



QUANTITATIVE AND QUALITATIVE RESEARCH: A MIXED METHOD APPROACH IN EDUCATIONAL SCIENCE

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Abstract-Mixed methods research involves the use of qualitative and quantitative data in a single research project. It represents an alternative methodological approach, combining qualitative and quantitative research approaches, which enables Educational Science researchers to search complex phenomena in detail. This paper studies on practical overview of mixed methods research and its application in Educational Science, to guide the researcher considering a mixed methods research project. At its most basic level, mixed methods research involves the use of both qualitative and quantitative data in a single project. It characterises an alternative method to traditional qualitative or quantitative research approaches, enabling researchers to assume detailed assessment of multifarious phenomenon. This paper provides a practical inference for educational science, of the application of mixed methods research. Mixed methods research is important today because of the complication of present day problems, the rise of interest in qualitative research, and the practical need to collect multiple forms of data for various audiences. The complexities of merging research designs could make mixed methods research a time consuming activity for researchers. Mixed methods research is essentially a complex task in every discipline, including education and very much helpful to carry the present day complex researches.

Keywords: Mixed methods research, qualitative research, quantitative research, Educational Science.

1. INTRODUCTION

1.1 Mixed Methods Research

A mixed methods study is research intentionally combining or integrating quantitative and qualitative approaches as components of the research. The use of these methods can follow at different points in the research process. Mixed methods research a “method” is with philosophical assumptions as well as quantitative and qualitative methods of inquiry. As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone.

2. QUANTITATIVE AND QUALITATIVE DATA

Quantitative data comprises closed-ended information such as that found on attitude or behaviour, tools. The collection of this kind of data might also involve using a closed-ended checklist, on which the researcher checks the behaviours seen. Sometimes quantitative material is found in documents such as census records or attendance records. The study comprises of statistically analyzing scores collected on tools, checklists, or public documents to answer research questions or to test hypotheses. In contrast, qualitative data consists of open-ended information that the researcher gathers through interviews with participants. The general, open ended questions asked during these interviews allow the participants to supply answers in their own words. Also, qualitative data may be collected by observing participants or sites of research, gathering documents from a private (e.g., diary) or public (e.g., minutes of meetings) source, or collecting audio-visual materials such as videotapes or arti-facts. The analysis of the qualitative data (words or text or images) typically follows the path of aggregating the words or images into categories of information and presenting the diversity of ideas gathered during data collection. The open- versus closed-ended nature of the data differentiates between the two types better than the sources of the data. The sources of the data do not cleanly map onto qualitative and quantitative research, at least as much as they used to. For example, surveys, a traditional quantitative source of data, are being used in ethnographic qualitative research, and narrative stories, associated with qualitative research, are being linked to quantitative event history modelling.

3. MIXING THE DATA

By collaborating data, between qualitative and quantitative data to better way-out of the problem than either approach alone. The different mixing processes are merging the two datasets, connecting the two datasets or embedding one dataset within the other so that one type of data provides a supportive role for the other dataset. It is

not enough to simply collect and analyze quantitative and qualitative data; they need to be “mixed” properly so that together they form a more complete picture of the problem than they appear alone.

- Mixed methods research gives powers to the weaknesses of both quantitative and qualitative research. The weakness of the quantitative research is here the voices of contributors are not directly heard. Further, quantitative researcher’s own personal biases and explanations are not discussed every time. Qualitative research makes up these flaws. In qualitative research researcher’s personal interpretations made create biasness, and the difficulty in generalizing findings to a large group because of the limited number of participants surveyed. Where in Quantitative research, has no this kind of drawbacks. The combination of both approaches can reduce the flaws than they appear alone.
- Mixed methods research helps answer questions that cannot be answered by qualitative or quantitative approaches alone. For example, “Do participant views from interviews and from standardized instruments converge or depart?” is a mixed methods question. Others would be, “What explains the quantitative results of a study?” (using qualitative data to explain the quantitative results) and “Will a treatment work with a particular sample in an experiment?” (exploring qualitatively before an experiment begins). To answer these questions, quantitative or qualitative approaches would not provide a satisfactory answer.
- Mixed methods encourages researchers to collaborate data in combative association between quantitative and qualitative data.

