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GUIDELINES FOR CONDUCTING MIXED METHODS RESEARCH: AN EXTENSION AND ILLUSTRATION

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GUIDELINES FOR CONDUCTING MIXED METHODS RESEARCH: AN EXTENSION AND ILLUSTRATION

ABSTRACT

The objective of this paper is to extend the guidelines of Venkatesh et al. (2013) for mixed methods research by identifying and integrating variations in mixed methods research. By taking into account 14 properties of mixed methods research (e.g., purposes, research questions, epistemological assumptions), our guidelines demonstrate how researchers can flexibly identify the existing variations in mixed methods research and proceed accordingly with a study design that suits their needs. To make the guidelines actionable for various situations and issues that researchers could encounter, we develop a decision tree to map the flow and relationship among the design strategies. We also provide an in-depth illustration of one possible type of mixed methods research in information systems and discuss how to develop and validate meta-inferences as the outcomes of such a study.

Keywords: Mixed Methods Research, Meta-inferences, Research Design, Qualitative, Quantitative

INTRODUCTION

Mixed methods research[1]—i.e., research in which elements of qualitative and quantitative research approaches are combined—is gaining popularity as a method of choice for studying phenomena in information systems (IS) research (e.g., Bhattacherjee & Premkumar, 2004; Keil & Tiwana, 2006; Koh, Ang, & Straub, 2004). Mixed methods research provides an opportunity to develop novel theoretical perspectives by combining the strengths of quantitative and qualitative methods. Thus, it provides rich insights by overcoming limitations associated with either method alone, while resulting in *meta-inferences*—an integrative view of findings from qualitative and quantitative strands of mixed methods research (Creswell, 2009; Teddlie &

[1] Although the terms mixed methods and multimethod have been used interchangeably in social and behavioral science, there is a conceptual distinction between the two (Venkatesh et al., 2013). Teddlie and Tashakkori (2003) identified two major types of multiple methods research: (1) mixed methods research and (2) multimethod research. In mixed methods research, quantitative and qualitative data collection procedures (e.g., survey and focus group interviews) or research methods (e.g., ethnography and field experiment) are used to answer the research questions (Tashakkori & Teddlie, 2003a). In contrast, in multimethod research, the research questions are addressed by utilizing two or more quantitative data collection procedures or research methods (e.g., survey and experiment) or two or more qualitative data collection procedures or research methods (e.g., ethnography and case study) (Teddlie & Tashakkori, 2003). Mixed methods research requires a combination of qualitative *and* quantitative procedures, whereas multimethod research requires a combination of qualitative *o*r quantitative procedures.

Tashakkori, 2003; Venkatesh, Brown, & Bala, 2013). However, the application of this method in the IS field has been quite limited (see Venkatesh et al., 2013). The contributions of IS scholars to understanding business phenomena using mixed methods research is constrained by the different paradigms underlying the knowledge about research methodology (Greene & Caracelli, 2003; Petter & Gallivan, 2004; Teddlie & Tashakkori, 2003; Venkatesh et al., 2013). Venkatesh et al. (2013) suggested that IS researchers could collaborate to leverage different paradigmatic views and, at the same time, be able to conduct rigorous mixed methods research. This is because a potentially useful aspect of mixed methods research is its ability to embrace diversity by reducing the tension between different paradigms (Ågerfalk, 2013).

Despite a need for IS research to bridge the gap between different paradigms and/or methods, no real mixed methods guidelines were provided within the emerging paradigms in the IS field. In response to this need, Venkatesh et al. (2013) developed a set of guidelines for conducting mixed methods research and illustrated the applicability of these guidelines using two published IS papers. Although their guidelines focus on the different types of mixed methods research by identifying possible combinations of qualitative and quantitative methods, they limit their discussion to the time ordering of the qualitative and quantitative methods within a single research inquiry and place less emphasis on how to design different types of mixed methods studies based on various criteria (e.g., priority, stage of integration, epistemological perspective).

Early approaches to mixed methods designs (e.g., Creswell, 2003; Greene, Caracelli, & Graham, 1989; Tashakkori & Teddlie, 2003b) have been primarily typological (Maxwell & Loomis, 2003). For example, Creswell (2003) identified two basic types of mixed methods designs: concurrent and sequential. Although a typological approach of mixed methods research could help researchers select a particular design for their study (Teddlie & Tashakkori, 2003), the

actual diversity in mixed methods studies is far greater than any single typology can actually capture (Caracelli & Greene, 1997; Guest, 2012; Maxwell & Loomis, 2003; Tashakkori & Teddlie, 2003b). In particular, the existence of more than two paradigms (e.g., positivist, critical realist, postpositivist), the diversity of qualitative and quantitative approaches that can be employed, the wide range of purposes of mixed methods research, and differences with respect to time orientation have made the actual use of a mixed methods design far more complicated than simply fitting it in a typology framework (Maxwell & Loomis, 2003). Consistent with Maxwell and Loomis (2003), we believe that a more flexible approach to mixed methods research designs can be used to address the limitations of the typology approach. Thus, rather than categorizing mixed methods designs into a typology framework, we view the design of a study as consisting of a number of different dimensions (from many different typologies) that can be flexibly integrated to meet the purposes of the study.

Against this backdrop, we aim to augment the mixed methods guidelines proposed by Venkatesh et al. (2013) by leveraging variations in mixed methods research. Instead of focusing on one typology or framework, we approach mixed methods designs by identifying different properties or typologies of mixed methods research. Our goal is to provide guidelines that are flexible enough to accommodate different types of mixed methods research. By taking into account different properties of mixed methods research (e.g., purposes, research questions, epistemological assumptions), our guidelines demonstrate how researchers can flexibly identify the existing variations in mixed methods research and proceed accordingly with a study design that suits their needs (see Maxwell, 1996; Maxwell & Loomis, 2003; Nastasi, Hitchcock, & Brown, 2010). In addition, we offer an in-depth illustration to rigorously demonstrate how to apply a mixed methods approach based on different properties of mixed methods research. We

also discuss how to develop and validate meta-inferences as the outcomes of a mixed methods research project. Bryman (2006), as cited in Harrison and Reilly (2011), found that scholars have had a difficult time in identifying exemplary mixed methods research due to the absence of best practice templates from which to draw upon when it comes to triangulating the findings. By providing an illustration of how to develop and validate meta-inferences, this work will help highlight a key advantage of mixed methods research over a single method design.

The remainder of the paper is organized as follows. We first provide a summary of mixed methods research and an overview of the guidelines for mixed methods research proposed by Venkatesh et al. (2013). We next discuss the variations in mixed methods research and leverage them to extend the guidelines of Venkatesh et al. (2013). Next, we present a decision tree to map the flow and relationship among the design strategies. Then, we offer an illustrative study of one possible type of mixed methods research and concomitant meta-inferences. The paper concludes with implications and suggestions for future research.

OVERVIEW OF MIXED METHODS RESEARCH

In general, research in the social sciences can be categorized into three groups: (1) *qualitative research*—i.e., dominated by, but not exclusively based on, constructive paradigms and focused on the analysis of narrative data (Tashakkori & Teddlie, 2003b); (2) *quantitative research*—i.e., dominated by positivist paradigms and focused on numerical analysis (Orlikowski & Baroudi, 1991); and (3) *mixed methods research*—i.e., within other paradigms, such as pragmatism, critical realism, and transformative-emancipatory, and focused on both types of data (Teddlie & Tashakkori, 2003). The concept of mixed methods research has been defined in a number of ways. In an effort to precisely define "*mixed methods research*," Johnson, Onwuegbuzie, and Turner (2007) reviewed various definitions of mixed methods research.

Based on their review, they defined mixed methods research as "the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration" (p. 123). This definition suggests mixed methods research can involve mixing "within a single study" or "within a program of research" and "mixing might occur across a closely related set of studies" (Johnson et al., 2007, p. 123).

Three advantages of mixed methods research have been identified: (1) it enables researchers to simultaneously address confirmatory and explanatory research questions and, therefore, it can evaluate and generate theory at the same time; (2) it has the ability to provide stronger inferences than a single method or worldview; and (3) it provides an opportunity for a greater assortment of divergent and/or complementary views (see Venkatesh et al., 2013). When used in combination, quantitative and qualitative methods complement each other and allow for a more robust analysis, leveraging the strengths of each method (Ivankova, Creswell, & Stick, 2006; Tashakkori & Teddlie, 2008). However, the goal of mixed methods research is not to replace either a quantitative or a qualitative approach but rather to draw from the strengths and minimize the weaknesses of both methods (Creswell, 2003; Jick, 1979; Johnson & Onwuegbuzie, 2004; Venkatesh et al., 2013).

The most recent guidelines for conducting mixed methods research were proposed by Venkatesh et al. (2013). They divided their guidelines into two major areas—*general guidelines* (i.e., appropriateness of mixed methods research and meta-inferences) (Steps 1 to 4) and *validation* (Steps 5 to 6). We summarize the guidelines next.

Step 1: Decide on the appropriateness of a mixed methods approach

At the initial stage of the study, researchers should carefully think about their research questions, purposes, paradigmatic views and contexts to decide on the appropriateness of a mixed methods approach. In mixed methods research, research questions (or research objectives) drive the methods used in the study and set boundaries on a research project. Researchers should only employ a mixed methods design when they intend to provide a holistic understanding of a phenomenon for which extant research is fragmented, inconclusive, and/or equivocal.

Step 2: Develop strategies for mixed methods research designs

Once the research questions, rationale, and objectives have been determined, the next step should be to identify the research design strategies. Although mixed methods researchers have suggested several design strategies, the guidelines focus on two of the most widely used mixed methods research designs: concurrent and sequential. Researchers should develop a design strategy that best fits their research questions and objectives.

Step 3: Develop strategies for collecting and analyzing mixed methods data

Researchers can employ multiple modes of data collection and proceed with a mixed methods data analysis approach. Researchers are encouraged to develop a strategy for mixed methods data analysis in which "both quantitative and qualitative data are analyzed rigorously so that useful and credible inferences can be made from these individual analyses" (Venkatesh et al., 2013, p. 38).

Step 4: Draw meta-inferences from mixed methods results

The term meta-inference is used to describe "the theoretical statements, narratives, or a study inferred from an integration of findings from quantitative and qualitative strands of mixed methods research" (Venkatesh et al., 2013, p. 29). A strong inference is only possible if there is a well-implemented design that is appropriate for the research question. Thus, researchers must

determine which research design is most suitable to address the research question and derive the meta-inferences or conclusions of the study based on their design selection.

Step 5: Assessing the quality of meta-inferences

Teddlie and Tashakkori (2003) proposed the term inference quality to refer to issues associated with validity in the context of mixed methods research. According to Teddlie and Tashakkori, a mixed methods nomenclature for validation can be useful to differentiate mixed methods validation from quantitative and qualitative validation (Venkatesh et al., 2013). Thus, consistent with Teddlie and Tashakkori, we use the umbrella term inference quality to refer to validity in mixed methods research. Venkatesh et al. (2013) proposed four stages of assessing the quality of meta-inferences: (1) *discuss quality criteria within quantitative and qualitative research*; (2) *use mixed methods research nomenclature when discussing inference quality*; (3) *discuss quality of mixed methods findings and/or meta-inferences (i.e., explanatory quality)*; and (4) *discuss quality from a research design point of view (i.e., design quality)*. To assess the quality of inferences, each component of the study should be assessed by criteria appropriate for its methodology. Only after that has been done can the quality assessment of the mixed methods study be applied to evaluate the quality of meta-inferences.

Step 6: Discuss potential threats and remedies

Finally, researchers should discuss the potential threats to quality that may arise during the data collection and analysis phases. Because any serious threats will compromise the quality of inferences, researchers should also discuss the potential remedies to overcome or minimize the threats.

VARIATIONS IN MIXED METHODS RESEARCH: AN EXTENSION

Although the guidelines of Venkatesh et al. (2013) discussed several properties of mixed methods research (i.e., paradigmatic assumptions, purposes of mixed methods research, time orientation, and quality of meta-inferences), these guidelines did not discuss other properties that can be used to develop strategies for conducting mixed methods research. Further, although attempts have previously been made to integrate different properties of mixed methods research (for example, see Maxwell & Loomis, 2003; Nastasi et al., 2010), existing mixed methods do not elaborate on different design variations and the relationships among them. Thus, we extend the guidelines of Venkatesh et al. (2013) by integrating different properties of mixed methods research into the guidelines. Identifying how different properties are related and determining how one design decision may lead to another decision will help researchers develop a high-quality mixed methods study (Guest, 2012; Tashakkori & Teddlie, 2003b).

In an effort to integrate the design variations that encompass the existing typologies, we conducted an in-depth review of the literature and highlighted different variations of mixed methods research based on the existing typologies in mixed methods research. The review revealed 14 important properties of mixed methods research (see Table 1) (the detailed literature review is presented in Appendix A).[2] Table 1 lists the 14 properties of mixed methods research and the possible dimensions that researchers can use to design their studies. We organize these properties into three categories—*foundations of design decisions* (i.e., preliminary decisions used to guide the research design), *primary design strategy decisions* (i.e., decisions related to the strands/phases of research and process of designing research), and *inference decisions* (i.e.,

[2] Although there are typologies that integrate two or more properties of mixed methods research (e.g., Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 1998), we exclude these typologies from our review because our objective is not to study a mixed methods research design as a choice from a fixed set of possible arrangements. Instead, we discuss the basic typologies of mixed methods research that are flexible enough to accommodate different types of mixed methods designs.

decisions related to the development of meta-inferences, data interpretation, and inference quality). Table 1 also provides a list of questions to help researchers select mixed methods designs that might be the best fit for their study. Table 2 maps the 14 properties to the guidelines of Venkatesh et al. (2013).

Table 1: Variations in the Properties of Mixed Methods Research[3]

Property of Mixed Methods Research	Design Question Addressed by the Property	Possible Dimensions
Foundations of Design Decisions		
Research questions	How will research questions be written?	▪ Rhetorical style—format: questions, aims, and/or hypotheses ▪ Rhetorical style—level of integration ▪ The relationship of questions to other questions: independent or dependent ▪ The relationship of questions to the research process: predetermined or emergent
Purposes of mixed methods research	Which of the following purposes does the research design serve?	▪ Complementarity ▪ Completeness ▪ Developmental ▪ Expansion ▪ Corroboration/confirmation ▪ Compensation ▪ Diversity
Epistemological perspectives	Does the study involve one paradigm or multiple paradigm stances?	▪ Single paradigm stance ▪ Multiple paradigm stance
Paradigmatic assumptions	What paradigmatic perspective will guide the research design?	▪ Pragmatism ▪ Critical realism ▪ Dialectical ▪ Other major paradigmatic perspectives (e.g., postpositivism)
Primary Design Strategies		
Design investigation strategies	Does the study aim to develop or test a theory?	▪ Exploratory investigation ▪ Confirmatory investigation
Strands/phases of research	Does the study involve one or multiple phases?	▪ Single phase (or single study) or monostrand design ▪ Multiple phases (or research program) or multistrand design

[3] Among these properties, Venkatesh et al. (2013) covered the purposes of mixed methods research (i.e., complementarity, completeness, developmental, expansion, corroboration/confirmation, compensation, and diversity), paradigmatic assumptions (i.e., pragmatism, transformative-emancipatory, and critical realism), time orientation (i.e., concurrent and sequential), and inference quality (design quality and explanation quality). The guidelines also discussed (albeit briefly) the types of reasoning in mixed methods research. In our current guidelines, we offer a more detailed discussion of the 14 properties listed in Table 1.

