



# Mix- Method Design in Educational Research: Strengths and Challenges

Zahra Ghasempour<sup>1</sup>, Md Nor Bakar<sup>2</sup>, Golam Reza Jahanshahloo<sup>3</sup>

<sup>1</sup>Islamic Azan University, Iran\*

<sup>2</sup>Universiti Teknologi Malaysia, Johor, Malaysia

<sup>3</sup>University of Teacher Education, Birjand Branch, Tehran, Iran

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**Abstract:** Methodology is a body of knowledge that empower researchers to explain and analyze a phenomena through association between research paradigms and strategies (i.e., quantitative (quan), qualitative (qual), or mix- method). In recent decade, the proficient of mix-method have raised up own philosophical, methodological, analytical and practical foundations for conducting the mix-method designs. However, there exist many communications related to the more common definitions of mixed methods research, it is yet required to be specify the particular criteria in choosing mix-method design for educational researches. Therefore, this study intends to provide a process of critical decisions for selecting suitable mix- method design. In this respect, an archive study is conducted to provide an overview of the four common mixed-method designs including: “Triangulation”, “Embedded”, “Explanatory” and “Exploratory”. In addition, the strengths, the challenges of each design, and the ways applying them are discussed. Conclusively, to perform an effective mix-method, researchers have to make decision about timing, weighting, as well as mixing source of quantitative and qualitative. Meanwhile, they should be able to state their philosophy of selected design regarding to their required skills and competency as well as justify their validity of findings. We assert that these findings can assist junior educational researchers to inquire their objectives in a consistent manner.

**Keywords:** Mix- method; Quantitative; Qualitative; Triangulation; Embedded; Explanatory.

## 1. Introduction

Research designs represent different procedures to guide decisions that a researchers must make for collecting, analyzing, interpreting, and reporting data in research studies. A researcher conducts a mixed-methods approach, when he/she has intended to provide a better understanding of her/his research problem by both, quantitative and qualitative data. On the other hand, this method can effectively lead researcher to build from one phase of research to another, for example a quantitative study may be followed up with a qualitative one to obtain more detailed specific information from the results of statistical tests.

Therefore, mixed- method designed is defined a procedure for collecting, analyzing, and “mixing” both quantitative and qualitative research and methods in a single study to understand a research problem (Creswell, 2012). Furthermore, Methodologists have classified the major types of mixed methods regarding

to different philosophies, disciplines, and terminology. In this respect, Cameron (2011) designed a paradigm framework with the five components include: “Paradigms; Pragmatism; Praxis; Proficiency; and Publishing”. The researchers’ competencies for conducting a mix- method design in each paradigm are explained as follows:

- 1) Paradigms: this paradigm requires sufficient understanding of the philosophical bases of research to determine how apparent paradigmatic differences of quantitative and qualitative methods might influence their work and be resolved;
- 2) Pragmatism: it demands researchers to be familiar with key literature and debates in mixed methods, and with exemplars of a variety of mixed methods approaches to research and learn to take risks, but also to justify choices made
- 3) Praxis: it asks researcher’ ability in determining the appropriateness of a selected method or methods, based on the research question(s),



moreover he/she can indicate whether mixing methods provide a cost-effective advantage over use of a single method. On the other hand, he/ she must be had knowledge of the variety, rules and implications of different sampling methods, and of alternative approaches to dealing with 'error' or deviance from the norm. Meanwhile, he/she have to admit what is not known, and seek advice.

- 4) Proficiency: researchers are required to be have well developed skills in carrying out research using at least one major methodological approach, but also a comprehensive understanding of a range of approaches and methods, particularly to understand the principles underlying those methods; have an ability to interpret data meaningfully, and to ask questions of the data, rather than to simply follow a formula; know and understand how software can be used to assist analysis tasks.
- 5) Publishing: researcher have to develop new ways of thinking about the presentation of research results, especially where the methods used and information gained does not neatly fit a conventional format.