4. FOUR OBJECTIVES ARE PURSUED IN MIXED METHODS RESEARCH

- Combining or integrating quantitative and qualitative methods toward the best possible approach to the research problem.
- Create quantitative and qualitative data to understanding of the research problem.
- Create quantitative and qualitative data from the same research problem that allows the researcher to give findings, suggestions and conclusions.
- Make more robust research by using the strengths from one research model to balance methodological drawbacks from the other. This produces more consistent research.

5. DESIGNING AND CONDUCTING MIXED METHODS RESEARCH

- A content analysis study: Consider a study in which only one type of data is collected but both types of data analysis are used. Researcher can collect only qualitative data but can evaluate the data both qualitatively (developing themes) and quantitatively (by rating reactions). A content analysis study is one where the researcher collects only qualitative data and transforms it into quantitative data by counting the number of reactions.
- Multi-method research (Morse, 2003) : Consider a study in which the researcher collects, analyzes, and mixes multiple forms of either qualitative or quantitative data. For example, a researcher could collect multiple forms of qualitative data, such as community documents for a participatory action research study and interviews during grounded theory research. A researcher could collect, analyze, and mix different types of quantitative data (e.g., quantitative surveys with structured observations). Are these examples of mixed methods research? This type of research is called multi-method research because it is based on multiple qualitative or quantitative methods and data sets.

6. MIXED METHODS RESEARCH DESIGNS

The design means the research plan that will guide the researcher in conducting the study.

Exploratory design using sequential phases (quantitative - qualitative). The objective of this design is the exploration of the research problem. Exploration is used when very little is known about the research problem. This design first uses a qualitative research approach to explore the experience of participants with the phenomenon under study, their culture or values of the group, or the structure of the institution being studied. With the findings of qualitative data, the researcher plans a quantitative process to measure the findings of the qualitative datasets.

Explanatory design using sequential phases (quantitative - qualitative). The purpose of this design is to study or describe the research problem in depth. Here first uses a quantitative study to measure the traits of problem and then to a qualitative study to develop the findings of quantitative datasets.

Convergence design using parallel phases. The objective of this design is to study the research problem in its entirety and dimension. The quantitative method helps to measure the objective aspects and the qualitative method is used to understand the subjective aspects. It is known as merging because each design approach is used to study different aspects of the problem. Merging occurs by the researcher who integrates quantitative and qualitative data to explain the current problem. Triangulation design using parallel phases. The objective of this design is to use quantitative and qualitative approaches to study in depth the same aspects of the research problem. To achieve this, the researcher carefully plans the entire process of research to address these aspects of the problem from quantitative



and qualitative perspectives. This is achieved if the measuring tools and research designs are merged and balancing to collect quantitative and qualitative data of the problem. Thus, the data analysis focuses on these aspects to obtain quantitative and qualitative data to examine the problem.

The objective of this design is to use one of the research approaches to counter the deficiencies of the other. In this design, a research approach is used in a primary role because it is the dominant or principal method of study.

In Multilevel designs the researcher needs to undertake different levels of analysis, study and research because the problem has several dimensions, manifestations or ramifications. Therefore requires different research methods and different groups or samples. A management of a private school decides to adopt a new curriculum where all classes will be conducted in English and Hindi alternately. One day the class will be in Hindi and the next in English. The school administration argues that this new approach will help create bilingual graduates better prepared for many changes that are occurring in the workplace. To assess the extent of this decision prior to implementation, the measure should be understood from different perspectives of what it will entail for faculty, students and parents. For example, how would this influence the daily preparation of teachers to teach a course bilingually. The same would apply to students. What monetary cost would this decision have for parents, perhaps, to purchase materials and equipment for their children in English and Hindi? In this example, the list of questions can be much larger, if approached from the various population groups that would be impacted by the decision (parents, teachers, students). To study this type of problem, multilevel design is used.