Property of Mixed Methods Research	Design Question Addressed by the Property	Possible Dimensions
Mixing strategies	Does the design involve using both qualitative and quantitative research across all components of a study?	▪ Fully mixed methods ▪ Partially mixed methods
Time orientation	Do the quantitative and qualitative data collection occur sequentially or concurrently?	▪ Sequential design ▪ Concurrent design
Priority of methodological approach	Does the qualitative or quantitative component have priority, or are they equally important?	▪ Equivalent status design ▪ Dominant-less dominant design (i.e., qualitative dominant or quantitative dominant)
Sampling design strategies	Which of the following sampling designs are used in the data collection stage?	▪ Basic mixed methods sampling strategies ▪ Sequential mixed methods sampling ▪ Concurrent mixed methods sampling ▪ Multiple mixed methods sampling strategies
Data collection strategies	What are the best strategies to collect the quantitative and qualitative data?	Multiple modes of data collection (both quantitative and qualitative data collection techniques)
Data analysis strategies	How are the qualitative and quantitative data analyzed?	▪ Concurrent mixed analysis ▪ Sequential qualitative-quantitative analysis ▪ Sequential quantitative-qualitative analysis
Inference Decisions		
Types of reasoning	Will the design be driven by a particular theoretical perspective?	▪ Inductive theoretical reasoning ▪ Deductive theoretical reasoning ▪ Inductive and deductive theoretical reasoning ▪ Abductive theoretical reasoning
Inference quality	Which quality issues are addressed in the study?	▪ Design and explanatory quality ▪ Sample integration ▪ Inside-outside ▪ Weakness minimization ▪ Conversion ▪ Paradigmatic mixing ▪ Commensurability ▪ Multiple validities ▪ Political

Table 2: Guidelines to Properties Mapping

Guidelines (Venkatesh et al. 2013)	Properties of Mixed Methods Research
(1) Decide on the appropriateness of a mixed methods approach.	**Foundations of Design Decisions:** ▪ Research questions ▪ Purposes of mixed methods research ▪ Epistemological perspectives ▪ Paradigmatic assumptions
(2) Develop strategies for mixed methods research designs.	**Primary Design Strategies:** ▪ Design investigation strategies ▪ Strands/phases of research ▪ Mixing strategies ▪ Time orientation

Guidelines (Venkatesh et al. 2013)	Properties of Mixed Methods Research
	▪ Priority of methodological approach
(3) Develop strategies for collecting and analyzing mixed methods data.	▪ Sampling design strategies ▪ Data collection strategies ▪ Data analysis strategies
(4) Draw meta-inferences from mixed methods results.	**Inference Decisions:** ▪ Types of reasoning
(5) Assess the quality of meta-inferences.	▪ Inference quality
(6) Discuss potential threats and remedies.	

Next, we discuss how the 14 properties are integrated into each step of our procedure for conducting mixed methods research.

Step 1: Decide on the appropriateness of a mixed methods approach

When determining the appropriateness of mixed methods research, decisions associated with (1) research questions; (2) research purposes; (3) selection of theoretical perspectives/ worldviews or paradigms; and (4) epistemological perspectives are crucial. These four properties of mixed methods research are the foundations of design decisions to determine the choice of approach that will help researchers establish the boundary assumptions to guide their research project (Creswell, 2003).

Research Questions

Mixed methods research questions are different from those of qualitative and quantitative research questions. Quantitative research questions tend to be very specific in nature (Onwuegbuzie & Leech, 2006). Most quantitative research questions are *descriptive*—simply seeking to quantify responses on one or more variables (e.g., what is the perception of ease of use of PCs?), *comparative*—seeking to compare two or more groups on some outcome variables (e.g., what is the difference in purchase behaviors between adopters and non-adopters?), or *relationship*—questions concerned with trends between (or among) two (or more) variables (e.g., what is the nature of the relationship between the intention to adopt and subsequent purchase behavior?) (Onwuegbuzie & Leech, 2006).

In contrast, qualitative research questions are more "open-ended, evolving, and non-directional" (Onwuegbuzie & Leech, 2006, p. 482). Good qualitative questions are broad but specific enough to focus on the issues most relevant to the individuals under investigation (Plano Clark & Badiee, 2010). Qualitative questions generally tend to seek, discover, and explore a process, or describe experiences (Onwuegbuzie & Leech, 2006). Referencing Onwuegbuzie and Leech (2006), Creswell (1998) argued that qualitative research questions can either represent broad questions (e.g., how have new adopters' attitudes toward technology or personal computers (PC) evolved as they used the technology every day?) or specific sub-questions that address major concerns and complexities to be resolved (e.g., what does it mean to non-adopters to change their attitudes toward the technology?). The major difference between quantitative and qualitative research questions is that quantitative research questions are generally developed before the study begins, whereas qualitative questions are developed either at the beginning of the study or they emerge at some point during the study (Onwuegbuzie & Leech, 2006).

Unlike qualitative or quantitative research questions, mixed methods research questions are "questions that embed both a quantitative research question and a qualitative research question within the same question" (Onwuegbuzie & Leech, 2006, p. 483). Mixed methods questions determine the primary design strategies, including whether qualitative data and quantitative data should be collected and analyzed concurrently, sequentially, or iteratively before the questions are addressed (Tashakkori & Creswell, 2007). Plano Clark and Badiee (2010) identified four dimensions that describe how researchers can write research questions within the context of their mixed methods studies: (1) *rhetorical style—question format;* (2) *rhetorical style—level of integration;* (3) *the relationship of questions to other questions;* and (4) *the relationship of questions to the research process.*

Based on its *rhetorical style—question format* dimension, a research question can be stated in three different formats: (1) *question*—researchers write an interrogative sentence complete with a question mark; (2) *aim*—researchers write a declarative sentence as an expression of research objectives; and (3) *hypothesis*—researchers write a statement that predicts an outcome for a research question (Plano Clark & Badiee, 2010).

Based on the second dimension (i.e., *rhetorical style—level of integration*), there are three ways to write research questions in a mixed methods study as described by Creswell (2009). First, researchers can independently write quantitative questions and qualitative questions. For example, in a study of online friendship, the quantitative question is "*what is the relationship between online friendship and happiness?"* and the qualitative question is "*what factors play a role in meaningful online friendship?"* (Plano Clark & Badiee, 2010). Second, researchers can write separate quantitative questions and/or qualitative questions and follow them with mixed methods questions. For example, the qualitative question is "*what theory explains adolescents' process of using social media?"*; the quantitative question is "*how are the identified factors related?"*; and the mixed methods research question is "*how do adolescents use social media?"* (Plano Clark & Badiee, 2010). Third, researchers can write only mixed methods questions that reflect the procedures or the research content. An example of this type of research question is "*how is an effective online community developed and tested?*"

If researchers attempt to address more than one research question, it is important to address the third dimension (i.e., *the relationship of questions to other questions*) (Plano Clark & Badiee, 2010). The relationship among the questions shapes the overall design and informs the relationship between the quantitative and qualitative components of the study (Plano Clark & Badiee, 2010). Two relationship alternatives are suggested: (1) research questions may be

independent of each other; and (2) one research question may be dependent on the results of other questions (Plano Clark & Badiee, 2010).

The last dimension is concerned with *the relationship of questions to the research process.* Research questions in mixed methods studies may be either *predetermined* or *emergent* within the process of research (Plano Clark & Badiee, 2010). Research questions are said to be predetermined when they are stated at the beginning of the study based on researchers' understanding of the literature and practice or disciplinary considerations. Emergent questions, in contrast, are formed during the design, data collection, data analysis, and/or interpretation phases of the research process (Plano Clark & Badiee, 2010).

Purposes of Mixed Methods Research

Based on several resources, including Greene et al. (1989), Creswell (2003) and Tashakkori and Teddlie (2003b), the purposes of mixed methods research can be summarized into seven categories: (1) *complementarity* (i.e., to gain complementary views about the same phenomena or relationships); (2) *completeness* (i.e., to gain a complete picture of phenomena); (3) *developmental* (i.e., to ensure the questions from one strand emerge from the inference of a previous one or one strand is used to develop hypotheses to be tested in the next one); (4) *expansion* (i.e., to explain or expand upon the understanding obtained in a previous strand of a study); (5) *corroboration/confirmation* or *triangulation* (i.e., to assess the credibility of inferences obtained from one approach); (6) *compensation* (i.e., to eliminate potential design weaknesses of one approach by using the other); and (7) *diversity* (i.e., to obtain divergent views of the same phenomenon) (see Venkatesh et al., 2013).

Epistemological Perspectives

From an epistemological perspective, mixed methods research can be conducted using a single paradigm or multiple paradigms. A single paradigm perspective proposes that both quantitative and qualitative research can be accommodated under the same paradigm (e.g., positivist, realist) (Tashakkori & Teddlie, 1998). A multiple paradigm perspective claims that alternative paradigms are not incompatible and can be used in one research project (Teddlie & Tashakkori, 2003). The combination of multiple paradigms and methodological practices can be viewed as a strategy that adds rigor, breadth complexity, richness, and depth to a research inquiry (Denzin, 2012). Under this multiple paradigm perspective, researchers have to decide which paradigms are best given their choice of a particular mixed methods design for their study (Creswell, Plano Clark, Gutmann, & Hanson, 2003).

Paradigmatic Assumptions

Although specific paradigms are commonly associated with specific methods, both qualitative and quantitative methods may be used appropriately with any research paradigm (Guba & Lincoln, 1994; Tashakkori & Teddlie, 1998). Several paradigms for mixed methods research have been proposed, including the *purist stance* (i.e., because the assumptions of different paradigms are incompatible, it is not possible to mix paradigms in the same study), *aparadigmatic stance* (i.e., driven by research questions and/or purposes), *substantive theory stance* (i.e., emergent paradigms may be embedded in or intertwined with substantive theories) (Greene, 2007; Venkatesh et al., 2013), *complementary strengths stance* (i.e., the assumptions of different paradigms are not fundamentally compatible but are different in important ways), *dialectic stance* (i.e., important paradigm differences should be respectfully and intentionally used together to engage meaningfully with difference), and *alternative paradigms stance* (i.e., the initiation of a new paradigm that actively embraces and promotes the mixing of methods)

(Greene, 2007). Our review reveals that the *dialectic*, *alternative paradigms* (i.e., *pragmatism and critical realism*), and *complementary strengths stances* (i.e., the use of multiple paradigms) are the most popular among mixed methods researchers.

The *dialectic paradigm* stance generally allows the use of more than one paradigmatic tradition in the same research project or research program because it assumes that the use of multiple paradigms contributes to greater understanding of the phenomenon under study (Greene & Hall, 2010; Teddlie & Tashakkori, 2003). This stance recognizes the legitimacy of multiple social inquiry theories and practices, as they represent different ways of seeing and understanding the social world (Greene, 2005, 2007; Greene & Hall, 2010). A mixed methods way of thinking under the dialectic paradigm offers researchers opportunities to meaningfully engage with difference as they encounter it in their study (Greene & Hall, 2010).

The *alternative paradigms* stance includes *pragmatism* and *critical realism*. One of the central ideas in pragmatism is that "engagement in philosophical activity should be done to address problems, not to build systems" (Biesta, 2010, p. 97). Pragmatism supports the use of both qualitative and quantitative research methods in the same research study or within multistage research programs (Teddlie & Tashakkori, 2003). Because a pragmatist perspective considers practical consequences to be a crucial component of meaning and truth (Venkatesh et al., 2013), researchers need to articulate a purpose for their mixed methods study to establish the rationale for why quantitative and qualitative data need to be mixed in the first place (Creswell, 2003).

Critical realists believe that there is an objective reality, but it can be understood only imperfectly and probabilistically (Tashakkori & Teddlie, 1998). They deny that we have any objective knowledge of the world and accept the possibility of alternative valid accounts of any

phenomenon (Maxwell & Mittapalli, 2010). Critical realism "embraces various methodological approaches from different philosophical positions by taking a critical stance towards the necessity and validity of current social arrangements without following the extant paradigms' assumptions at face value" (Zachariadis, Scott, & Barret, 2013, p. 856). Thus, critical realism is an ideal paradigm for mixed methods research because its philosophical stance is compatible with the methodological characteristics of both quantitative and qualitative research (Maxwell & Mittapalli, 2010).

Finally, according to the *complementary strengths stance,* other major paradigms used in the social and behavioral sciences (e.g., *constructivism/interpretivism*, *positivism*, *postpositivism*) can be combined and used to support mixed methods research. Constructivism/interpretivism believes that people construct their own understanding and subjective knowledge as they interact with the world around them (Tashakkori & Teddlie, 2003b). Thus, researchers who embrace this paradigm try to understand phenomena by accessing the meanings participants assign to them (Orlikowski & Baroudi, 1991). Phenomenological sociology, hermeneutics, and ethnography are examples of the constructivist approach (Lee, 1991). Positivism, in contrast, is premised on the existence of a priori fixed hypotheses or relationships among constructs that are typically investigated with structured instrumentation (Lee, 1991; Orlikowski & Baroudi, 1991). Whereas positivists believe that the researcher and the object of inquiry are independent of each other, postpositivists accept that theories, background, knowledge and values of the researcher can influence the study (Trochim & Donnelly, 2007). Mixed methods research can be conducted with the combination of these paradigmatic approaches (Creswell et al., 2003; Lee, 1991). For example, researchers might use an ethnographic method to study system analysts and end-users (Lee, 1991). Based on the results, researchers might use a positivist approach to formulate a

formal, general theory that explains, for instance, end-user resistance to systems analysis (Lee, 1991).

In terms of conducting empirical mixed methods studies, researchers should be able to consider what the alternative paradigmatic positions are and determine which of the alternative positions is most suitable for their studies (Tashakkori & Teddlie, 2010). The development of a mixed methods study should begin with the identification of paradigmatic assumptions, including their philosophical assumptions and theoretical framework, as research foundations that intertwine with the research questions and purposes of mixed methods research.

Step 2: Develop strategies for mixed methods research designs

After the appropriateness of mixed methods research is established, the primary design decisions associated with strands/phases of research, priority of methodological approach, design investigation strategies, mixing strategies, and time orientation have to be made carefully. Although these decisions are interrelated, they can be independent of each other and can vary as the study evolves.