However, these paradigms will provide a very sound "starting block", but it will not be expected that junior mix- method researchers to be fully competent in all aspects of the mix- method landscapes, although it is strongly required to be able in making decisions about 'Theoretical drive: Inductive or deductive; Core component: qual or quan; Supplemental component(s): qual or quan; Pacing: Simultaneous or sequential; Point of interface: Analytic or results narrative ". Accordingly, this study provide an overview of specific elements in four common mix- method design of Creswell (2002, 2012) to assist novices in proper elections for designing a mix- method study.

Creswell (2012) advanced a parsimonious and functional classification with four principal mixed-methods designs, such as "Triangulation", "Embedded", "Explanatory" and "Exploratory". In this regard, he stated that these designs with the following key characteristics can be collaborated on choosing a suitable research design:

*"Rationale" refers to why researcher are collecting both quantitative and qualitative data , for instance, "Explanatory" design is "Rationale" , because of test findings obtain in first phase, then related results are explained in more detail in second phase , lastly a more complete understanding can be concluded than either quantitative or qualitative alone.*

*"Priority" means researcher takes more emphasis on one type of data than on other types. In other word, researcher clarifies whether quantitative and qualitative data are considered with equal weight in study, or one carries more weight of other.*

*"Sequence" demonstrates whether collecting both quantitative and qualitative data is done at the same time, or different time, such as gathering quantitative data first, followed by qualitative data, and vice versa.*

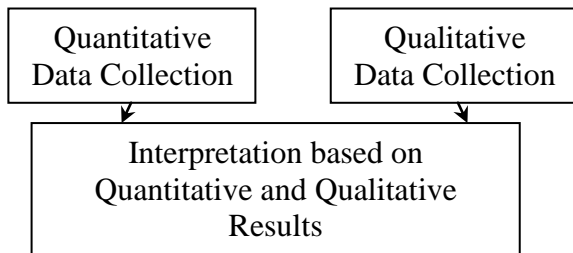
Accordingly, the fundamental decisions in choosing a particular type of mix-method study are comprised of (i) assessing the feasibility of using this design according to researchers' data gathering skills and knowledge, besides limitation of time and place in a research, (ii) determining the level of interaction between the quantitative and qualitative strands, (iii) the priority of the strands, (iv) the timing of the strands, as well as (v) where and how to mix the strands. However, in each of mixed-method designs, it is needed to be more clarified the suitable strategies for meeting challenges that may be occurred during executing these steps.

Recently, many excellent articles and book chapters on mixed- methods have been published by well-known methodologists; such as Creswell (2002, 2012), Creswell and Plano Clark (2006) and so on, so that PhD scholars and investigators in educational and social science are attracted to perform their studies based on mix-method designs as a novel and effective methodology. Despite these significant recourses, many researchers and reviewers are currently unfamiliar with the different types of mixed methods designs, it is important to include an overview that introduces the design when writing about a study in proposals or research reports. Therefore, the main objectives of this study are to provide an overview of mix-methods designs, and discuss about strength and challenges each of them. In addition, it is presented some examples of prior doctoral thesis that used successfully the mix-method designs. In order to this study is acquired by reviewing significant literatures in term of content analysis, it can support junior educational and social science researchers to make sense of their research questions by choosing a consistent and scientific methodology .

## **2. The Triangulation Design, Procedures, Strengths, and Challenges**

This common design is used when a researcher wants to directly compare and contrast quantitative statistical results with qualitative findings or to validate or expand quantitative results with qualitative data. The "Triangulation" design is a one-phase design in which

researchers implement the quantitative and qualitative methods during the same timeframe and with equal weight, then he/she attempts to merge the two data sets, typically by bringing the separate results together in the interpretation or by transforming data to facilitate integrating the two data types during the analysis. Accordingly, Figure 1 presents Triangulation design procedures.