Emergent designs (transformative design). It is common in mixed studies to deviate from the research design for the following reasons that occur when combined quantitative and qualitative approaches in the same study; the researcher encounters quantitative and qualitative data that contradict, the researcher identifies new perspectives on the problem that had not been included in the initial study design, however they merit investigation, or discovers methodological errors in the study. When these situations occur, the researcher has two options; concludes his study and accept this as limitations of research or modify the design to respond to them. Findings that emerge from the research process and that merit response it is known as an emergent design. Therefore, the researcher must explain this in the final research report. In other words, the study began with a design that evolved to another in the process of conducting research.

7. DATA COLLECTION IN MIXED STUDIES

7.1 Research Problem

The research problem consists of situations, phenomena, processes or persons who are the focus of study. In mixed studies, research problems have the tendency to be complex because they include objective and subjective elements to be addressed with a combination of approaches.

7.2 Research Questions

Research questions decompose the problem into controllable units to be studied. In mixed methods studies quantitative and qualitative questions are used. A common practice in mixed methods studies is always designing questions beginning with what, how, when and where. This is accepted because it is easier to answer questions when contrasting with the survey data.

7.3 Research Design

The principle key in selecting the design is to understand the quantitative and qualitative research to use them appropriately in a mixed methods study. It is very difficult to conduct a mixed methods study without understanding the models of quantitative and qualitative research. The problem and research questions have to connect with the mixed research design.

7.4 Study Title

Titles should reflect three components; the research topic, the study population and research design.

7.5 Sample

Primary sampling (adhere to the established). Consists of selecting the sample according to the parameters of the respective models of quantitative and qualitative research.

7.6 Tools and Techniques

As the sampling, the development of tools and techniques for data collection must follow the criteria established by the quantitative and qualitative research. An important element in this task is to ensure that the tools and techniques of data collection are aligned to the research objectives; generate the quantitative and qualitative data to answer the research questions, generate quantitative and qualitative data to understand clearly and deeply the research problem, produce quantitative and qualitative data of the same phenomenon under research.



8. ANALYSIS OF MIXED DATA

Analyzing data is to extract meaning, implicit or explicit, of the information collected in the study. Analyzing data is a three step process; encode and describe the information to understand the messages that may be there, analyze and interpret information to make it clean data and communicate findings and identify the most effective way to convey the findings. In mixed studies three types of data analysis are used; analysis of quantitative data, qualitative data analysis and analysis of mixed data.

8.1 Validity in Mixed Studies

In research, terms like internal and external validity are commonly used to describe the investigative accuracy of a study. The term internal validity is used to describe how much communication exists between the data collected and the research problem. External validity refers to whether the study data can be used beyond the situation of the study. In mixed studies the validity criteria from qualitative and quantitative models are used to meet the investigative thoroughness of the respective models. However, as mentioned above, the aim of combining or integrating quantitative and qualitative approaches is to project into complex problems where there are clear objective and subjective aspects to generate quantitative and qualitative data to more or better approach to the research problem. In mixed studies the term of inference validity is used to describe the effectiveness of the researcher to approach and capture the complexity of the research problem using quantitative and qualitative approaches. Inference validity signifies that the quantitative and qualitative data describe, explain or accurately capture the research problem and its complexity. When this occurs, the researcher can argue that it was effective in combining or integrating qualitative and quantitative approaches and is therefore in a better position to make valid inferences or interpretations of the research problem for the richness of its quantitative and qualitative data collected.

8.2 Writing the Mixed Methods Research Report

The content of mixed methods research reports follow the same linear arrangement of quantitative and qualitative thesis or dissertations: Statement of the problem, literature review, method, findings and discussion.

9. IMPLICATIONS OF MIXED METHOD RESEARCH IN EDUCATIONAL SCIENCE

Several dissertations help to examine the strength and challenge of using mixed methods research in educational science:

Researching teaching and learning: Medina (2012) used a complementary mixed method design to study the effect of a virtual laboratory on students' academic achievement in ninth grade in a biology course. In the quantitative phase a pre-post test was used in two groups (experimental and control). The qualitative phase consisted of focus groups with the study participants and observations made by the teachers during the experiment. The results demonstrated that both strategies (virtual and present) were effective in students' academic achievement.