Strands/Phases[4] of Research

Based on the strands/phases of research, mixed methods designs can be categorized into two types: *mixed methods monostrand designs* and *mixed methods multistrand designs* (Tashakkori & Teddlie, 2003b; Teddlie & Tashakkori, 2006). Teddlie and Tashakkori (2009) defined strand or phase as encompassing three stages—conceptualization (i.e., theoretical foundations, purpose, and research methods), experiential (i.e., data collection and analysis), and inferential (i.e., data interpretation and application). In a monostrand study, there is only a single phase of the conceptualization-experiential-inferential process, yet it includes both qualitative

[4]*Strands* can also refer to distinctions with regard to a single study (i.e., monostrand) versus multiple studies in a broader research program (i.e., multistrand) (Nastasi et al., 2007, 2010).

and quantitative components of the study (Nastasi et al., 2010; Teddlie & Tashakkori, 2006). In contrast, *mixed methods multistrand designs* contain at least two research strands (Bryman, 2006; Teddlie & Tashakkori, 2006). In these designs, mixing of the quantitative and qualitative components can occur within or across all stages (i.e., conceptualization-experiential-inferential process) of the study (Teddlie & Tashakkori, 2006). Mixed methods multistrand designs often involve multiple phases in a broader research program, with each phase encompassing all of the stages from conceptualization through inference (Teddlie & Tashakkori, 2009).

The decision related to strands/phases of research is important because it influences researchers' decisions associated with other design strategies, such as the priority of methodological approach, mixing strategies, and time orientation. Naturally, monostrand designs have their constraints (Teddlie & Tashakkori, 2006). In contrast, mixed methods multistrand designs can be implemented using parallel, sequential, conversion, or multilevel mixed designs (Teddlie & Tashakkori, 2009).

Priority of Methodological Approach

Based on its prioritization of the methodological approach, mixed methods research can be categorized into: *equivalent status designs* and *dominant-less dominant status designs*. In *equivalent status designs*, researchers generally conduct a study using both qualitative and quantitative approaches about equally to understand the phenomena of interest (Tashakkori & Teddlie, 1998). In *dominant-less dominant status designs*, researchers usually conduct a study within a single dominant paradigm with a small component of the overall research project drawn from an alternative design (Tashakkori & Teddlie, 1998).

The *dominant-less dominant status designs* can be divided into two categories: *qualitative dominant* and *quantitative dominant mixed methods research* (Johnson et al., 2007).

Qualitative dominant mixed methods research refers to "the type of mixed research in which one relies on a qualitative, constructivist-poststructuralist-critical view of the research process, while concurrently recognizing that the addition of quantitative data and approaches are likely to benefit most research projects" (Johnson et al., 2007, p. 124). In contrast, a quantitative dominant mixed design is "the type of mixed research in which one relies on a quantitative, postpositivist view of the research process, while concurrently recognizing that the addition of qualitative data and approaches are likely to benefit most research projects" (Johnson et al., 2007, p. 124).

Although determining the priority of methodological approach is important, researchers can modify their priority decision after the study is complete (Teddlie & Tashakkori, 2009). For example, a quantitative dominant mixed methods study may become a qualitative dominant study if the qualitative data become more important in understanding the phenomenon under study and vice versa (Teddlie & Tashakkori, 2009). Despite this flexibility, researchers are encouraged to refer to their research questions and purposes when deciding whether one component has significantly higher priority than does the other component.

Design Investigation Strategies

The choice of design investigation strategies essentially influences the process of inference development through theoretical reasoning techniques (Tashakkori & Teddlie, 1998). Using Patton's (1990) typology of design dimensions, Tashakkori and Teddlie (1998) identified two different types of investigations in mixed methods research—*exploratory* and *confirmatory*. In *exploratory investigations*, the purpose of the study is typically to develop or generate a new theory. These designs include qualitative case studies, experimental designs, and non-experimental studies. In contrast, in *confirmatory investigations*, the study is typically intended

to test an existing theory using hypotheses established a priori. These designs include naturalistic inquiry and quantitative explanatory studies, such as surveys (Tashakkori & Teddlie, 1998).

Mixing Strategies

Mixing or integration is the core value of mixed methods research because the purpose of mixing methods is to gain insights from multiple methods (Fielding, 2012). Further, the decisions regarding what types of data are being integrated and how they are integrated should be taken into account when a mixed methods study is designed. Teddlie and Tashakkori (2009) proposed two dimensions of mixing strategies—*fully mixed methods* and *partially mixed methods*. A fully mixed methods design involves using both qualitative and quantitative research across all components of a study (e.g., objective, type of data and operations, type of analysis, type of inference) (Leech & Onwuegbuzie, 2009). A fully mixed methods design is also known as *a mixed model design*—this design represents the highest degree of mixing paradigms in which the qualitative and quantitative paradigms are mixed at all or many steps of the study (Tashakkori & Teddlie, 1998). In contrast, a partially mixed methods design involves conducting a study where the quantitative and qualitative portions of the study are mixed at specific stages, such as sampling stage, data collection, data analysis or data inference (Teddlie & Tashakkori, 2009). In this design, mixing could occur in a parallel manner, across chronological phases of the study, or across multiple levels of analysis (Teddlie & Tashakkori, 2009).

Time Orientation

Based on its time orientation, mixed methods research can be categorized into two types: *sequential* and *concurrent*. In sequential mixed methods designs, researchers typically conduct one strand of the study (e.g., qualitative) first and then the other strand of the study (e.g., quantitative) (Creswell, 2003). The sequence is dependent upon the objective of the study and

the research questions. Creswell et al. (2003) proposed three types of sequential mixed methods designs: (1) *sequential explanatory* (i.e., this design is characterized by conducting the quantitative phase of the study followed by the qualitative phase of the study); (2) *sequential exploratory* (i.e., this design is characterized by an initial phase of qualitative data collection and analysis followed by a phase of quantitative data collection and analysis); and (3) *sequential transformative* (i.e., the priority may be given to either the quantitative or the qualitative phase and researchers generally use a theoretical lens as an overarching perspective within the design that contains both quantitative and qualitative components to guide the study).

A concurrent mixed methods design is characterized by conducting the qualitative and quantitative components of the study during the same stage (Castro, Kellison, Boyd, & Kopak, 2010). This design uses both qualitative and quantitative data and analyses in independent strands to answer the research questions (Teddlie & Tashakkori, 2006). Creswell et al. (2003) identified three types of concurrent mixed methods designs: (1) *concurrent triangulation* (i.e., the use of both qualitative and quantitative data to accurately define relationships among variables of interest); (2) *concurrent nested* (i.e., a type of design in which both qualitative and quantitative data are collected concurrently, albeit one type of data is given weight over the other); and (3) *concurrent transformative design* (i.e., a type of design used to provide support for various perspectives in the context of social change or advocacy). The decision associated with time orientation is influenced by the research questions and purposes of mixed methods research. For example, if the goal of a study is to understand a phenomenon as it currently happens, a concurrent mixed methods design should be employed (Venkatesh et al., 2013). In contrast, if the objective of a study is to identify and test theoretical constructs in a new context, a qualitative study followed by a quantitative study is appropriate (Venkatesh et al., 2013).

Step 3: Develop strategies for collecting and analyzing mixed methods data

After the primary design decisions associated with strands/phases of research, design investigation strategies, priority of methodological approach, mixing strategies, and time orientation have been made, researchers need to develop a set of strategies for collecting and analyzing mixed methods data. Before collecting data for their study, researchers should decide on the strategy to select the participants as well as the number of participants (i.e., sampling design strategies) (Collins, 2010).

Sampling Design Strategies

Sampling is an important step in a research process because it helps determine the inference quality made by researchers and influences the degree to which the findings can be generalized to other individuals, groups, or contexts (Collins, Onwuegbuzie, & Jiao, 2007). In mixed methods investigations, researchers must make sampling decisions for both the qualitative and quantitative components of the study. Teddlie and Yu (2007) proposed five different types of mixed methods sampling strategies: (1) *basic*; (2) *sequential*; (3) *concurrent*; (4) *multilevel*; and (5) *multiple*. To the same end, Onwuegbuzie and Collins (2007) developed a framework for formulating sampling decisions in mixed methods research based on (1) *the time orientation of the component* (i.e., simultaneously or sequentially); and (2) *the relationship between the qualitative and quantitative samples* (i.e., identical versus parallel versus nested versus multilevel). Onwuegbuzie and Collin's framework is similar to Teddlie and Yu's strategies to the degree that they can both be categorized into either sequential or concurrent mixed methods. We discuss four types of mixed methods sampling designs by integrating these two typologies: basic, sequential, concurrent, and multiple sampling designs.

Basic mixed methods sampling strategies typically include *probability sampling* (i.e., researchers randomly select the sampling units that are representative of the population) (Collins, 2010), *stratified purposive sampling* (i.e., researchers first divide the group of interest into strata and then select a small number of cases to study intensively within each strata using a purposive sampling technique), and *purposive random sampling* (i.e., involves taking a random sample of a small number of units from a much larger target population) (Teddlie & Yu, 2007). Probabilistic sampling designs are generally associated with quantitative studies, whereas purposive sampling designs are associated with qualitative studies (Collins, 2010), and both probabilistic and purposive sampling can be used in quantitative and qualitative studies (Onwuegbuzie & Collins, 2007).

Sequential sampling strategies typically involve the use of methodology and results from the first strand to inform the methodology employed in the second strand (Teddlie & Yu, 2007). According to Onwuegbuzie and Collins (2007), sequential mixed methods sampling designs can be categorized based on their sampling strategies: (1) *identical samples*—the same sample members participate in both the qualitative and qualitative phases of the investigation; (2) *parallel samples*—the samples for the quantitative and qualitative components of the study are different but are drawn from the same underlying population; (3) *nested samples*—the sample members selected for one phase of the study represent a subset of those participants chosen for the other component of the study; and (4) *multilevel samples design*—involves the use of two or more sets of samples that are obtained from different levels of the study (Collins et al., 2007).

Concurrent sampling strategies allow researchers to triangulate the results from the separate quantitative and qualitative components of their research (Teddlie & Yu, 2007) and confirm, cross-validate, or corroborate their findings within a single study (Creswell et al., 2003).

Like the sequential sampling designs, the concurrent mixed methods sampling strategies can be categorized into four types of designs (see previous paragraph).

Finally, multiple sampling strategies generally involve the utilization of more than one sampling technique, such as the integration of a stratified purposive sampling with concurrent mixed methods sampling (Teddlie & Yu, 2007).

Data Collection Strategies

Data collection strategies in mixed methods research can be categorized based on their *degree of predetermined nature*, their *use of closed-* (e.g., a set of questions about users' attitude toward a particular technology) and *open-ended questions* (e.g., conducting an interview in which individuals are allowed to talk openly about a topic), and their *focus for numeric versus non-numeric data analysis* (Creswell, 2003). Mixed methods data collection strategies can be either a quantitative approach to data collection—involves relatively planned "instruments" or predetermined questions for data collection—or a qualitative approach—mostly unstructured methods of data collection for measurement or observation (Tashakkori & Teddlie, 1998). Also, the type of data may be numeric or text, recording or reporting the voice of participants (Creswell, 2003). In a mixed methods study, it is necessary to recognize that those data collection strategies have their limitations as well as their strengths (Johnson & Turner, 2003). Therefore, researchers can use the strengths of one method to overcome the weaknesses of another method by using both in a research study (Johnson & Onwuegbuzie, 2004).

Data Analysis Strategies

In general, there are three data analysis strategies in mixed methods research: (1) *concurrent mixed analysis*—both qualitative and quantitative data are analyzed simultaneously; (2) *sequential qualitative-quantitative data analysis*—qualitative data analysis is followed by

quantitative data analysis; and (3) *sequential quantitative—qualitative data analysis*—quantitative data analysis is followed by qualitative data analysis (Tashakkori & Teddlie, 1998).

There are several strategies to analyze data in mixed methods research (e.g., data reduction, data transformation, data correlation) (see Johnson & Onwuegbuzie, 2004). One of the most common practices of data analysis is *data conversion or transformation* (i.e., qualitative data are converted into numerical codes that can be represented statistically—*quantized*—and quantitative data are converted into narrative data that can be analyzed qualitatively—*qualitized*) (Teddlie & Tashakkori, 2009). Quantizing qualitative data for integration with quantitative data can be used to "answer research questions or test hypotheses addressing relationships between independent variables and dependent variables" (Fielding, 2012, p. 126). The quantizing practice also provides useful information by obtaining the numerical values of observations in addition to researchers' narrative descriptions (Onwuegbuzie & Johnson, 2006; Sandelowski, 2000).

The second type of data conversion is qualitizing. Qualitizing techniques can be conducted if researchers aim to extract more information from quantitative data or to confirm interpretations of those data (Sandelowski, 2000). Examples of qualitizing data are rarer than those of quantizing data (Teddlie & Tashakkori, 2009). As cited by Teddlie and Tashakkori (2009), Creswell and Plano Clark (2007, p. 188) noted that: "More work needs to be done to expand the techniques for quantifying qualitative data and to develop the analysis options for such transformed data. Writers have written even less about transforming quantitative data into qualitative data. This area is ripe for researcher innovation and future research."

One of the possible qualitizing techniques is taking a distribution of numeric data on a single variable and then generating separate narrative categories based on the ranges of values within that distribution (i.e., cluster analysis) (Teddlie & Tashakkori, 2009). An example of IS

research that used a qualitizing technique is the study of IS career histories by Joseph, Koh, and Ang (2012). The researchers used quantitative cluster analysis to identify distinct career paths in their quantitative data. Their analysis yielded three clusters of IS career paths: information technology, professional labor market, and secondary labor market career. This type of qualitizing is called narrative profile formation because it involves constructing qualitative profiles from quantitative data (Teddlie & Tashakkori, 2009).

In general, a decision to transform the data may be planned before the study is conducted but generally occurs after the data are collected (Teddlie & Tashakkori, 2006). For example, in monostrand mixed methods designs, data transformation is usually planned prior to the study because researchers generally only collect one type of data (either qualitative or quantitative data) and this type of data is converted into the other and then analyzed accordingly (Teddlie & Tashakkori, 2006). It can also be conducted in multistrand designs, depending on the researchers' methodological approach and/or the findings from each phase of the study. For example, if the research priority is qualitative data collection and analysis, it is suggested that researchers perform a quantizing technique to help explain the qualitative results (Creswell, Fetters, & Ivankova, 2004). However, if researchers believe that the results of each strand of research is sufficient (based on the theoretical concepts), data transformation might not have a significant contribution to the findings. In most cases, data transformation occurs serendipitously (Teddlie & Tashakkori, 2009). For example, researchers may determine that there are emerging patterns from interview data that can be converted into numerical forms and then analyzed quantitatively. This practice allows the researchers to do a more thorough analysis of the data, thereby strengthening the inference quality (Teddlie & Tashakkori, 2006).

Whereas there are a number of benefits associated with data transformation in mixed methods research, there are several limitations and challenges as well. First, although qualitizing techniques could help researchers gain more insights from their quantitative data, it should be used cautiously because it might represent an over-generalization of the observed numeric data (Teddlie & Tashakkori, 2009). It is also possible that profiles emerging from this practice yield an unrealistic representation (Sandelowski, 2000).