**Figure 1. Triangulation design procedures (Adapted from: Cresswell, et al., 2003).**

Variants of the triangulation design are the convergence model, the data transformation model, the validating quantitative data model, and the multilevel model. The first two models differ in terms of how the researcher attempts to merge the two data types (either during interpretation or during analysis), the third model is used to enhance findings from a survey, and the fourth is used to investigate different levels of analysis. This design has a number of strengths and advantages, including the following:

- 1) The design makes insightful sense, so that junior researchers prefer it.
- 2) It is an efficient design, in which both types of data are collected during one phase of the research at roughly the same time. In addition, it allows researchers to be more confident of their results. Triangulation can play many other constructive roles as well.
- 3) It can stimulate the creation of inventive methods, new ways of capturing a problem to balance with conventional data collection methods.
- 4) Each type of data can be collected and analyzed separately and independently, using the techniques traditionally associated with each data type. This lends itself to team research, in which the team can include individuals with both quantitative and qualitative expertise (Creswell, 2002).

Although this design is the most popular mixed methods design, it is also probably the most challenging of the four major types of designs. Here are some of the challenges facing researchers using the “Triangulation” design:

- 1) Much effort and expertise is required, particularly because of the concurrent data collection and the fact that equal weight is usually given to each data type. This can be addressed by forming a research team that includes members who have quantitative and qualitative expertise, by including researchers who have quantitative and qualitative expertise on graduate committees, or by training single researchers in both quantitative and qualitative research.
- 2) Researchers may face the question of what to do if the quantitative and qualitative results do not agree. These differences can be difficult to resolve and may require the collection of additional data. The question then develops as to what type of additional data to collect: quantitative data, qualitative data, or both?
- 3) Researchers need to consider the consequences of having different samples and different sample sizes when converging the two data sets.
- 4) Researchers need to develop procedures for transforming data and make decisions about how the data will be transformed. In general, it is easier for researchers to quantify their qualitative data by transforming qualitative codes or themes into counts or ratings.

Doctoral thesis of Jick (1979) is an example of applying “Triangulation”. He conducted “Triangulation” strategy to identify the effects of a merger on employees. Jick (1979) stated that the following reasons for choosing this strategy:

“One focus of the research was to document and examine the sources and symptoms of anxiety, the individuals experiencing it and its impact on the functioning of the newly merging organization. In this study data triangulation entailed the comparison of qualitative data received from structured interviews with facilitators and coordinators with quantitative data from the Stages of Concern Questionnaire and the demographic and relevant information questionnaire of facilitators and coordinators. Using this dual approach does not result in a single, clear-cut, consistent picture, but rather presents a challenge to improve comprehension of the various reasons for the existence of inconsistencies between the two sets of data.

### 3. The Embedded Design, Procedures, Strengths, and Challenges

Researchers use this design when they need to include qualitative or quantitative data to answer a research question within a largely quantitative or qualitative study, in other words it includes the

collection of both quantitative and qualitative data, but one of the data types plays a supplemental role within the overall design. This design is particularly useful when a researcher needs to embed a qualitative component within a quantitative design, as in the case of an experimental or correlation design. In the experimental example, the investigator includes qualitative data for several reasons, such as to develop a treatment, to examine the process of an intervention or the mechanisms that relate variables, or to follow up on the results of an experiment. As can be seen in Figure2, through “Embedded” design could embed qualitative data within a quantitative methodology and vice versa. The common variants of “Embedded “ are experimental, correlation, embedded instrument development and validation, mixed- methods case study, narrative research, and ethnography (Creswell and Plano Clark, 2006).

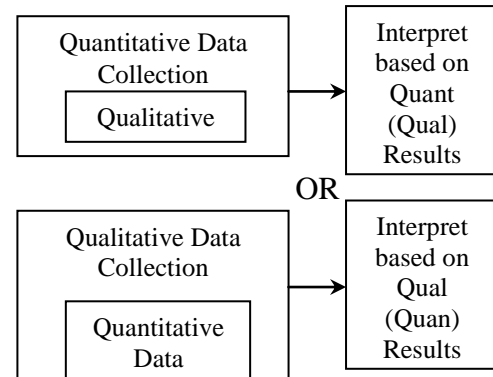
The Strengths specific to this design include the following:

- 1) It can be used when a researcher does not have sufficient time or resources to commit to extensive quantitative and qualitative data collection because one data type is given less priority than the other.
- 2) This design may be logistically more manageable for graduate students because one method requires less data than the other method.
- 3) This design may be appealing to funding agencies because the primary focus of the design is traditionally quantitative, such as an experiment or a correlation analysis.