Perez (2012) developed a study to measure the effect of self-monitoring strategy in the academic achievement of students' performance in fourth grade regarding to sum skill in regrouping up to a million and explore their experience with the strategy. To perform the same, the author used a complementary mixed method. The quantitative phase used an experimental design (pre-post test) and the qualitative phase served as a complementary function to know the perception of students towards self-monitoring strategy (interviews). The findings showed a statistically significant difference between the experimental and comparison group. The experimental group ran significantly better than the comparison group.

Medina (2014) used a triangulation mixed methods research design in parallel phases to study the effect of graphic organizers in learning math with college students. The quantitative phase consisted of an experiment using two groups with a pre-post test. The objective of the experiment was to measure the effect of using graphic organizers to learn math. The qualitative phase consisted of using a one minute paper to asses learning during the development of the experiment. The objective was to understand the students' math learning process while using graphic organizers. At the end of the experiment a focus group was asked open-ended questions to understand the students' experience using graphic organizer to learn math. A triangulation of data consisted of comparing quantitative data from pre-post tests with the qualitative learning assessment exercises data and the interview data. In these studies, the mixed methods design allows the researchers to capture and explain the complexity of the teaching-learning process as a phenomenon. The quantitative component measured the effects of the teaching strategies (experiment treatments). The qualitative component permitted understanding how students perceived the teaching strategies, what happened in their minds and what factors allow learning.

Researching stress in high school teachers. Lopez (2014) used an exploratory design with sequential phases (qualitative-quantitative) to study stress in high school teachers. The study objectives were: a) identify the factors that contribute to occupational stress in high school teachers from the Department of Education of Puerto Rico and its impact on the performance of their duty; b) develop, validate and administer a measurement instrument on the

factors that contribute to job stress and c) determine the relationship between these factors and their impact on teacher performance in high school teachers in the public education system in Puerto Rico. The research design used a sequential mixed methodology (Phase I- Qualitative and Phase II Quantitative). The study was conducted across the island, and included all educational regions of the Department of Education of Puerto Rico. The sample of Phase I- Qualitative consisted of five teachers belonging to a high school who participated in an interview. Phase II- Quantitative sample consisted of 379 teachers, in which was developed, administered and validated a measurement instrument based on the findings of Phase I Qualitative. The findings and results of both phases of the study helped identify and describe the factors that contribute to job stress of high school teachers. In terms of the relationship between occupational stress factors and teachers performance, there weren't statistically significant inverse relationships between those factors and performance (higher stress, lower performance). However, in her study it was evident that there is a moderate direct relationship, between some factors of job stress and teacher performance (higher stress, higher performance). Based on the findings and results, including both phases of the study, the use of mixed methods research was recommended to increase awareness about this problem and know the strategies used by high school teachers in the island to deal with stress. Similarly, it was suggested to develop studies that reveal how those factors influence the health of teachers. Finally, the author encouraged raising awareness among staff of the Department of Education on the issue of job stress on teachers. In this study, the qualitative phase allows the researcher to capture teacher's daily stress conditions in the Department of Education of Puerto Rico (public schools). The quantitative research phase allows validation of these conditions in a representative sample of teachers from different districts of the same educational system.

In the studies, the research complexities came from two sources. The first source of complexity came from the teaching-learning process or the educational phenomenon being studied (Medina, 2012; Perez, 2012; Medina, 2014). The second source of complexity came from the cultural-context of the educational system where the teachers stress study was conducted (Lopez, 2014). In these studies, capturing and explaining the educational complexities was possible because of the quantitative and qualitative research designs used as components of the studies designs. These studies allow seeing the strength of mixed methods research designs in capturing educational complexities.

CONCLUSIONS

In this paper the basics of mixed research and its applications to the field of educational research are discussed. The examples of mixed methods research in educational research presented allow us to appreciate the strength of mixed methods research in potential educational phenomenon such as the teaching-learning process. It becomes clear from the above discussions, that implementing mixed research studies successfully requires understanding of quantitative, qualitative and mixed methods research designs. The complexities of merging research designs could make mixed methods research a time consuming activity for researchers. Mixed methods research is essentially a complex task in every discipline, including education.

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