Second, data transformation might lead to the loss of depth and flexibility of data interpretation (Driscoll, Apiah-Yeboah, Salib, & Rupert, 2007). Qualitative data are generally multidimensional—i.e., they can provide insights into a host of interrelated conceptual themes during analysis. These themes are also flexible—i.e., they can be revisited during analysis in an iterative analytical process to allow for the recognition of emergent patterns (Bazeley, 2004). However, quantized data are usually fixed and unidimensional—they consist of a single set of responses representing a conceptual category determined prior to data collection (Driscoll et al., 2007). To overcome this limitation, researchers have to be able to switch back and forth from a qualitative lens to a quantitative lens by revisiting qualitative data components associated with significant statistical findings (Driscoll et al., 2007). Further, researchers should always assess the conversion legitimation when their data analysis and designs involve data transformation (Onwuegbuzie & Johnson, 2006).

The third challenge of data transformation comes from a quantitative research perspective. Quantitative researchers argue that quantized data are vulnerable to the problem of multicollinearity, wherein response categories are themselves linked as a result of the coding strategy (Driscoll et al., 2007). Further, the need to collect and analyze qualitative data can force researchers to reduce their sample size, which can limit the kinds of statistical procedures that

might be used for data analysis (Driscoll et al., 2007). To overcome the collinearity issue, researchers can utilize available statistical remedies (e.g., separating dichotomized codes derived from a single open-ended question in subsequent statistical analysis) (Driscoll et al., 2007). Moreover, if researchers are not able to collect a sufficient sample size for accurate estimation, they should avoid doing data transformation.

Step 4: Draw meta-inferences from mixed methods results

Development of high quality meta-inferences is dependent upon the quality of the data analysis in the qualitative and quantitative components of the study (Venkatesh et al., 2013). Given that meta-inferences are generally theoretical statements about a phenomenon, including its interrelated components and boundary conditions, the process of developing inferences is conceptually similar to the process of theory development from observation (Venkatesh et al., 2013). Thus, the development of inferences can be inductive, deductive, or abductive, depending on the existence of theoretical foundations or conceptual frameworks underlying the study (Morse, 2010).

Theoretical Reasoning

When researchers use mixed methods to examine their research questions, they generally switch between different modes of generalizability (Tashakkori & Teddlie, 1998). These differences in generalizability concerns can be categorized into four modes—*inductive reasoning*, *deductive reasoning* (Tashakkori & Teddlie, 1998), *the combination of inductive and deductive reasoning* (Tashakkori & Teddlie, 1998), and *abductive reasoning* (Van de Ven, 2007). In the *inductive mode*, researchers generally gather data from specific instances to build up a theory and the generalizations are initially from one specific setting to another context as the theory evolves (Tashakkori & Teddlie, 1998). In general, inductive theoretical reasoning is a

research strategy used in qualitative studies (Merriam, 1998). However, although the reasoning style of qualitative studies is mostly inductive, there are also qualitative studies with deductive reasoning processes (Creswell, 2003). In the *deductive mode*, in contrast, researchers generally predict outcomes that are supposed to occur in a theoretical population. Thus, the generalizations are from a specific sample used in the study to a broader population (Tashakkori & Teddlie, 1998).

Although a particular study may adopt either deductive or inductive theoretical reasoning, it is likely that *the combination of both types of theoretical reasoning* will be used simultaneously in developing meta-inferences (Miller, 2003; Tashakkori & Teddlie, 1998). According to pragmatism, mixed methods researchers will have an option to select both the inductive and deductive logic, and use them simultaneously in the course of conducting research aimed at addressing the research questions (Tashakkori & Teddlie, 1998). The fourth type of reasoning is *abduction* (Van de Ven, 2007). Abduction refers to "the logical connection made by researchers between data and theory, often used for theorizing about a surprising event" (Feilzer, 2010, p. 10). In abduction, researchers move back and forth between theories and data—"first converting observations into theories and then assessing those theories through action" (Morgan, 2007, p. 71). This type of reasoning requires the utilization of different approaches to theory and data and offers great opportunity to triangulate inferences developed from qualitative and quantitative research (Feilzer, 2010; Morgan, 2007).

The development of meta-inferences is dependent on research questions, specific methods employed, and empirical domains under investigation (Erzberger & Kelle, 2003). Erzberger and Kelle (2003) suggested that researchers should always look for sufficient empirical evidence for their theoretical statements and that any additional assumptions, which

cannot be examined with the help of empirical data, should be avoided. Given that the most important step in mixed methods research is when the results (i.e., findings, inferences) from the qualitative and quantitative studies are triangulated into a coherent conceptual framework that provides an effective answer to the research questions, it is crucial to properly develop good inferences in each strand of the study.

In qualitative research, a good inference should "capture the meaning of the phenomenon under consideration for study participants" (Teddlie & Tashakkori, 2009, p. 295). A good qualitative inference is a *credible inference*—"there is a correspondence between the way respondents actually perceive social constructs and the way researchers portray their overviews" (Mertens, 2005, p. 254). A variety of techniques for evaluating and enhancing the quality of inferences in qualitative research (i.e., design validity, analytical validity, and inferential validity) has been summarized by Venkatesh et al. (2013). We will discuss more details about these types of quantitative validities in our illustrative study.

In quantitative research, a good inference has the following characteristics: (1) it establishes relations between variables while providing reasonable certainty that such relationships do not happen by chance; (2) its intensity matches the demonstrated magnitude of the relationship between variables, supported by the results of data analysis; and (3) it is free of systematic bias in interpretation of the results (Teddlie & Tashakkori, 2009). Some validity criteria, such as statistical conclusion validity, internal validity, construct validity and external validity, can be used to evaluate the quality of quantitative inferences (Venkatesh et al., 2013). We will discuss more details about these types of quantitative validity in our illustrative study.

There are three possible patterns of findings from mixed methods: divergence, convergence, and complementarity (Erzberger & Kelle, 2003). If the qualitative and quantitative

methods applied in the study lead to *divergent results* (i.e., qualitative and quantitative results are contradictory), then there are two possible explanations: either the divergence is the result of methodological mistakes or the initial theoretical assumptions have to be modified and revised (Erzberger & Kelle, 2003). The modification and revision of theoretical assumptions as a consequence of divergent findings should be done carefully. Researchers have to formulate ad-hoc hypotheses based on already collected empirical data that may lead them to retain their initial theories as well as formulate "far-reaching speculations that lack a sound empirical basis" (Erzberger & Kelle, 2003, p. 483). These newly developed hypotheses must increase the empirical content of the initial theoretical assumptions without diminishing their consistency or these hypotheses must improve the consistency of the initial theory without resulting in a loss of empirical content. The newly developed hypotheses also need to be empirically tested using new data and they should be adaptable to other well-established theories about the phenomena under investigation (Erzberger & Kelle, 2003). If the divergence is the result of methodological mistakes, researchers must engage in a re-examination process to assess whether divergent findings are associated with the quality issues in one or more of the methods used or if they are suggestive of a greater complexity inherent in the phenomenon under study (da Costa & Remedios, 2014).

If the quantitative and qualitative methods lead to *convergent results* (i.e., qualitative and quantitative methods lead to the same results), then the integration may provide good arguments for the quality of the inferences and strengthen the initial theoretical assumptions (Erzberger & Kelle, 2003). Finally, if mixed methods lead to *complementary results* (i.e., qualitative and quantitative results are related to different objects or phenomena but may be complementary to

each other), then the integration provides a more complete picture of the empirical domain under study (Erzberger & Kelle, 2003).

Step 5: Assess the quality of meta-inferences

To maximize the quality of meta-inferences drawn from the qualitative and quantitative components, inference quality, including design quality, explanatory quality and other legitimation criteria, must be examined.

Inference Quality

The quality of meta-inferences is assessed by simultaneously examining the *design quality*—the degree to which a researcher has selected the most appropriate procedures for answering the research questions—and the *explanatory quality*—the degree to which credible interpretations have been made on the basis of obtained results (see Tashakkori & Teddlie, 2010; Teddlie & Tashakkori, 2003; Venkatesh et al., 2013). The definitions of different types of inference quality are presented in Appendix B. In addition to design and explanatory quality, Onwuegbuzie and Johnson (2006) proposed a typology including nine mixed methods legitimation types: (1) *sample integration*, (2) *inside-outside*; (3) *weakness minimization*; (4) *sequential*; (5) *conversion*; (6) *paradigmatic mixing*; (7) *commensurability*; (8) *multiple validities*; and (9) *political legitimation.* Whereas Tashakkori and Teddlie's quality framework assumes legitimation as an outcome that revolves around inference quality, Onwuegbuzie and Johnson's typology views legitimation as a continuous process that should be evaluated at each stage of the mixed research process (Onwuegbuzie & Johnson, 2006). By bringing together Tashakkori and Teddlie's concept of inference quality and Onwuegbuzie and Johnson's nine aspects of legitimation, researchers will be able to extensively assess the quality of their mixed

methods study not only by using the appropriate qualitative and quantitative quality standards, but also by applying the quality criteria that address the entire mixed methods study.

Sample integration legitimation applies to situations in which researchers aim to make statistical generalizations from a sample population to a larger population (Onwuegbuzie & Johnson, 2006). *Inside-outside legitimation* refers to "the extent to which the researcher accurately presents and appropriately utilizes the insider's view and the observer's views for purposes, such as description and explanation" (Onwuegbuzie & Johnson, 2006, p. 57). *Weakness minimization legitimation* refers to "the extent to which the weakness from one approach is compensated by the strengths from the other approach" (Onwuegbuzie & Johnson, 2006, p. 57). *Sequential legitimation* is defined as "the extent to which one has minimized the potential problem wherein the meta-inferences could be affected by revising the sequence of the quantitative and qualitative phases" (Onwuegbuzie & Johnson, 2006, p. 57). To assess sequential legitimation, researchers can change the sequential design to a multiple wave design (i.e., the qualitative and quantitative data collection and analysis phases are conducted multiple times) (Onwuegbuzie & Johnson, 2006; Sandelowski, 2003). *Conversion* refers to the extent to which quantizing and qualitizing lead to interpretable data and high inference quality. *Paradigmatic mixing legitimation* refers to the extent to which researchers' paradigmatic assumptions underlying the qualitative and quantitative approaches are successfully "combined and blinded into a usable package" (Onwuegbuzie & Johnson, 2006, p. 57).

In order to meet *commensurability legitimation*, mixed methods researchers need to be able to make *Gestalt switches*—the ability to switch back and forth from a qualitative lens to a quantitative lens. This iterative process is expected to create a viewpoint that is separate from and goes beyond what is provided by either a qualitative or quantitative viewpoint. *Multiple*

validities legitimation refers to the extent to which all relevant research strategies are utilized and the study meets multiple relevant validity criteria. The last legitimation type is *political legitimation*. It refers to "the extent to which consumers of mixed methods research value the meta-inferences stemming from both the qualitative and quantitative components of a study" (Onwuegbuzie & Johnson, 2006, p. 57). One of the strategies to achieve this legitimation is to advocate pluralism of perspective and try to generate practical theories or results that consumers will value because the results answer important questions and provide practical solutions (Onwuegbuzie & Johnson, 2006).

Based on our discussion regarding the development and validation of inferences in mixed methods research in Steps 4 and 5, the general guidelines for developing high quality meta-inferences in mixed methods research are summarized in Table 3.

Table 3: Guidelines for Developing Inferences and Meta-Inferences

Component	Guidelines
General guidelines	1. In making inferences, keep the research purposes and research questions in the foreground of all data analysis and interpretations. 2. If there is more than one research question, state each question separately and examine or summarize all of the results that are relevant to that question. 3. Review the statistical results, text information, field notes, and summary notes from the literature reviews. 4. Make tentative interpretations about each part of the results in an effort to address each research question. 5. After going through several iterations of interpretations, examine the answers to the questions, or the interpretation, to see if they can be combined. Compare, contrast, combine, or try to explain differences.
Qualitative inferences	1. In qualitative research, inferences should capture the meaning of phenomena under consideration for the participants. 2. Inferences should be made on the basis of qualitative data analysis results. 3. Research questions and design decisions will influence the theoretical reasoning technique (i.e., deductive versus inductive) used by researchers to develop qualitative inferences. 4. Use the appropriate qualitative standards to assess the quality of qualitative inferences.
Quantitative inferences	1. Inferences should establish relationships between variables while providing reasonable certainty that such relationships do not happen by chance. 2. Inferences should be made on the basis of quantitative data analysis. 3. Inferences should be free of systematic bias in interpretation of the results. 4. Use the appropriate quantitative standards to assess the quality of quantitative inferences.
Meta-inferences	1. In mixed methods research, the quality of inferences depends on the strength of inferences that emerge from the qualitative and quantitative strands of the study.

Component	Guidelines
	2. The development of meta-inferences in mixed methods research could involve inductive, deductive, both inductive and deductive, or abductive theoretical reasoning. 3. Meta-inferences must directly address the initial and intended purposes for using mixed methods. 4. Researchers' study designs also influence their inferences. For example, in sequential mixed designs, researchers have to determine the purpose at the beginning of the study, or it might emerge from the inferences of the first strand. 5. The quality of meta-inferences made on the basis of qualitative and quantitative inferences should be assessed using *design quality* and *explanatory quality* (see Appendix B). Other relevant legitimation issues, such as sample integration, inside-outside and conversion legitimation, should also be addressed. 6. There are three possible patterns of mixed methods research findings: divergence, convergence, and complementarity. If the results are divergent, it is necessary to identify the cause and re-examine the results. If the results are convergent, then the integration may provide a good argument for inference quality. If the results are complementary, two or more methods are needed to investigate the phenomenon under study.

*These guidelines are primarily adapted from Teddlie and Tashakkori (2009) and Erzberger and Kelle (2003)

Step 6: Discuss potential threats and remedies

The legitimation framework proposed by Onwuegbuzie and Johnson (2006) discussed previously can be used to identify the quality threats that may potentially compromise the credibility of meta-inferences.[5] Given that threats to inference quality may vary depending on the types of design decisions used in the study, we will discuss more details about these threats in our illustrative study.

Model of Decision Choice for Conducting Mixed Methods Research

In order to provide guidance for mixed methods researchers in selecting the most suitable designs for their studies, we develop a decision tree to map the flow and relationship among the design strategies. The decision tree depicting various design decisions that mixed methods researchers have to make is presented in Figure 1. The rectangles represent basic steps or process

[5] In quantitative research, Onwuegbuzie (2003) identified 22 threats to internal validity (e.g., history, maturity, testing) and 12 threats to external validity (e.g., population validity, ecological validity, multiple treatment interference) at the data collection stage. At the data analysis stage, 21 threats (e.g., statistical regression, multicollinearity, violated assumptions) and five threats (e.g., matching bias, researcher bias) to internal validity and external validity were identified, respectively. Finally, at the data interpretation stage, seven and three threats to internal validity and external validities were identified, respectively (see Onwuegbuzie & Johnson, 2006). Further, in qualitative research, Onwuegbuzie and Leech (2007) identified 14 threats to external credibility (e.g., catalytic validity, communicative validity, action validity) and 15 threats to internal credibility (e.g., observational bias, researcher bias, confirmation bias) (see Onwuegbuzie & Leech, 2007).

and design options in a research project, the diamonds indicate design decisions that need to be made by researchers, the arrows are relationships between design decisions and/or processes, and the numbers inside the boxes represent the steps in conducting mixed methods research as described in Table 2.

