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A General Typology of Research Designs Featuring Mixed Methods[1]

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This article presents a general typology of research designs that features those utilizing mixed methods. The Methods-Strands Matrix includes both monomethod and mixed methods designs, but the emphasis is on the more complex and adaptable mixed ones. The article starts with a brief discussion of why typologies of mixed methods designs are valuable at this time. The Methods-Strands Matrix is produced by crossing number of methods employed (monomethod, mixed methods) by number of research strands (single, multiple). The multistrand, mixed methods cell in the matrix includes four families of MM designs: sequential, concurrent, conversion, and fully integrated. Examples of each of these strands are presented. Quasi-mixed designs are also described in which qualitative and quantitative data are collected, but there is no true integration of the findings or inferences for the overall study. We conclude that it is impossible to create a complete taxonomy of mixed methods designs, because they have an evolving nature that can spin off numerous permutations. The article concludes with a seven-step process for selecting the most appropriate mixed methods design for a research study.

This article presents the Methods-Strands Matrix, which is a general typology of designs used in the social and behavioral sciences. This typology includes monomethod designs (qualitative or quantitative), but it features mixed methods (MM) research designs, especially four families of MM designs: sequential, concurrent, conversion, and fully integrated. Before discussing the matrix, we will briefly discuss (a) why typologies of MM research designs are useful, and (b) the dimensions that have been used by various authors to create MM design typologies.

Are Typologies of Mixed Methods Designs Necessary?

Scholars writing in the field of MM research have developed typologies of mixed designs from the time the field emerged. For instance, Greene, Caracelli, and Graham (1989) examined a large number of MM studies and developed a typology for the designs used in those studies based on their design characteristics and functions.

Why have so many of their colleagues followed the lead of Greene et al. (1989) in developing MM typologies? Following are five reasons why typologies are important in MM research:

1. Typologies help researchers decide how to proceed when designing their MM studies. They provide a variety of paths, or ideal design types, that may be chosen to accomplish the goals of the study.
2. Typologies of MM research designs are useful in helping to establish a common language for the field. For instance, Morse's (1991, 2003) typology of MM research designs includes notations and abbreviations still used today.
3. Typologies of MM designs help to provide the field with an organizational structure. At this point in time, given the range of existing MM typologies, it is more accurate to say that such typologies provide the field with multiple alternative organizational structures.
4. Typologies of MM designs help to legitimize the field because they provide examples of research designs that are clearly distinct from either quantitative (QUAN) or qualitative (QUAL) research designs.
5. Typologies are useful as a pedagogical tool. A particularly effective teaching technique is to present alternative design typologies and then have the students discuss their strengths and weaknesses.

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Can a Typology of MM Designs Be Exhaustive?

While typologies of MM designs are valuable, researchers should not expect them to be exhaustive. This is an important point, especially because many researchers from the QUAN tradition expect an exhaustive "menu" of designs from which to select the "correct" one for their studies (e.g., Shadish, Cook, & Campbell, 2002).

We argue throughout this article that methodologists cannot create a complete taxonomy of MM designs, due to their (the designs') capacity to mutate into other diverse forms. Similarly, Maxwell and Loomis (2003) concluded that "the actual diversity in mixed methods studies is far greater than any typology can adequately encompass" (p. 244). This diversity in MM designs is produced by two factors:

1. The QUAL component of MM research studies. MM research utilizes an emergent strategy in at least the QUAL component of the design. Emergent designs may evolve into other forms as QUAL data collection and analysis occur (e.g., Lincoln & Guba, 1985; Patton, 1990, 2002).
2. The opportunistic nature of MM design. In many cases, a MM research study may have a predetermined research design, but new components of the design may evolve as researchers follow up on leads that develop as data are collected and analyzed. These "opportunistic" designs may be slightly different from those contained in previously published typologies of MM designs.

Given this diversity in MM designs, our typology will feature families of designs, each of which may have several different members.