On the other hand, there are many challenges associated with the variants of the “Embedded” design. These challenges, and suggested strategies for dealing with them, include the following for all variants:

- 1) The researcher must specify the purpose of collecting qualitative (or quantitative) data as part of a larger quantitative (or qualitative) study.
- 2) Researchers can state these as the primary and secondary purposes for the study.

It can be difficult to integrate the results when the two methods are used to answer different research questions. However, unlike the “Triangulation” design, the intent of the “Embedded “ design is not to converge two different data sets collected to answer the same question. For meeting this challenge, Researchers can keep the two sets of results separate in their reports or even report them in separate papers. Few examples exist and little has been written about embedding quantitative data within traditionally qualitative designs.



**Figure2. Embedded design procedures (Adapted from: Creswell, 2012).**

Creswell and Plano Clark(2006) referred to the Harrison’s(2007) doctoral dissertation as a case of “Embedded Correlation Model” to give readers an idea about this useful approach when a researcher needs qualitative information to explain how the mechanisms work in the correlation study in term of quantitative research.

“Harrison (2007) aimed to study an undergraduate mentoring program in teacher education. She plotted longitudinal trends in relationship building using Working Alliance Inventory scores (WAI) over time. During this study, she followed 18 undergraduates in leadership program over 2 years as they learned how to forge mentor-mentee relationships in an undergraduate teacher education program. She collected quantitative data by WAI instrument, during six administrations over 2-years period. After analyzing the obtained major information in term of correlation data analysis, she found that several factors; such as number of times the mentors-mentees met, would influence the building of positive relationships. She also collected limited data in the form of three qualitative focus group interviews with the students to help her understand why some mentors-mentees forged closer relationships, or formed more distant relationships over time. “

#### **4. The Explanatory Design, Procedures, Strengths, and Challenges**

The “Explanatory” design as two-phase mixed methods is well suited to a study in which a researcher needs qualitative data to explain significant (or no significant) quantitative results, or when he/ she wants to form groups based on this results and follow up with the groups through subsequent qualitative research. Furthermore, in this method quantitative participant characteristics can be used to guide

purposeful sampling for a qualitative phase (Creswell and Plano Clark, 2006).. Therefore, there are two variants of the “Explanatory” design: the follow-up explanations model and the participant selection model. As Figure3 illustrates the procedures of design are started with the collection and analysis of quantitative data, then followed by the subsequent collection and analysis of qualitative data.

The “Explanatory” design is considered the most straightforward of the mixed methods designs. The advantages of this design include the following:

- 1) Its two-phase structure makes it straightforward to implement, because the researcher conducts the two methods in separate phases and collects only one type of data at a time. This means that single researchers can conduct this design; a research team is not required to carry out the design.
- 2) The final report can be written in two phases, making it straightforward to write and providing a clear delineation for readers.
- 3) This design lends itself to multiphase investigations, as well as single mixed methods studies.
- 4) This design appeals to quantitative researchers, because it often begins with a strong quantitative orientation.

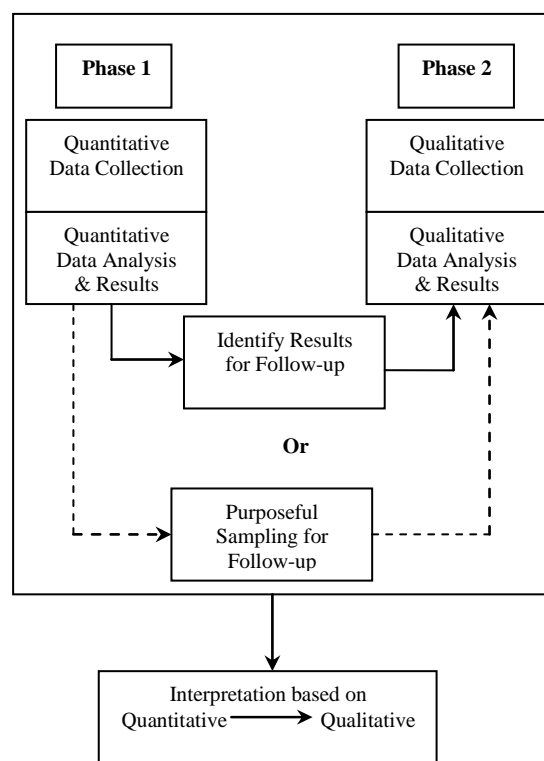
Although the Explanatory design is straightforward, researchers choosing this approach still face challenges specific to this design as follows:

- 1) This design requires a lengthy amount of time for implementing the two phases. Researchers should recognize that the qualitative phase (depending on the emphasis) will take more times than the quantitative phase, but that the qualitative phase can be limited to a few participants. Still, adequate time must be budgeted for the qualitative phase.
- 2) The researcher must decide whether to use the same individuals for both phases, to use individuals from the same sample for both phases, or to draw participants from the same population for the two phases. It can be difficult to secure Internal Review Board (IRB) approval for this design because the researcher cannot specify how participants will be selected for the second phase until the initial findings are obtained. The researcher must decide which quantitative results need to be further explained.
- 3) Although this cannot be determined precisely until after the quantitative phase is complete. For meeting this challenge, options; such as selecting significant results and strong predictors, can be discussed and weighed as the study is being planned. Investigators need to specify criteria for

the selection of participants for the qualitative phase of the research. Options include the use of demographic characteristics, groups used in comparisons during the quantitative phase, and individuals who vary on select predictors(Cresswell, et al., 2003).

As a practical case of implementing the “Explanatory” design in educational research, can point out to Knoell’s (2012) doctoral dissertation that used this design in an excellent manner as he stated that:

*“The intent of this mixed methods study was to develop a more holistic understanding of the student-teacher relationship from the perspective of the fifth graders in two mid-western elementary schools on either end of the poverty spectrum. Quantitative data was gathered through the ClassMaps Survey (CMS) and analyzed for correlations with growth in student achievement data as measured by the Measure of Academic Progress (MAP). In the qualitative follow-up, the CMS data was further explored through semi-structured interviews. The qualitative data sources were analyzed for themes so as to provide a more in-depth understanding of the dynamics and importance of the student-teacher relationship in the lives of the fifth grade students in both schools.”*



**Figure3. Explanatory design procedures (Adapted from: Creswell, et al., 2003).**



## 5. The Exploratory Design, Procedures, Strengths, and Challenges

This two- phases design is particularly useful when a researcher needs to develop and test an instrument because one is not available or identify important variables to study quantitatively when the variables are unknown. It is also appropriate when a researcher wants to generalize results to different groups, to test aspects of an emergent theory or classification, or to explore a phenomenon in depth and then measure its prevalence. This design has two common variants: the instrument development model and the taxonomy development model. Each of these models begins with an initial qualitative phase and ends with a quantitative phase. They differ in the way the researcher connects the two phases and in the relative emphasis of the two methods (see Figure4).

The “Exploratory” design advantages present a similarity to the “Explanatory” design strengths, because both of them are performed via two-phases. Its advantages include the following:

- 1) The separate phases make this design straightforward to describe, implement, and report.
- 2) Although this design typically emphasizes the qualitative aspect, the inclusion of a quantitative component can make the qualitative approach more acceptable to quantitative-biased audiences.
- 3) This design is easily applied to multiphase research studies in addition to single studies.

There are a number of challenges associated with the “Exploratory” design and its variants.