Our decision tree also shows that although mixed methods research always starts with one or more research questions, the remainder of the decisions can vary in order (i.e., they are not necessarily linear or unidirectional), and sometimes the questions and/or purposes can be revised when needed (Johnson & Onwuegbuzie, 2004). Further, a decision at an earlier stage may or may not influence a decision at a later stage of research. For example, the decision associated with strands or phases of research influences the decision related to data collection and analysis; however, mixing strategies do not necessarily influence the decision associated with time orientation.

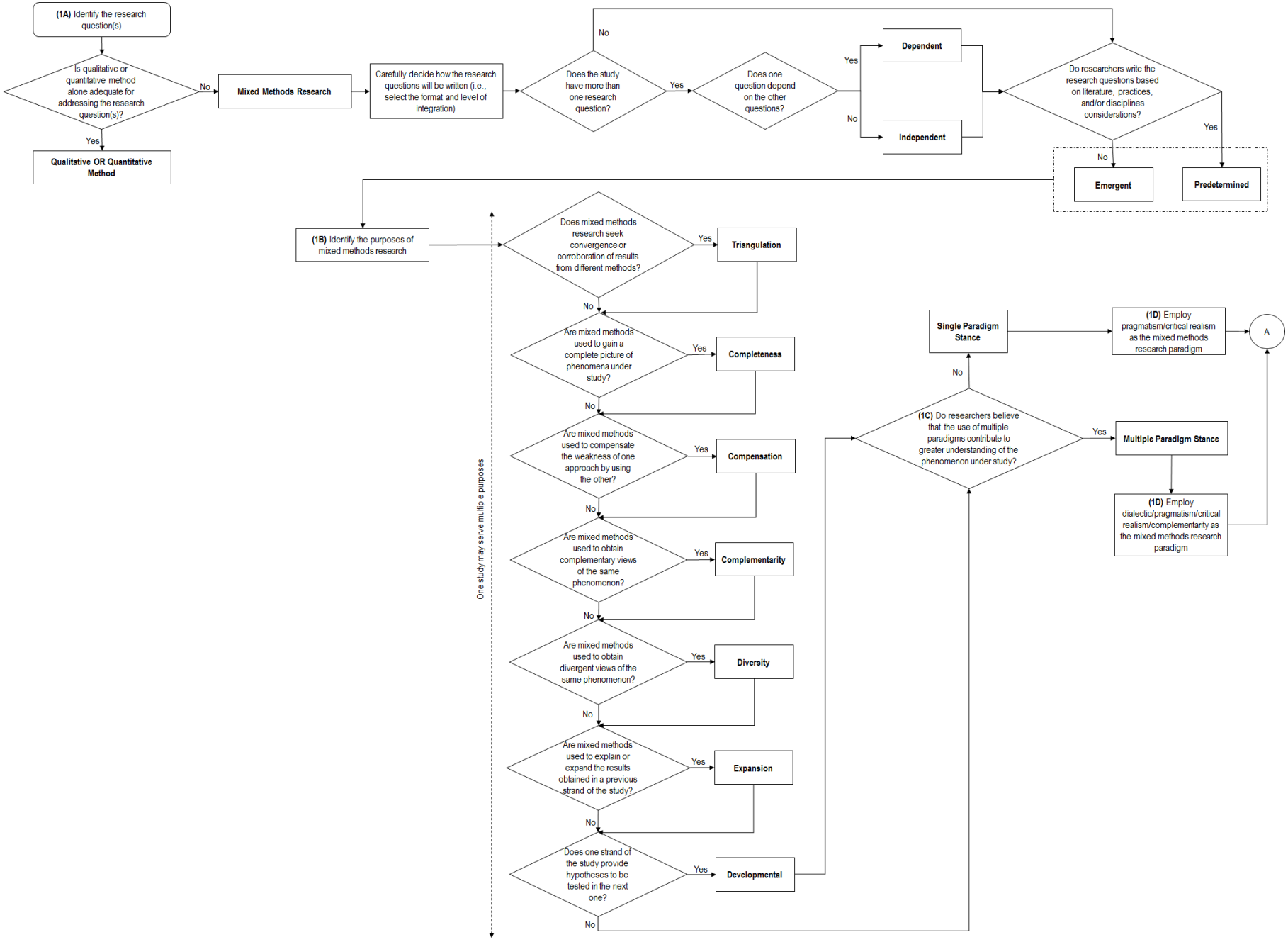

Figure 1A: Model of Decision Choice for Conducting Mixed Methods Research (Step 1)

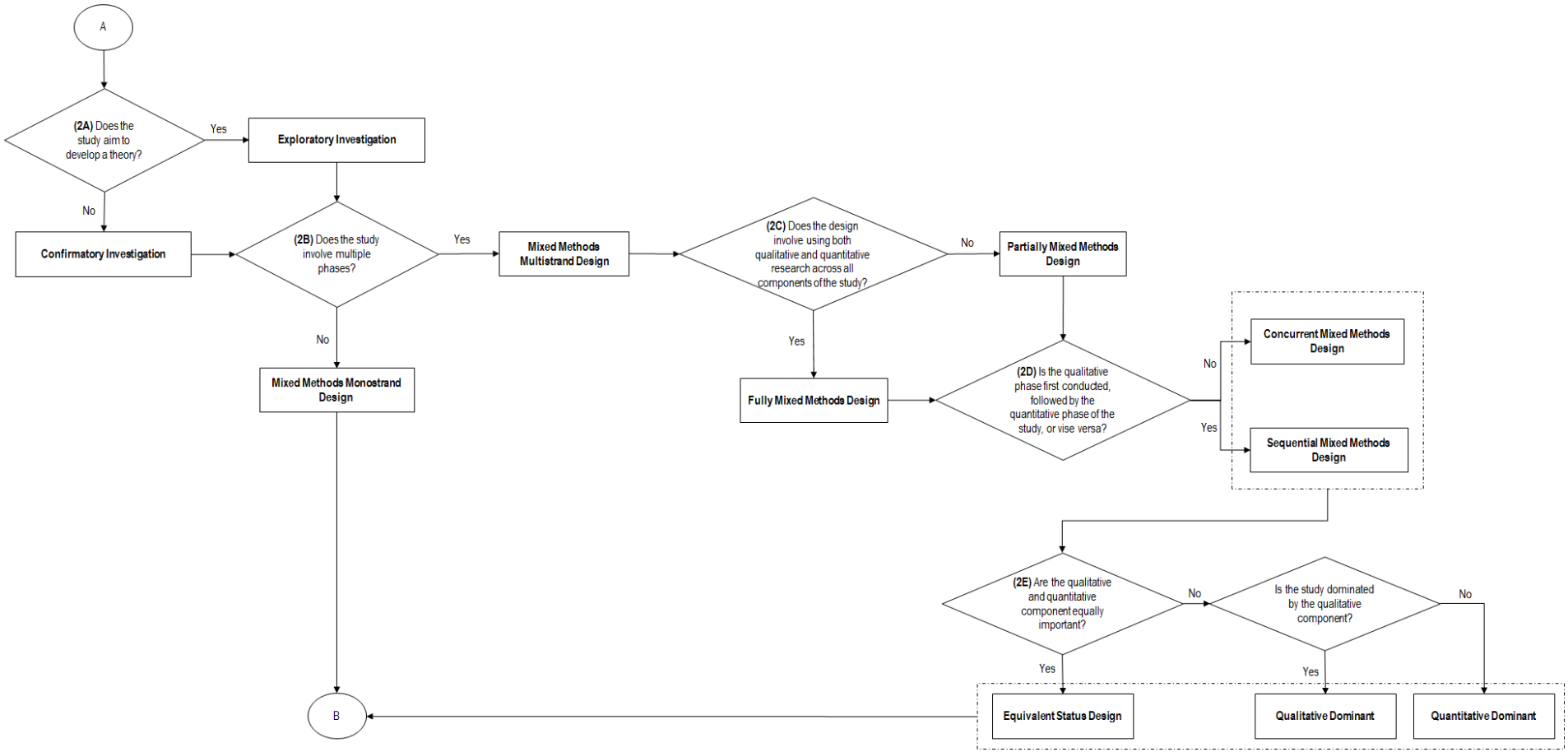

Figure 1B: Model of Decision Choice for Conducting Mixed Methods Research (Step 2)

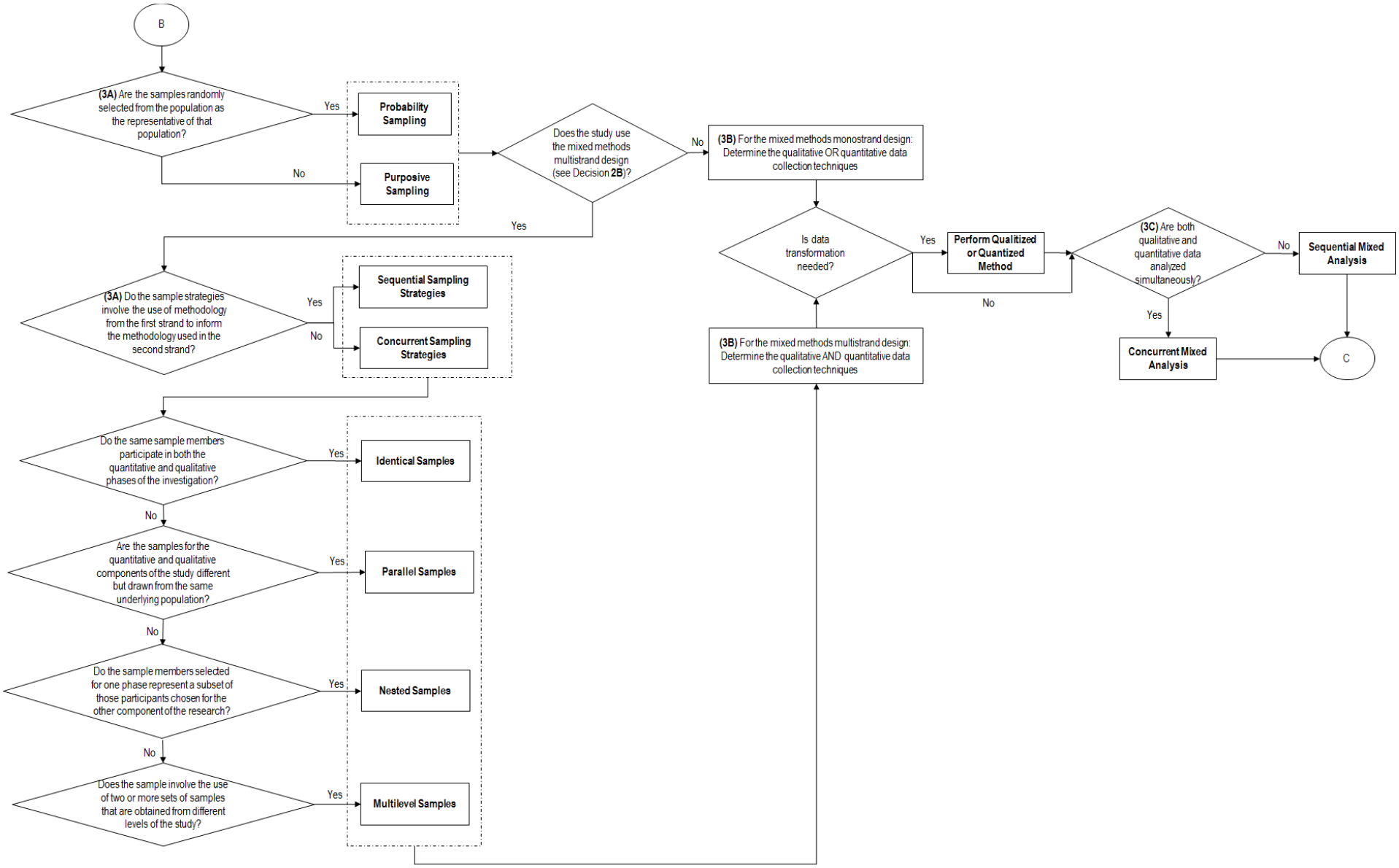

Figure 1C: Model of Decision Choice for Conducting Mixed Methods Research (Step 3)

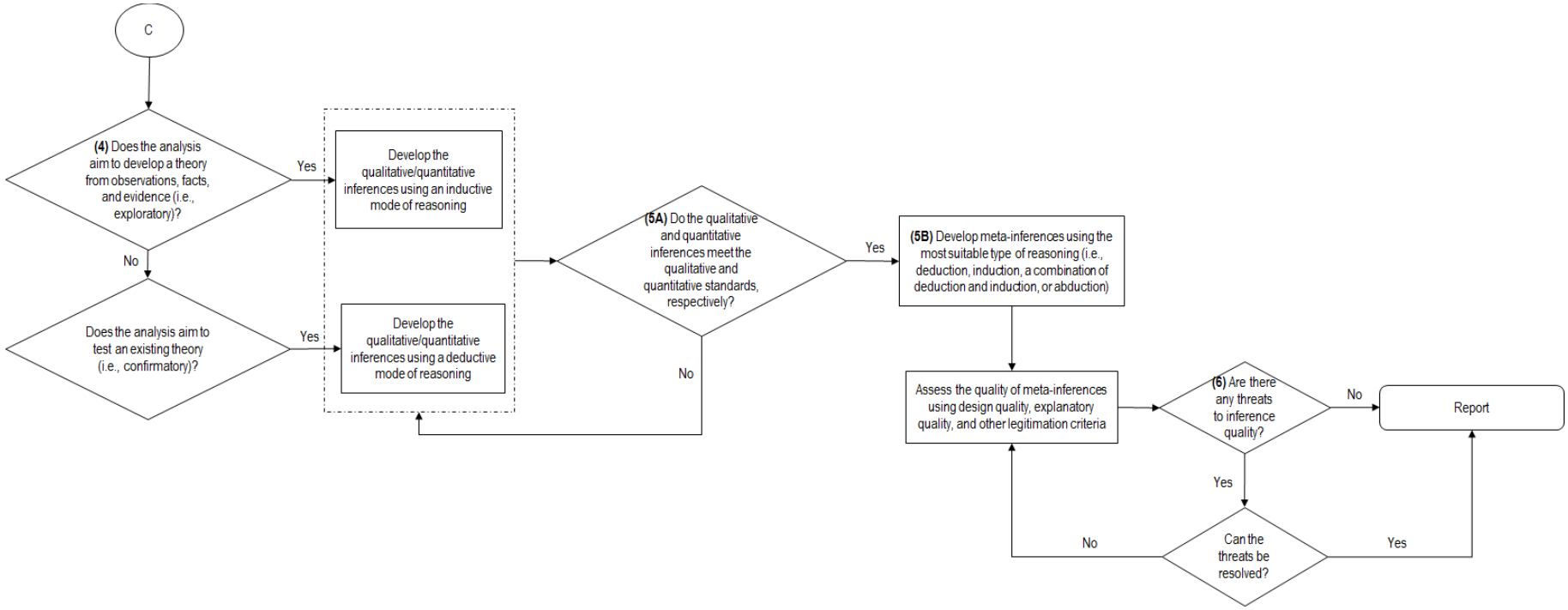

Figure 1D: Model of Decision Choice for Conducting Mixed Methods Research (Steps 4, 5, & 6)

AN ILLUSTRATIVE STUDY

With 14 classification dimensions of mixed methods research discussed earlier, the possible number of ways studies can involve a mixed methods approach is large. In this section, we offer an in-depth illustration of one possible type of mixed methods study. The guidelines discussed previously are applied to the examination of factors influencing technology adoption in households. For this illustration, we re-analyzed the qualitative data from Venkatesh and Brown (2001) and the quantitative data from Brown and Venkatesh (2005) using a mixed methods research approach. The summary of our illustrative study is presented in Table 4. We also include references to the model of decision choice (Figures 1A-1D) in Table 4.