Criteria Used in MM Research Typologies

Table 1 presents seven criteria that authors have used to create their MM typologies (e.g., Creswell, Plano-Clark, Gutmann, & Hanson, 2003; Greene & Caracelli, 1997; Greene et al., 1989; Johnson & Onwuegbuzie, 2004; Morgan, 1998; Morse 1991, 2003). These criteria include:

- number of methodological approaches used
- number of strands or phases
- type of implementation process
- stage of integration of approaches
- priority of methodological approach
- function of the research study
- theoretical perspective

Our typology utilizes the first four criteria[2] in the generation of what we call the Methods-Strands Matrix. We do not use the other three criteria in our typology, which focuses on methodological components of research designs. Specific reasons for the non-inclusion of the other criteria include the following:

- The priority of methodological approach. While an important consideration, the relative importance of the QUAL or QUAN components of a research study cannot be completely determined before the study occurs. In the real world, a QUAN + qual study may become a QUAL + quan study if the qualitative data become more important in understanding the phenomenon under study, and vice versa. Because the actual priority of approach (QUAL, QUAN) is determined after the study is conducted, it is not part of our design typology.
- The function of the research study. In our opinion, the intended function of a research study (e.g., triangulation, complementarity) is not a design issue, but is related to the function that the results from the study eventually serve (e.g., to corroborate findings, to enhance or elaborate findings). Because the outcomes of a MM study come after its design, we do not include this criterion in our design typology.
- The theoretical perspective. Some analysts include theoretical perspective, such as the transformative-emancipatory orientation, as a design component. While this is an important axiological (or values) component for doing research, it is a purpose (i.e., to create social justice) of the research study, rather than a design component. For researchers working within the transformative-emancipatory orientation, the pursuit of social justice is not a design choice; rather, it is the reason for doing the research, which supersedes design choices. Therefore, we do not include theoretical perspective as a criterion in our design typology.

Table 1
Criteria Used in MM Research Typologies and the Design Questions They Answer

Criterion Used	What design questions does this criterion answer?	What possible values for the criterion exist?	Is this criterion used in our typology?
(1) Number of Methodological Approaches Used	Will the study involve one method (QUAN or QUAL) or both (QUAL and QUAN)?	* Monomethods Study * Mixed Methods Study	Yes
(2) Number of Strands or Phases	Will the study involve one phase only or multiple phases?	* Monostrand * Multistarnd	Yes
(3) Type of Implementation Process	Will the QUAN and QUAL data collection occur sequentially or concurrently? Will data conversion occur?	* Concurrent * Sequential * Conversion * Combination	Yes
(4) Stage of Integration of Approaches	Will the study be mixed (QUAL, QUAN) in the experiential stage only, or across stages, or other combinations?	* Across all stages * Within experiential stage only * Other combinations	Yes, but only to allow the inclusion of quasi-mixed designs
(5) Priority of Methodological Approach	Does the QUAL or QUAN component have priority, or are they equal in importance, at the onset of the study?	* QUAL+quan * QUAN+qual	No
(6) Functions of the Research Study	Which of the following functions does the research design serve?	* Triangulation * Complementarity * Development * Initiation * Expansion * Other functions	No
(7) Theoretical Perspective	Will the design be driven by a particular theoretical perspective (typically the transformative perspective)?	* Some Variant of the Transformative Perspective * No Theoretical Perspective in the Design	No

One of the reasons for limiting the number of dimensions in our typology is that it could become overly complex otherwise. As observed by Mertens (2005), sub-types can easily be constructed and/or modified within the general types, depending on the purpose of the research and the research questions. For example, within a sequential design, sub-types may be constructed on the basis of priority (Creswell et al., 2003) of either the QUAL and QUAN strand.

We should also mention that in our current classification, we have abandoned (or de-emphasized) components of our previous typologies (Tashakkori & Teddlie, 1998, 2003) for a specific reason. Newer conceptualizations of mixed methods research all recognize the fact that a study is not considered mixed if there is no integration across stages. Previously, we have distinguished mixed methods (studies using two types of data and their analysis) from mixed models (studies that are mixed throughout, with two types of questions, data and interpretations). More recent definitions and conceptualizations in the field define mixed methods very similarly to our mixed models. We are assuming that all properly defined mixed methods studies these days are of this sort; therefore a distinction between mixed methods and mixed models studies is no longer necessary.[3]

Supporting this change in terminology is the definition of mixed methods in the *Call for Papers of the Journal of Mixed Methods Research* (Sage Publications, first issue expected in January 2007):

"mixed methods research is defined as research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry."

