviews or questionnaires which may be called waves. These interviews or the questionnaires are administered at fixed times and well separated occasions. Mathison (2005) indicates that a panel study surveys the same individuals at different times, while a cohort study samples from the same group at different times. Because of this difference, a panel study is sometimes considered as a true longitudinal study whereas a cohort study is an approximation.

Cohort Study:

Cohort design is a non-experimental study comparing occurrences of phenomena in two or more groups referred to as cohorts. They consist of people with differing characteristics like risk factor, or exposure (Mabmud 2012). A cohort study samples a group of people who typically experience the same event at a given point in time and commonly conducted by medical researchers who observe participants without intervention. According to Barrett et al (2019) cohort studies are effective method in establishing cause and effect because they are usually large in size and can confidently conclude the link between the cause and effect. Cohort study design are either retrospective or prospective cohort studies where the participants are followed for a period of time as further discussed below.

Retrospective study:

Retrospective study uses already existing data, collected during previously conducted research with similar methodology and variables. The researcher uses a database which has

been pre-existing like medical records, employee duty attendance, accident cases recorded over a period of time or one-to-one interviews. Mathison (2005) says that retrospective study is research that uses information from the past to draw conclusions. Retrospective studies are used when the outcomes are long-term, which makes the study longitudinal. Think of a study where a researcher is interested if adult learning has any significant influence on future career choices of working populations. In such a case a retrospective study could dig into what the adults learnt with possibility of shaping their future careers.”

Most research is constructed on retrospective knowledge information, Cousy et al (2021) argue that in a retrospective cohort study design, a sample of research participants who show the desirable outcomes of interest is followed backwards into time until when they were similar using recall data. Retrospective research is therefore beneficial to researchers who are interested in the distant past than those interested in knowledge of the present past.

Prospective study

David (2011) define prospective study as inquiry of cases forward in time, measuring attributes at multiple time points by examining differences between each time point or study wave. He opines that compared to experimental designs, prospective designs do not include randomized control groups or experimental interventions. Prospective studies have the potential of documenting things as they occur. According to David (2011) social researchers employ four main types of prospective design. The first is the ongoing single cohort design where the study consists of a single cohort that is tracked indefinitely and the second type tracks multiple cohorts

Cross Sectional Survey

Chris et al (2004) define cross sectional survey as where the entire population or a is selected, it is called cross-sectional because the information about the independent and dependent variables that is gathered represents what is going on at only one point in time. Mapuva et al (2020) argue that when data to be collected involves more than one group in the same study and in the same period of time, the study should employ the cross-sectional design because it is easier to manage the groups meaning that the design is economical. Most of the academic research undergraduates and post graduate students is cross sectional survey research because data is consciously and continuously sought and picked without a break for periods ranging from one month to six months. Examples of cross -sectional surveys include political opinion

polls, customers' satisfaction surveys and acceptability of products in the market. Chen et al (2021) is an example of cross-sectional survey where data was collected from questionnaires from June 1 to 18, 2013 with a total of 200 individuals answering the survey instrument. Another compelling example of cross-sectional survey is by Tlotlo et al (2021) who conducted a cross-sectional study involving sampling at multiple locations and multiple data collection platforms. They argue that by cross-sectional study design, data were collected at a single point in time from a heterogeneous sample of the population. Cross sectional studies are therefore very practical in large studies with homogeneous populations and where quick , generalizable results are required. As stated by Abutabenjeh (2018) Cross-sectional studies are descriptive in nature providing a wealth of information that is easy to understand and interpret with the ability for identifying problems and suggest solutions.

2.2.2 Experimental Design

According to QuestionPro website (2021). Experimental research is a scientific methodology of conducting research, where one or more independent variables are manipulated and applied to one or more dependent variables to determine the causal effect on the two groups of variables. The relationship and the effect of the independent variables on the dependent variables is recorded over a period of time, so that acceptable conclusions can be adduced about the relationship between the two variables. The experimental research design is mostly used in physical and social sciences, psychology, and education disciplines. An experiment is a study which the researcher manipulates the level of some independent variable and then measures the outcome. Experimental research can be divided further into two subcategories, true experimental design quasi experimental design.