- 1) The two-phase approach requires considerable time to implement. Researchers need to recognize this factor and build it into their study’s plan.
- 2) It is difficult to specify the procedures of the quantitative phase when applying for initial internal review board approval for the study. Some tentative direction must be provided in a project plan for the Internal Review Board.
- 3) Researchers should discuss whether the same individuals will serve as participants in both the qualitative and quantitative phases.
- 4) The researcher needs to decide which data to use from the qualitative phase to build the quantitative instrument and how to use these data to generate quantitative measures.
- 5) Procedures should be undertaken to ensure that the scores developed on the instrument are valid and reliable.
- 6) Decisions must be made in determining the relevant qualitative findings to use. Options include using themes for variables and the

relationships between themes and subthemes (codes) for taxonomy development.

As a model of conducting “Exploratory” design for investigating a unknown phenomena, the below section is adapted of Eli’s (2009) doctoral dissertation as a title” An Exploratory Mixed Method Study of Prospective Middle Grades Teachers’ Mathematical Connections While Completing Investigative Tasks in Geometry”

*“According to curricula perform, prospective teachers must be prepared to facilitate learning at a conceptual level. This research study is exploratory in nature as it generates information about unknown aspects of (a) the types of mathematical connections prospective middle grades teachers made while engaged in tasks meant to probe mathematical connections and (b) how these connections are related to prospective middle grades’ teachers mathematics knowledge for teaching geometry. To address these concerns, an exploratory mixed methods investigation of twenty-eight prospective middle grades teachers’ mathematics knowledge for teaching geometry and mathematical connection-making was conducted at a large public southeastern university. The quantitative data from the Diagnostic Teacher Assessment in Mathematics and Science (DTAMS) and the qualitative data from the Mathematical Connection Evaluation (MCE) and Card Sort Activity (CSA) were analyzed separately, results and findings merged during interpretation of entire analysis.”*

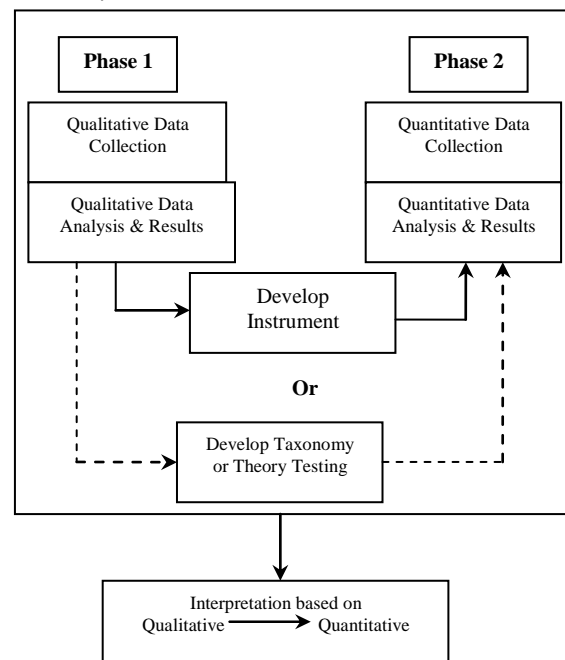


Figure4. Exploratory design procedures (Adapted from: Cresswell, et al., 2003).



**6. Validity Approaches in Mixed-methods Research**

Creswell and Plano Clark (2006) offered the following validation strategies based upon his and the writing of others:

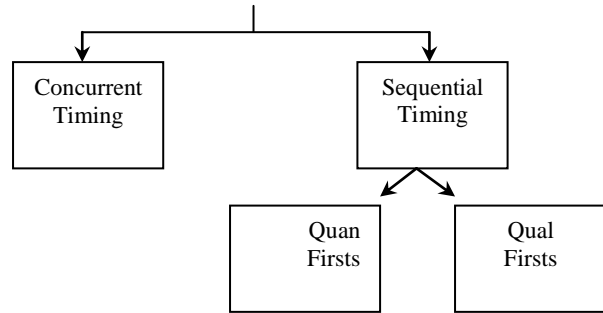
- 1) Both quantitative and qualitative validity should be analyzed and reported. For this case, Konell (2012) declared several avenues can be pursued when one considers validity in quantitative research; such as content validity, criterion-related validity, predictive validity, and construct validity. On the other hand, in terms of validation of the qualitative data, Konell's (2012) recommendations include to the use of the corroborating of evidence from many different, peer review or debriefing sessions, and transferability, namely the use of rich, thick descriptions with the goal of enabling readers to transfer or apply information to other settings.
- 2) The term validity is used to refer to validity procedures that will be used in both quantitative and qualitative research, as opposed to other terms that have been proposed by other researchers.
- 3) Validity is a significant character for the type of mixed methods design of the study (i.e. triangulation, embedded, explanatory, and exploratory).
- 4) Potential threats to validity in the mixed methods study should be discussed throughout the study in regular debriefing sessions with special panel, affiliated with the study as my doctoral advisor, and who is not affiliated with this study.