Next, we offer a detailed commentary on our mixed methods study. We discuss each step of the study, including the design selection and application of the mixed methods guidelines presented earlier.

Step 1: Decide on the appropriateness of a mixed methods approach

In reporting the appropriateness of a mixed methods approach, it is important to describe why a mixed research study is necessary. Researchers should start with and clearly state the research questions, followed by the purposes of mixed methods research (Leech, 2012). Further, it is necessary to state the epistemological assumptions of the study.

The illustrative study addresses three research questions—one qualitative research questions, one quantitative research question, and one mixed methods research question. Although Venkatesh and Brown (2001) framed their study with objectives, we can translate them into the following question: *"What are the factors that determine household PC adoption among adopters and non-adopters?"* This research question was addressed in study 1. The qualitative component in this research question is broad (identifying the adoption factors) but specific

enough to focus on the issue of technology adoption in households. Prior literature, at the time of the original research activities (late 1990s), did not provide adequate foundation for understanding IT adoption in households. For this reason, using qualitative data to answer this exploratory question was appropriate. Once the data were collected, a quantizing method was employed to transform the qualitative data.

The quantitative research question from Brown and Venkatesh's (2005) paper[6] was addressed in study 2. The question is: "*Does the model of adoption of technology in households (MATH) explain household adoption and non-adoption of PCs?"* This question was addressed using a survey methodology in order to operationalize the constructs identified in the qualitative phase of the study and empirically test MATH (Brown & Venkatesh, 2005). Our mixed methods question is *"In what way do the results from the quantitative data collection (study 2) support or refute the results from the qualitative data collection (study 1)?"* We state our mixed methods research question using a *procedural focus*—it explicitly directs the procedures of mixing the strands of a mixed methods study and is tied to the specific design being used (Plano Clark & Badiee, 2010). This mixed methods question focuses on the need to triangulate the findings from the qualitative and quantitative phases of the study.

Because the quantitative research questions can only be addressed after the qualitative research question was answered, the questions were dependent on each other. Further, triangulation can only be conducted after both the qualitative and quantitative research questions were addressed. The relationship of our research questions to the research process was

[6] Brown and Venkatesh (2005) also addressed the second research question: "Does the inclusion of the household life cycle components improve MATH?" However, this question was not relevant for the illustrative study because the purpose of study 2 was to test the model (i.e., MATH) developed in study 1, which did not include the household life cycle components. Thus, it is not discussed in the current paper.

predetermined—we stated the questions at the beginning of the study based on our understanding of the literature.

Table 4: Summary of Mixed Methods Research (An Illustrative Study)

	Property	Decision Consideration	Other Design Decision(s) Likely to Affect Current Decision	Design Decision and Reference to the Decision Tree
Step 1: Decide on the appropriateness of mixed methods research	Research questions	Qualitative or quantitative method alone was not adequate for addressing the research question. Thus, a mixed methods research approach was used.	None	Identify the research questions *(Decision Tree: Figure 1A, #1A)* ▪ The qualitative and quantitative research questions were written separately, followed by a mixed methods research question. ▪ The qualitative research question was *"What are the factors that determine household PC adoption among adopters and non-adopters?"* ▪ The quantitative research question was *"Does MATH explain household adoption and non-adoption of PCs?"* ▪ The mixed methods research question was *"In what way do the results from quantitative data collection (study 2) support or refute the results from qualitative data collection (study 1)?"* ▪ The research questions were written in the question format. ▪ The quantitative research question was dependent on the results of the qualitative research question. The mixed methods question was dependent on the results of both qualitative and quantitative research questions. ▪ The relationship between the questions and the research process was predetermined.
	Purposes of mixed methods research	• Mixed methods research was intended to seek convergence or corroboration of results from different methods. • Mixed methods research was used to obtain complementary views of the same phenomenon.	Research questions	Corroboration/confirmation with an emergent element of complementarity. *(Decision Tree: Figure 1A, #1B)*

	Property	Decision Consideration	Other Design Decision(s) Likely to Affect Current Decision	Design Decision and Reference to the Decision Tree
	Epistemological perspective	Both qualitative and quantitative components of the study used the same paradigmatic assumptions.	Research questions, purposes of mixed methods	Single paradigm stance. *(Decision Tree: Figure 1A, #1C)*
	Paradigmatic assumptions	The researchers believed in the importance of research questions and embraced various methodological approaches from different worldviews.	Research questions, purposes of mixed methods	Pragmatism (positivist was used in both qualitative and quantitative components of the study). *(Decision Tree: Figure 1A, #1D)*
Step 2: Develop strategies for mixed methods research designs	Design investigation strategy	The study was intended to develop and test a theory.	Research questions, paradigmatic assumptions	▪ Study 1: Exploratory investigation. ▪ Study 2: Confirmatory investigation. *(Decision Tree: Figure 1B, #2A)*
	Strands/phases of research	The study involved multiple phases.	Purposes of mixed methods research	Multistrand design. *(Decision Tree: Figure 1B, #2B)*
	Mixing strategy	The qualitative and quantitative components of the study were mixed at the data analysis and inferential stages.	Purposes of mixed methods research, strands/phases of research	Partially mixed methods. *(Decision Tree: Figure 1B, #2C)*
	Time orientation	The qualitative phase was first conducted, followed by the quantitative phase of the study.	Research questions, strands/phases of research	Sequential (explanatory) design. *(Decision Tree: Figure 1B, #2D)*
	Priority of methodological approach	The qualitative and quantitative components were equally important.	Research questions, strands/phases of research	Equivalent status design. *(Decision Tree: Figure 1B, #2E)*
Step 3: Develop strategies for collecting and analyzing mixed methods data	Sampling design strategies	The samples for the quantitative and qualitative components of the study were different but drawn from the same underlying population.	Design investigation strategy, time orientation	Probability sampling with sequential design using parallel samples. *(Decision Tree: Figure 1C, #3A)*
	Data collection strategies	▪ In study 1, qualitative data were collected. ▪ In study 2, quantitative data were collected.	Sampling design strategies, time orientation, strands/phases of research	▪ Study 1: Closed- and open-ended questioning (i.e., the methodology employed in study 1 was drawn from the concepts of qualitative interviewing). ▪ Study 2: Closed-ended questioning (i.e., traditional survey design). *(Decision Tree: Figure 1C, #3B)*

	Property	Decision Consideration	Other Design Decision(s) Likely to Affect Current Decision	Design Decision and Reference to the Decision Tree
	Data analysis strategy	▪ The qualitative data were analyzed quantitatively. ▪ The qualitative data were first analyzed, followed by the analysis of quantitative data.	Time orientation, data collection strategy, strands/phases of research	Sequential qualitative-quantitative analysis. *(Decision Tree: Figure 1C, #3C)*
Step 4: Draw meta-inferences from mixed methods results	Types of reasoning	The analysis was concerned with developing and testing/confirming hypotheses.	Design investigation strategy	Inductive and deductive theoretical reasoning. *(Decision Tree: Figure 1D, #4)*
Step 5: Assessing the quality of meta-inferences	Inference quality	▪ The qualitative inferences met the appropriate qualitative standards. ▪ The quantitative inferences met the appropriate quantitative standards. ▪ The quality of meta-inferences were assessed.	Mostly primary design strategies, sampling design strategies, data collection strategies, data analysis strategies, type of reasoning	Design and explanatory quality; sample integration; inside-outside; weakness minimization; conversion; multiple validities. *(Decision Tree: Figure 1D, #5A & 5B)*
Step 6: Discuss potential threats and remedies	Inference quality	All potential threats to inference quality were discussed and remedies were provided.	Data collection strategies, data analysis strategies	Threats to sample integration; inside-outside; data conversion; and multiple validities. *(Decision Tree: Figure 1D, #6)*

Based on our research questions, the primary purpose of our illustrative study is *triangulation or corroboration/confirmation*, with an emergent element of *complementarity*. Qualitative and quantitative techniques were used to validate the results through triangulation, and the combination of the qualitative and quantitative data collection and analysis was used to produce a more complete understanding of PC adoption and use through complementarity. The complementarity purpose seeks to enhance, illustrate, or clarify results from one method type using results from other methods (Caracelli & Greene, 1993). Because the results from study 2 were used to test and confirm the results from study 1, complementarity is considered a secondary purpose of our illustrative study.

In the illustrative study, we adopted *a single paradigm perspective*. The overall mixed methods study was based on the *pragmatism paradigm*—combining the positivist qualitative data collection and analysis with the positivist quantitative data collection and analysis. Although the data collected in study 1 were qualitative, pragmatists believe that a qualitative study can be conducted using the positivist paradigm. Given the nature of the qualitative data analysis and subsequent statistical analysis in study 1, we consider study 1 to be a positivist qualitative study. Similar to study 1, study 2 was based on the positivist paradigm. The use of two different methods supports our triangulation purpose—seeking corroboration of results across studies.

The illustrative study focused on MATH and empirically derived and validated this model for adopters and non-adopters in order to identify the factors that influence technology adoption in households. MATH was proposed by Venkatesh and Brown (2001) using the theory of planned behavior (TPB; Ajzen, 1985, 1991) as the framework. According to the TPB, behavioral intention, which was the key dependent variable, is determined by attitude toward

behavior, subjective norm, and perceived behavioral control. Using this framework, Venkatesh and Brown sought to understand and explain household PC adoption.

Step 2: Develop strategies for mixed methods research designs

In this stage, we determine the strands/phases of research, design investigation strategy, priority of methodological approach, mixing strategy, and time orientation of the study. When reporting the strategies, it is imperative to delineate why a mixed methods research design is used (Leech, 2012). Consistent with the research questions and paradigmatic assumptions discussed previously, study 1 was characterized as a predominantly *exploratory study*—although the initial constructs' definitions were drawn from previous literature, the final MATH constructs were derived from the qualitative data. Study 2 was a *confirmatory quantitative study*—quantitative data and operations analyzed with statistical analysis and inference. To achieve the purposes of mixed methods research, *a mixed methods multistrand design* was the appropriate design because study 2 was needed to validate the results of study 1.

Based on the strategy of mixing, this study adopted *a partially mixed methods design*, where mixing occurs at the data analysis and inferential stage. Given that both the qualitative and quantitative components of the study contributed equally to address the research questions, our illustrative study followed an *equivalent status design*. Further, based on our research questions, the overall mixed methods research design of this illustrative study followed *a sequential design approach*, where findings from the qualitative study informed the quantitative study (see Creswell et al., 2003; Creswell & Plano Clark, 2007). Therefore, it was crucial that the qualitative study be conducted before the quantitative study.

Step 3: Develop strategies for collecting and analyzing mixed methods data

When writing a mixed methods research report, much like all research reports, it is important to include enough information so that readers can fully understand how the research was conducted (Gliner, Morgan, & Leech, 2009; Leech, 2012). Given that our mixed methods study used a sequential mixed methods design aimed to develop and test MATH, *a probability sampling with sequential design using parallel samples* was used as the sampling design strategy. The qualitative study was longitudinal—an initial interview of factors influencing purchase or use decisions and follow-up interviews that were conducted six months after the initial interview to measure the dependent variables (i.e., purchase or use behaviors). Similarly, study 2 was longitudinal—an initial survey to identify factors influencing purchase or use decisions and a follow-up survey 6 months after the initial survey to measure purchase behavior for those who did not own a PC at the time of the initial survey and use behavior for owners at the time of the initial survey. The sample in each study was divided into two categories: adopters and non-adopters. Actual use behavior and purchase behavior were used as the dependent variable of adopters and non-adopters respectively (see Brown & Venkatesh, 2005). Appendix C presents an overview of the studies, sample sizes, and timing of measurement. The scales for the MATH constructs were developed, pre-tested, and tested in Brown and Venkatesh (2005).

In writing a mixed research report, researchers also need to describe and justify the analysis and explain how data sets are combined and integrated. Consistent with our time orientation, sampling design, and data collection strategies, we used *a sequential qualitative-quantitative analysis design strategy* with an emergent element of *data transformation technique* (i.e., quantized) as our data analysis strategy. Next, we discuss the qualitative and quantitative data analysis in study 1 and study 2, respectively.

Study 1 Data Analysis

In our illustrative study, we re-analyzed Venkatesh and Brown's data set[7] to examine not only its descriptive statistics, but also its quantized data. An important component of the method in Venkatesh and Brown's (2001) study was that once respondents who were primary decision makers in households identified a particular factor, they were then asked to indicate the degree to which that factor was important in their decision to adopt or not to adopt a PC for household use. This technique provided not only the factors that were derived from coding the qualitative data, but also the associated magnitude of importance (Babbie, 1990; Stone, 1978).

Coding and Data Transformation

Two individuals were employed to code the qualitative data. The coders were provided with construct definitions from existing models, as suggested by Miles and Huberman (1994). Each coder conducted a preliminary analysis of 30 randomly selected participants' responses. Each participant could have provided multiple responses (reasons) for each decision. After this first round of coding, the coders were brought together to discuss their coding. Following discussions, inter-coder discrepancies were resolved. The coders then coded the remaining data, holding out any responses that did not fit easily into any of the constructs. Consistent with Weber (1990), a given response was examined against each of the constructs in order to determine the fit of the response with the conceptual definitions of the constructs. Although traditional content coding relies on an existing, tested coding scheme, no such coding scheme existed for household adoption of PCs when the study was conducted. Thus, a coding scheme was derived based on the TPB framework (Venkatesh & Brown, 2001). For example, if the respondents indicated that entertainment was a factor driving purchase intention, then this response was coded as "applications for fun" and categorized as a hedonic outcome under an attitudinal belief structure.

[7] Readers are referred to Venkatesh and Brown (2001) for full methodological details, including the interview script used to gather data.