True Experimental Design

Sahoo (2020) defines true experimental design as that which provides a systematic and logical method of manipulating certain stimuli or environmental conditions with a view to observing change. Experiment therefore involves the comparison of two effects of a particular treatment with that of a different treatment or no treatment. There must be two groups categorized as experiment group and the other one a control group. The experiment group may be manipulated whereas the control group is not manipulated so that it forms the

baseline of comparison. In experimental research there is more knowledge generated because researchers can observe how one variable influences the other variables. Alewine (2010) explains that experimental studies manipulate variables of interest while controlling for other variables. He further argues that extant literature is scarce on studies that employ experimental methods. Experiments also contain advantage for analyzing future courses of action. Hank (2010) indicate that experiments can account for future change because imagined possibilities can serve as a basis for determining current and future debates on particular subjects or issues. Oliver (2013) describes true experiment as where the researcher randomly assigns subjects to different categories (treatments) of the independent variable. This randomization can yield high internal validity in assessing the causal effect of the independent variable on the dependent (outcome) variable. She further argues that experiments are critical in policy areas such as education, welfare provision, population control, or medical treatments (Akinlula 2020). We conclude that experimental research designs basically deal with conducting research a way that evidence of causal validity is highly manifest because the researcher is interested in showing how the independent variables will be manipulated and the effect on the dependent variable

Quasi-experimental Design

Harris, et al, (2006) define quasi-experiments as type of studies that aim to evaluate interventions but do not use randomization and they endeavor to show causality between an intervention and an outcome. Gopalan (2020) argued that quasi-experimental research designs, use non-experimental (or non-researcher-induced) variation in the main independent variable of interest, they mimic the experiment environment in which some subjects are exposed to treatment and others are not. In quasi experimental research therefore, an independent variable is manipulated, but the participants of a group are not randomly assigned as in the true experimental research design. Quasi-research design is mostly adopted in research conditions or environments where random assignment is not necessary. Sahoo (2020) says that it is not always possible to manipulate the experimental (independent) variable to generate cause-and-effect because the randomization of subjects and randomization of conditions, which are the critical factors in true experiment are hard to be achieved in some environments.

2.2.3 Ex Post Facto Research Design

Ex post facto design is a quasi-experimental study that examines how an independent variable, present prior to the study in the participants, affects a dependent variable. This is a type of quasi-experimental design that examines how an independent variable, that existed prior to the study affects the dependent variable. Akinlula (2020) argues that the ex post facto research design adopts several aspects of a true experiment especially as it concerns the separation of groups and the analysis of data but is in fact non-experimental. Ex post facto research cannot be used to demonstrate causality among variables but can suggest it since it explores problems or conditions after the fact. Ex post facto research design is a method in which groups with qualities that already exist are compared on some dependent variable and it is also known as "after the fact" research, meaning that there were factors which existed previously. Kerlinger (1964) defined ex post facto research as the research where the independent variable or variables have already occurred and in which the researcher starts with the observation of a dependent variable or variables. The research studies the independent variables in retrospect for their possible relations to the dependent variable or variables. Adonai et al (2018), pointed out that an ex post facto study explores the existence of relationships between variables that the researcher cannot control, since their manifestations previously happened or took place, meaning what is being studied is past but the researcher only seeks to establish the influence of the said variables on the dependent variable without any manipulation

3.0 Conclusions

Quantitative research designs may be adopted at any level because of their applicability in a wide area. Survey design is the friendliest because of its ability to handle large samples from the population with ease of generalizing of the findings. Care should be taken on whether one intends to conduct a longitudinal or cross-sectional survey considering factors like time required by the longitudinal studies. Those with limited time should opt for cross sectional studies which save on cost. Panel, cohort and retrospective studies, are quantitative, but fit more in a qualitative type of studies because at one point in time, there would be a lot of reflection and emotional involvement. Finally, experimental, quasi experimental and ex post factor studies would be useful in the social sciences context but more useful in the medical and other scientific disciplines which rely on laboratories

3.1 Recommendations

The researcher must first and foremost familiarize with different types of research designs before making an informed decision. Those seeking to unearth true feelings and the social aspect of the research where the solution to the problem is embedded in the feelings of the participants, qualitative research design should suffice because the path may change with different discoveries as the research progress.

Where the situation is about understanding the relationship between different phenomena, quantitative research design should be pursued. Quantitative designs will apply predetermined and fixed plans, standard and codified rules and formal procedures which may be used for replication of the study. The paper recommends that those researchers dealing with quantifiable and measurable data may use quantitative research designs. Researchers interested in large sizes of samples may use survey because of its ability to handle large sizes of data. Finally, review of this literature recommends that experimental, quasi experimental and ex post facto studies would be useful in social sciences context but more useful in the medical and other scientific disciplines using laboratories.

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