**7. Conclusion**

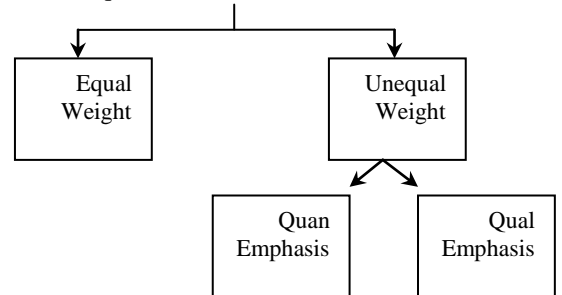
This paper reviews the characteristics of mixed-methods research that highlights four major types of designs such as "Triangulation", "Embedded", "Explanatory", and "Exploratory". Our study reveals that researchers designing a mix-method study can be satisfied with the advantages inherent in each design, whilst they should carefully consider their challenges and suitable plan to strategies for further tackling. In this view, the foundation researchers select mix-method design in a logical manner and make decisions about timing and weighting of both quantitative and qualitative approaches, as well as the best methods that can be mixed for addressing the research problem. However, the requirement of investigators thinking about other aspects of mixed-method design including the ethical issues and the ways of data analysis to complete their study is inevitable. It is highly recommended to the junior researchers to discuss about

the following activities to properly write the methodology of the research proposal, thesis or papers based on mix- method designs.

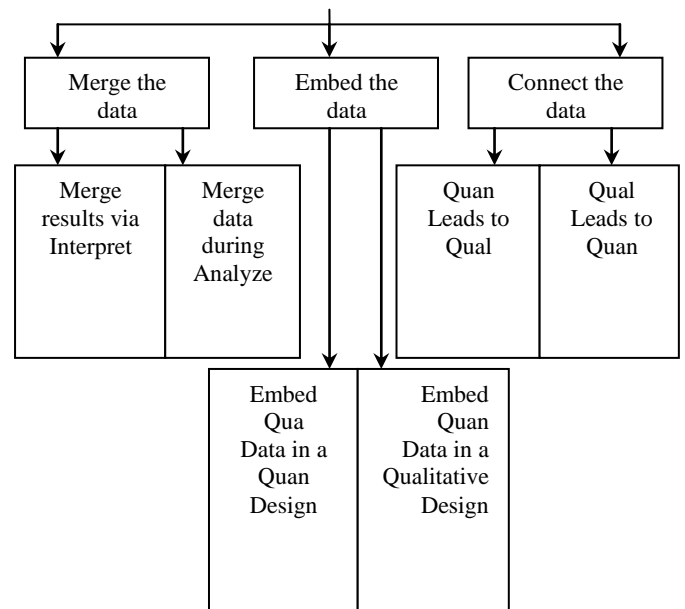
Activity1: What will the timing of the quantitative and qualitative methods be?



Activity2: What will the weighting of the quantitative and qualitative methods be?



Activity 3: How will the quantitative and qualitative methods be mixed?





In addition, philosophical foundations and paradigmatic stance should be thoroughly explicated before methodological choices. As a result, it can indicate a sound of researchers' knowledge base of mixed methods research designs and methodological considerations, proficiency and competence in both the quantitative and qualitative methods chosen as well as using rules of integration to methods and data analysis.

As a consequence of this study, we recommend supervisors and educators guide and teach mixed methods contents to improve junior mix- method researchers.

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