Other examples of the coding are provided in Appendix D. The coding process revealed 13 key factors of technology adoptions in households (i.e., MATH). These factors include attitudinal beliefs (i.e., applications for personal use, utility for children, utility for work-related use, applications for fun, and status gains), normative beliefs (i.e., friends and family influences, secondary sources' influences, and workplace referents' influences), and control beliefs (i.e., fear of technological advances, declining cost, cost, perceived ease of use, and requisite knowledge). The construct definitions of MATH are presented in Appendix E.

After the key factors of technology adoption in households were identified through a coding process, we converted the qualitative data into quantitative data (i.e., quantized). The descriptive statistics and correlations of quantized data analysis are reported in Appendix F. Given that open-ended responses were elicited and the magnitude of importance was measured on a 5-point scale, each coded response and the associated importance resulted in a single indicator for a specific construct. Therefore, in this case, there was a one-to-one correspondence between indicator variables and latent variables. Although using single indicators does pose a potential problem, such use of coded qualitative data and the corresponding magnitudes (quantitative data) was consistent with approaches suggested by Babbie (1990) and Miles and Huberman (1994). We assessed the quantitative validity of quantized data using several different techniques and report the results in Appendix G.

Qualitative Validation of Study 1

Before we analyzed the quantized data, we needed to establish validity in the qualitative data collection. We report three types of validity as discussed in Venkatesh et al. (2013): (1) *design validity*; (2) *analytical validity*; and (3) *inferential validity*.

Design validity consists of descriptive validity, credibility, and transferability. *Descriptive validity* (i.e., the accuracy of what is reported by researchers) was established by providing information about the research setting (see earlier discussion about data collection strategies) (Maxwell, 1992). To ensure the *credibility and transparency* (i.e., the extent to which the results of qualitative research are credible and believable) of the qualitative study, data were collected from a large random sample of households and telephone interviews were used for data collection. In order to ensure *transferability* (i.e., the degree to which the results of qualitative research can be generalized to other contexts), Venkatesh and Brown (2001) used a longitudinal study with two waves of measurement, an initial interview (during a three-week window in March/April 1997) and a follow-up interview six months later. A comparison of the characteristics of the sample to the population in general indicates that the random sample of households included in this study was highly representative of the population of American households (see Venkatesh & Brown, 2001).

Analytical validity consists of theoretical validity and plausibility, dependability, and consistency. *Theoretical validity and plausibility* (i.e., the extent to which theoretical explanation and the findings of the study fit the data, and are, therefore, credible and defensible) were established by using a well-designed protocol for the data collection technique (Orlikowski, 1993). The interview protocol was first pre-tested to solicit comments and suggestions about the instrument from respondents (Venkatesh & Brown, 2001). The pre-test also helped identify wording issues that needed to be addressed. During the interview, interviewers asked every question and in the prescribed order, per the interview protocol. This helped maintain data reliability and credibility (Judd, Smith, & Kidder, 1991). Another strategy to promote theoretical validity was the use of an existing theory (i.e., TPB) along with a number of established research

bases in technology adoption, customer behavior, and psychology as guiding frameworks for the proposed theoretical model (see Venkatesh & Brown, 2001). *Dependability* in qualitative research emphasizes the need for the researcher to account for every change that occurs in the setting (Venkatesh et al., 2013). In this study, reliability or dependability was assessed through inter-rater (or coder) reliability (IRR), which is a measure of consistency in qualitative data analysis. The IRR was .89, indicating a high degree of consistency in the qualitative data analysis. Triangulation was used to identify themes that were common to several data sources and the coding schemes were derived based on the existing theoretical framework (Jick, 1979). To maintain *consistency*, 12 interviewers assigned to this project had an average 3.2 years of experience, including at least six months of telephone interviewing experience, and were trained on this particular interview protocol/script. Interviewers followed the same interview protocol/script for all the interviewees.

Inferential validity consists of *interpretive validity* and *confirmability*. There is limited, if any, research in IS that has reported inferential validity. We believe that it is necessary to report this type of validity because qualitative researchers are not only concerned with providing a valid description of the objects, events, and behaviors in the setting they study, but also concerned with what these objects, events, and behaviors mean to the people engaged with them (Maxwell, 1992). In this study, *interpretive validity* (i.e., the degree to which participants' views, thoughts, feelings, intentions, and experiences are accurately understood by the researchers) was achieved by obtaining participant's feedback during the interview. The data were also coded and reported as close as possible to participants' accounts and interview transcripts and notes. All procedures for checking and cross-checking the data throughout the study were documented, ensuring

c*onfirmability* (i.e., the degree to which the results could be confirmed or corroborated with others) of the qualitative study (Lincoln & Guba, 1985).

Results of Study 1

Among current users (n=201), the model was tested with use as the dependent variable. The results of study 1 are presented in Appendix H. MATH, with five key predictors—all three utilitarian outcomes, applications for fun, and status gains—explained 58% of the variance in use behavior. Appendix H also presents the results associated with the model for households that did not possess a PC at the time of the initial survey with follow-up purchase behavior that was measured six months after the initial survey as the dependent variable (n=435). MATH explained 57% of the variance in purchase behavior.

Study 2 Data Analysis

The results of study 1 suggest that various factors in MATH influence adoption and use of technologies in households. In study 2, the MATH constructs were operationalized for survey research. Construct reliability and validity were measured.

Quantitative Validation of Study 2

The data were analyzed using PLS. The measurement model results supported reliability and convergent and discriminant validity—all ICRs were greater than .70 and all AVEs were greater than inter-construct correlations. The validity was further supported by acceptable loadings (>.65) and low cross-loadings (<.30) in model tests for adopters and non-adopters. The ICRs, AVEs, descriptive statistics, and correlations are presented in Appendix I. Although internal validity is a weakness of survey-based research, the longitudinal data collection here, helped us provide better support for causality. The demographics of the respondents and non-respondents at both time periods were compared and no significant differences were found,

indicating that threats to internal validity (e.g., selection, history, maturation) were not influencing the results. Statistical conclusion validity was ensured by using an appropriate data analysis procedure and tool, and by ensuring no statistical assumptions were violated. These validity criteria (i.e., internal validity, construct validity, discriminant validity, and statistical conclusion validity) also confirmed that the quantitative inference criteria were met (Venkatesh et al., 2013).

Results of Study 2

Among current users (n=370), the models were tested with use as the dependent variable. Appendix H shows the belief structures of MATH explained 57% of variance in use behavior. Appendix H also presents the PLS analysis results associated with the model testing of the data from households that did not possess a PC at the time of the initial survey with follow-up purchase behavior that was measured six months after the initial survey as the dependent variable. MATH explained 50% of the variance in purchase behavior.

Step 4: Draw meta-inferences from mixed methods results

In making the qualitative inferences, we followed the guidelines presented in Table 3. At the beginning of study 1, a theoretical framework was inductively built on the basis of previous models (e.g., TPB). The resulting theoretical framework was then used as the basis of study 2. Inductive and (primarily) deductive theoretical reasoning were used to develop the meta-inferences. The purpose of our mixed methods study was to assess the credibility of inferences obtained from qualitative and quantitative data analysis (i.e., triangulation with the emergence of complementarity). To achieve this goal, a triangulation technique was used to develop the meta-inferences. The advantages of a triangulation technique are that it (1) allows researchers to be more confident in their results; (2) can stimulate the creation of inventive methods and new ways

of understanding a problem from multiple perspectives; (3) may help uncover various dimensions of a phenomenon; and (4) can lead to a synthesis or integration of theories (Jick, 1979).

We first developed the qualitative inferences, followed by the quantitative inferences (see Table 6). In our illustrative study, the results showed a great deal of convergence but also revealed some inconsistent findings. Overall, we found that the same set of factors represented significant predictors of home PC adoption and use in both the qualitative and quantitative studies. Although the questionnaire used in the quantitative study was derived from the results of the interviews, there were two significant differences in findings between the studies. In the qualitative study, requisite knowledge was significant for current non-adopters, whereas it was not significant in the quantitative study. In the qualitative study, status gains was significant for adopters, whereas in the quantitative study, it was not.

One of the limitations of our study was that we did not re-examine the divergent findings using a new dataset (Erzberger & Kelle, 2003). However, we offered a theoretical explanation to resolve the divergent findings. Because these divergent findings were unlikely due to a mistake made in the application of data collection or analysis (see validation section for details), we felt that a re-examination of theoretical assumptions was sufficient to address this issue. We explain these divergent findings next.

First, the analysis of the qualitative data for the current non-adopters group showed that the majority of respondents indicated requisite knowledge influenced their decision to adopt a PC. At the same time, they considered fear of technology change to be the main barrier. Based on the arguments formulated by current non-adopters, it was evident that requisite knowledge became a dominant issue because learning a new technology was difficult for them. Thus, it was

likely that requisite knowledge has no direct effect (or the effect was small) on purchase behavior. However, this relationship could be mediated by other variables. For example, in their study, Kim and Kankanhalli (2009) found that requisite knowledge (i.e., self-efficacy) had no direct effect on user resistance. Rather, the effect of self-efficacy on user resistance was mediated by switching cost. With respect to our results, further investigation is needed to test whether there is an indirect effect of requisite knowledge on purchase behavior through mediating variables. For instance, individuals' belief that they have the knowledge necessary to use a PC may influence their perception of the utility they would achieve when using the PC, which in turn, will influence their purchase behavior. This potential mediating relationship could, therefore, explain the non-significant direct effect of requisite knowledge found in study 2.

Second, status gains was found to be significant among current adopters in the qualitative study, whereas it was not in the quantitative study. Contrary to the finding from the quantitative study, prior research has reported that status gains was an important determinant of adoption behaviors (e.g., Fisher & Price, 1992; Kim & Han, 2009). Moreover, the innovation literature has indicated that social outcomes, such as status gains, are important in the early stage of technology adoption (Venkatesh & Brown, 2001). Later adopters are unlikely to be influenced by social rewards because the status value of adopting diminishes as more people adopt (Brown & Venkatesh, 2003).

Overall, our meta-inferences are consistent with the theoretical concepts of MATH. The integration of qualitative and quantitative research strands has successfully added value beyond the individual studies. Given that data were collected from different sets of participants and different data collection procedures were used, the similarity of findings indicates strength of the theoretical models that were used as the research foundations. The richness and robustness of the

results gives us confidence about the factors that predict household PC adoption and use. The mixed methods design helped us identify and understand the factors that influence household PC adoption and use. The qualitative study helped us identify a set of factors and their importance, whereas the quantitative study helped us empirically examine the theoretical model (developed from the qualitative study) to identify what factors drive household PC adoption and use and how these factors help explain the behavior differences between adopters and non-adopters. Taken together, these studies offer a deep understanding of the factors that drive household PC adoption and use. The summary of our meta-inferences is presented in Table 6.

Table 6: Development of Qualitative Inferences, Quantitative Inferences, and Meta-inferences

Context	Qualitative Inference	Quantitative Inference	Meta-inference	Explanation
Attitudinal belief structures	The effect of applications for personal use was significant for both current adopters and non-adopters.	Consistent with the qualitative findings.	Utilitarian outcomes (i.e., personal use and work-related) were positively associated with use behavior (for current adopters) and purchase (for non-adopters).	-
	Utility for children and utility for work-related use were positively associated with the use behavior of current owners. However, only utility for work-related use was significant for non-adopters.	Consistent with the qualitative findings.		
	Applications for fun was positively associated with the use behavior of current owners and purchase behavior of non-owners.	Consistent with the qualitative findings.	Hedonic outcome (i.e., applications for fun) was positively associated with use behavior (for current adopters) and purchase (for non-adopters).	-
	Status gains was significant for current owners, but not for current non-owners.	Status gains was not significant for both groups.	There was NO relationship between status gains and use behavior (for current owners) and purchase (for current non-owners).	The innovation literature has indicated that social outcomes, such as status gains, are important in the early stage of technology adoption (Venkatesh & Brown, 2001). Later adopters are unlikely to be influenced by social rewards because the status value of adopting diminishes as more people adopt (Brown & Venkatesh, 2003).
Normative belief structures	Friends and family and secondary sources positively influenced purchase behavior of current non-owners. However, neither	Consistent with the qualitative findings.	- There was NO relationship between social influences and use behavior. - There was NO relationship between secondary	-

Context	Qualitative Inference	Quantitative Inference	Meta-inference	Explanation
	predictor was significant for current owners.		sources and use behavior of current owners. - Social influences and secondary sources were positively associated with purchase behavior.	
Control belief structures	Fear of technology change, declining cost, perceived ease of use, and requisite knowledge for PC use were not significant for current owners. However, they were significant only for current non-owners.	Consistent with the qualitative findings, except the quantitative study found that requisite knowledge was not significant for current non-owners.	- One's control beliefs (i.e., fear of technology change, declining cost, and perceived ease of use) were NOT associated with use behavior. - One's control beliefs (i.e., fear of technology change, declining cost) were negatively associated with purchase. - One's control belief (i.e., perceived ease of use) was positively associated with purchase.	Based on the arguments formulated by current non-adopters, it was evident that requisite knowledge became a dominant issue because learning a new technology was difficult for them. Thus, it was likely that requisite knowledge had no direct effect (or the effect was small) on purchase behavior. However, this relationship could be mediated by other variables. Further investigation is needed to test whether there is an indirect effect of requisite knowledge on purchase behavior through mediating variables. For instance, individuals' belief that they have the knowledge necessary to use a PC may influence their perception of the utility they would achieve in using the PC, which in turn, will influence their purchase behavior. This potential mediating relationship could, therefore, explain the non-significant direct effect of requisite knowledge found in study 2.

Step 5: Assess the quality of meta-inferences

After we discussed the validity of quantitative and qualitative components (see the data analysis section), we assessed the quality of the meta-inferences. As stated earlier, the results from both studies were consistent, providing evidence of the high quality of the mixed methods data (i.e., reliability). The design quality was ensured by selecting the most appropriate research designs based on our research questions and the purposes of our mixed methods study. The explanation quality was checked following the procedures recommended by Venkatesh et al. (2013). Each type of validity criterion is presented in Table 7. Further, we assess the quality of meta-inferences using Onwuegbuzie and Johnson's (2006) typology (see Table 8).

Table 7: Quality of Meta-Inferences

Criteria	Indicators
Design suitability	• The qualitative study was conducted to address the first research question (i.e., what are the factors that determine household PC adoption among adopters and non-adopters?) and the quantitative study was conducted to address the second research question (i.e., does MATH explain household adoption and non-adoption of PCs?). The first question was addressed using a qualitative method because at the time when the study was conducted, prior literature did not provide adequate foundation for understanding IT adoption in households. The second research question was addressed using a survey methodology in order to operationalize the constructs identified in the qualitative phase of the study and empirically test the model of adoption of technology in household. • The mixed methods research question (i.e., in what way do the results from the quantitative data collection (study 2) support or refute the results from the qualitative data collection (study 1)?) was answered by triangulating the findings from the qualitative and quantitative studies. • Based on the research questions and specified purposes of the project, we carefully selected the mixed methods designs (see Table 4).
Design adequacy	• Various design components (e.g., sampling, data collection and analysis procedures) were integrated and the selected criteria were applied to address the research questions. • Two major sources of data were used: (1) open- and closed-ended qualitative interview (Venkatesh & Brown, 2001); and (2) standardized questionnaire survey to measure the various constructs described in MATH (Brown & Venkatesh, 2005). • Both the qualitative and quantitative study were longitudinal. In the qualitative data collection, interviewers followed the same protocol to maintain consistency. A comparison of the sample characteristics with the population characteristics in general indicated that the sample was representative of the population. In the quantitative data collection, the measurement items were carefully developed, pre-tested, and tested based on the results of study 1.
Analytical adequacy	• A sequential mixed methods data analysis was undertaken to analyze the data.

Criteria	Indicators
	• Qualitative data were converted into quantitative data. Quantized data were statistically analyzed to test the hypothesized relationships. • Quantitative data were analyzed using the PLS-SEM. PLS was chosen because it is more robust, with fewer identifiability issues (Hair, Ringle, & Sarstedt, 2011). • Percentage of explained variance in the structural model of both the qualitative and quantitative studies was consistent, suggesting the study designs were appropriate to create the expected effect.
Integrative efficacy	• Meta-inferences were the results of the triangulation of qualitative and quantitative findings. For example, the qualitative inference is "the effect of applications for personal use was significant for both current adopters and non-adopters" and the quantitative inference is "utility for children and utility for work-related use were positively associated with the use behavior of current owners. However, only utility for work-related use was significant for non-adopters." We integrate these inferences to develop a meta-inference (i.e., utilitarian outcomes (i.e., personal use and work-related) were positively associated with use behavior (for current adopters) and purchase (for non-adopters)") (see Table 6 for details). • The inconsistent findings across studies were theoretically explained. For example, the qualitative study revealed that status gains was significant for owners, but not for current non-owners, whereas the quantitative study showed status gains was not significant for both groups. This inconsistency was explained by reviewing the innovation literature (see Table 6 for details).
Inference transferability	• Inferences were consistent with the initial hypotheses of MATH. • The model is generalizable to the household population in the U.S., but not necessarily to other countries, unless the PC was adopted in a similar way in these countries. • The outcomes and inferences might be applicable to study the adoption of other related technologies.
Integrative correspondence	Meta-inferences clearly represented the initial purposes of the study. The primary purpose of the study was triangulation or corroboration/confirmation, with an emergent element of complementarity. The mixed methods designs implemented in the illustrative study were sufficient to achieve the goals of the study. Using the qualitative study, the factors that determine household PC adoption among adopters and non-adopters were identified. The predictive power of these factors was then examined in the quantitative study.

Table 8: Legitimation of Meta-Inferences (Onwuegbuzie & Johnson, 2006)

Legitimation	Indicators
Sample integration legitimation	A sequential mixed methods sampling strategy with parallel samples was used to collect the qualitative and quantitative data.
Inside-outside legitimation	• Two individuals/coders were employed to code the qualitative data. • Data analysis and integration were reviewed by everyone on the research team.
Weakness minimization legitimation	The potential threats and remedies of each method were identified (see step 6).
Conversion legitimation	• Conversion was conducted on the basis of theoretical perspectives. • The validity of quantified data was established.
Multiple validity legitimation	• When addressing the legitimation of the qualitative component, the relevant qualitative validities were addressed and established. • When addressing the legitimation of the quantitative component, the relevant quantitative validities were addressed and established. • The relevant mixed methods legitimation types were also addressed.

Legitimation	Indicators
Political legitimation	• Meta-inferences were developed based on the qualitative and quantitative inferences. • The results supported the theory. • Research questions were properly addressed using mixed methods research.

In our illustrative study, although we addressed most of the legitimation issues, we did not address sequential legitimation, paradigmatic mixing, and commensurability legitimation. One method to assess sequential legitimation is to change the sequence of the research study. Because we re-analyzed already collected data for this illustration, sequential legitimation cannot be assessed in this work. However, because most of our qualitative and quantitative inferences were consistent, we believe that the threat to sequential legitimation is not a major issue in our study. Paradigmatic mixing was not addressed in our illustration because we employed a pragmatism paradigm (i.e., both studies used a positivist approach). However, we successfully integrated the qualitative and quantitative inferences to develop meta-inferences. We also discussed the inference quality of the qualitative and quantitative data analysis. Finally, commensurability legitimation can be addressed if researchers are able to negotiate cognitively the importance of *Gestalt switch*—switching back and forth from a qualitative lens to a quantitative lens (Onwuegbuzie & Johnson, 2006). Onwuegbuzie and Johnson (2006) suggested that this is possible through cognitive and empathy training and if researchers have a limited ability to do this gestalt switch, then commensurability legitimation can be ignored.

Conducting mixed methods research involves inherent challenges that make it more difficult than conducting a monomethod study. We review some of the challenges we encountered in the illustrative study (see Appendix B). First, it is crucial for the researchers to understand and explain the rationale for using a mixed methods research approach in their study (Teddlie & Tashakkori, 2009). Although the original papers used in the illustrative study were published as two independent papers, they were from the same research program in which the

authors employed a mixed methods approach for collecting and analyzing the data. The initial challenge we encountered in this illustrative study is finding the rationale for combining the qualitative and quantitative data in the face of seemingly incompatible paradigms. Selecting an appropriate paradigm is a necessary step to justify the use of a mixed methods approach. To deal with this issue, we employed a pragmatism paradigm approach by combining the positivist qualitative data collection and analysis with the positivist quantitative data collection and analysis. Understanding the philosophical assumptions underlying each paradigm can also be a challenge for researchers because it requires knowledge and methodological expertise in multiple areas.

The second challenge is associated with selecting the most suitable design to address the research questions. The process of selecting the best mixed methods research design involves several steps as presented in the decision tree (see Figure 1). In order to select the most appropriate design, researchers are required to understand the characteristics and goals of each design choice. For example, in our illustrative study, we discussed the rationale for selecting a multistrand design that led us to select a sequential (explanatory) design and an equivalent status design. The design options discussed in this paper could be overwhelming, especially for those who are new to the field. Conducting mixed methods research also requires more time and resources (e.g., funding, staffing). Without enough time and resources within the research team, a mixed methods research project can be challenging.

The issue of nomenclature and basic definitions used in mixed methods research is another challenge in conducting a mixed methods study (Teddlie & Tashakkori, 2003). For example, although the term “validity” is routinely used in quantitative research, many qualitative researchers object to the use of this term (Onwuegbuzie & Johnson, 2006). In contrast, some

qualitative researchers (e.g., Maxwell, 1992) do not refute the use of the term "validity" in qualitative research. Similarly, in the context of mixed methods research, some scholars used different terms to refer to the same concepts. For example, Teddlie and Tashakkori (2003) proposed the term inference quality to refer to validity in the context of mixed methods research (Venkatesh et al., 2013), whereas Onwuegbuzie and Johnson (2006) recommended that validity in mixed methods research be termed legitimation. We believe that mixed methods researchers should adopt a common nomenclature for validation in order to differentiate mixed methods validation from qualitative and quantitative validation (Teddlie & Tashakkori, 2003; Venkatesh et al., 2013). The differences in terminology should be diminished in order to maintain consistency across mixed methods studies.

In our illustrative study, some of the results from the qualitative study were inconsistent with the qualitative study. These divergent findings forced us to examine our findings more closely and review the existing literature more carefully to create more advanced theoretical explanation (Teddlie & Tashakkori, 2009). Identifying the major source of inconsistency can be challenging in mixed methods research because it requires researchers to reexamine the data, reassess the inference quality, go back to the literature, and even collect a new dataset (Erzerber & Kelle, 2003). Despite the challenge of identifying the source of inconsistency, divergent inferences in a mixed methods study might lead to a better understanding of the phenomenon under study (Teddlie & Tashakkori, 2009).

Step 6: Discuss potential threats and remedies

Although there are several possible threats to the inference quality of mixed methods research, these threats were minimized through several remedial actions. Table 9 provides a list of threats and remedial actions.

Table 9: Potential Threats to Inference Quality and Remedial Actions*

Areas	Legitimation Type	Threats	Remedial Actions
Data Collection	Threat(s) to sample integration	Selecting different individuals for the qualitative and quantitative data collection.	1. The sampling frame for the quantitative and qualitative data collection were drawn from the same population.
		Unequal sample sizes for the qualitative and quantitative data collection.	2. Both studies had a fairly large sample size.
	Threat(s) to inside-outside legitimation	Introducing potential bias in the data collection.	3. Data were collected by a professional marketing firm and a specific interview protocol/script was used for all interviewees.
Data Analysis	Threat(s) to data conversion	Inadequate data transformation approaches.	1. The qualitative data was quantized by creating codes and then counting codes and evaluating their weights.
	Threat(s) to multiple validities	Not addressing validity issues.	2. Validity was assessed and discussed for both studies.

* Adapted from Creswell & Plano Clark (2007)

In our illustrative study, we discuss only one of many alternative designs that can be utilized by mixed methods researchers. Researchers can be flexible in selecting their designs based on the objectives of their study. For example, it is possible to use a multiple paradigmatic stance (e.g., interpretivism might be used in the qualitative study and positivism might be used in the quantitative study) to address the research questions proposed in our illustrative study. Researchers can also adopt either qualitative dominant or quantitative dominant designs, depending on the purpose of the study. For example, if the primary goal of the study is to identify factors that determine PC adoption in households, then the qualitative dominant design with the interpretivism paradigm and sequential-exploratory design should be selected.

The 14 properties discussed in this paper can be flexibly integrated to help researchers select the most suitable mixed methods designs for their studies. We suggest that when planning a mixed methods study, researchers should consider these properties and select those most relevant to the objectives of their study. Among these 14 properties, research questions, purposes

of mixed methods research, and paradigmatic assumptions are absolutely fundamental during the conceptualization stage of the study. For example, in our illustrative study, the research questions and purposes of mixed methods research are our basic foundations for selecting the mixed methods design based on the assumptions underlying pragmatism. At the methodological stage, the components of time orientation, data collection strategies, and data analysis strategies are critical and should not be overlooked in mixed methods research because they determine the quality of inferences. Other properties, such as priority of methodological approach, can be less salient, depending on the research questions. For example, if it is unclear whether the qualitative or quantitative data will ultimately be the most important in the results and inferences, then priority of approach is not a critical element of design dimensions (Teddlie & Tashakkori, 2010). The inference quality should also be assessed carefully because inferences are the most important aspects or outcomes of mixed methods research (Teddlie & Tashakkori, 2010).

DISCUSSION

This paper extends the guidelines of Venkatesh et al. (2013) by identifying and integrating 14 variations of mixed methods research properties. These guidelines offer a new perspective to accommodate the diversity of mixed methods designs. Further, we offer an in-depth illustration of one possible type of mixed methods research. We also discuss the development and validation of meta-inferences (i.e., validation of mixed methods research) in our illustrative study. This paper contributes to the development of mixed methods research by viewing mixed methods as an integrative model of design based on various properties of mixed methods research (Maxwell & Loomis, 2003). Finally, this paper advances our understanding of mixed methods research by presenting the variety of possible mixed methods applications and

demonstrating that a mixed methods approach may generate stronger inferences because of an integration of qualitative and quantitative inferences.

Contributions

This research makes several key contributions to the literature on mixed methods. First, we extend the guidelines of Venkatesh et al. (2013) for mixed methods research by integrating 14 properties of mixed methods into the guidelines. Our guidelines are also intended to complement the other existing mixed methods research guidelines (e.g., Maxwell & Loomis, 2003; Nastasi et al., 2010; Tashakkori & Teddlie, 1998, 2003b). The critical element of our guidelines is the integration of various dimensions of mixed methods research to accommodate different types of mixed methods designs. Although the guidelines are positioned within an IS context, due to the dearth of guidance on how to better execute mixed methods research, they are also broadly applicable beyond IS.

Second, this study shows how mixed methods research can be used to extract significant findings that can be compromised by the limitations inherent in a single method alone. Through this study, we provide researchers with the information necessary to select the best mixed methods designs for their research project based on 14 general properties of the studies that have been well established in mixed methods research. We also offer a decision tree to map the flow and relationship among the design strategies.

Third, we offer an in-depth illustration of one possible type of mixed methods research by characterizing the study from multiple dimensions of mixed methods research. Our illustration shows that researchers can select the designs of mixed methods research that best fit with their research questions and purposes. This illustration will provide an opportunity to open

up the research process from which the research community may learn about the best practices as well as the challenges in conducting mixed methods research.

Fourth, we contribute to the development of mixed methods research, particularly in the IS field. We argue that the application of mixed methods research, if done well, may drive the development of IS research. Although the utilization of mixed methods research in social science is in its adolescence (Teddlie & Tashakkori, 2003), its utilization in IS is relatively new. We suggest that IS researchers familiarize themselves with the theoretical paradigms and different properties of mixed methods research. Although research methods and theoretical paradigms that underlie these methods should follow the research questions, IS researchers should be able to integrate those different paradigms and not rely solely on a single paradigm (Tashakkori & Teddlie, 1998; Venkatesh et al., 2013). IS researchers are also advised to be flexible in making their research design decisions, depending on the purposes of their mixed methods research study.

Finally, although we offer an in-depth illustration of mixed methods research, it only illustrates one possible type of mixed methods study. Future research is needed to illustrate how to conduct different types of mixed methods study based on different properties of mixed methods research discussed in this paper. For instance, mixed methods research to answer a research question with expansion and developmental purposes can be conducted to increase the validity of constructs and inquiry results by selecting the most appropriate methods and maximizing the method strengths (Greene et al., 1989). Based on the research question and well-defined purposes, researchers then can select the most appropriate paradigmatic assumptions and determine their mixed methods design strategies.

CONCLUSIONS

The objective of this paper was to extend the guidelines of Venkatesh et al. (2013) for mixed methods research by elaborating various properties of the studies. The integrative framework that we presented was intended to accommodate different types of mixed methods research. We deliberately tried to be comprehensive in selecting and reviewing the mixed methods properties to offer researchers the opportunity to properly utilize a mixed methods approach in their study. We provided an in-depth illustration of one possible type of mixed methods research. This is one of the first illustrations that applies various properties of mixed methods research by incorporating qualitative and quantitative data collection and analysis in a sequential manner—and explains the decisions made at various stages of the research endeavor. The illustration also presented the development and validation of meta-inferences in a broader research program.

Note that the specific guidelines we proposed and illustrated reflect a certain set of preferences and are dominated by our paradigmatic assumptions in-use. Our goal was not to constrain all mixed methods researchers to follow the same research designs as illustrated in our exemplar. Instead, our intention was to provide general guidelines that would enable authors to critically think about their designs prior to the study and offer justification of their approaches after the study. Thus, authors and reviewers need to be flexible in adapting the guidelines based on the objectives of their study as well as the ontological and epistemological assumptions underlying the different components of the mixed methods study. We hope this work motivates researchers to adopt mixed methods in their research projects to gain richer insights into phenomena under investigation.

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