Following this conceptualization, one might call the studies in which two types of data are collected, but no integration of the findings/inferences occurs as *quasi-mixed designs*. We continue the use of "stage of integration" as a fourth criterion in our typology (see Table 1) in order to allow for the recognition of these *quasi-mixed designs*.

The Methods–Strand Matrix

The approach to classifying MM research designs presented in this article has evolved over time (e.g., Tashakkori & Teddlie, 1998, 2003; Teddlie & Tashakkori, 2005, forthcoming). We employ Morse's basic notational system, but we have developed our own set of MM research designs, which are included in the Methods-Strands Matrix. The latest incarnation of this typology was developed for three reasons:

- to more specifically locate MM designs within the larger framework of a general typology of research designs in the social and behavioral sciences
- to provide more clarity on how specific MM research designs are generated from a technical perspective that features methodological components
- to present an alternative perspective on MM research designs that features methodological components, rather than theoretical perspectives and research purposes or functions

Generation of the Methods-Strands Matrix

A simplified version of our typology is presented in Table 2, which is a matrix created by crossing two basic design dimensions:

- Type of approach or methods employed in the study (Monomethod or Mixed Methods).
- Number of strands (or phases) of the study (Monostrand or Multistrand).

Table 2

The Methods-Strands Matrix: A Typology of Research Designs Featuring Mixed Methods

Design Type	Monostrand Designs	Multistrand Designs
Monomethod Designs	**Cell One** Monomethod Monostrand Designs: (1) Traditional QUAN design (2) Traditional QUAL Design	**Cell Two** Monomethod Multistrand Designs: (1) Concurrent Monomethod a. QUAN+QUAN b. QUAL+QUAL (2) Sequential Monomethod a. QUAN→QUAN b. QUAL→QUAL
Mixed Methods Designs	**Cell Three** Quasi-Mixed Mono-Strand Designs: Monostrand Conversion Design	**Cell Four** A) Mixed Methods Multistrand Designs: (1) Concurrent Mixed Designs (2) Sequential Mixed Designs (3) Conversion Mixed Designs (4) Fully Integrated Designs B) Quasi-Mixed Multi-Strand Designs: Designs Mixed at the Experiential Stage Only, including the Concurrent Quasi-Mixed Design [4]

It is more accurate to state that the matrix contains "families" of research designs, because each of its four cells includes numerous designs.

Four Decision Points in the Methods-Strands Matrix

Investigators make four basic methodological decisions when selecting a design for their study from the matrix (see Table 1, Criteria 1-4). The first two decision points create the matrix itself, which crosses the number of methodological approaches used and the number of strands (or phases) of a study.

Number of Methodological Approaches Used. The Methods-Strands Matrix presented in Table 2 conceptually encompasses all three research approaches (QUAL, QUAN, MM), because it also includes purely QUAN and QUAL designs. The emphasis in this article is on the MM designs, but it is also useful to consider how they are conceptually related to monomethod QUAL and QUAN designs. The basic definitions of monomethod and MM designs are as follows:

- Monomethod designs – a type of research design in which only the QUAL approach, or only the QUAN approach, is utilized across all stages of the study.
- Mixed methods designs – a type of research design in which QUAL and QUAN approaches are mixed across the stages of a study.

Number of Strands or Phases in the Research Design. The second dimension of the Methods Strands Matrix presented in Table 2 refers to whether the research study has only one strand or more than one strand. The basic definitions of these terms are as follows:

- Strand of a research design – is a phase of a study that includes three stages: the conceptualization stage, the experiential stage methodological/analytical), and the inferential stage.
- Monostrand design - these designs employ only a single phase and it encompasses all of the stages from conceptualization through inference.
- Multistrand design - these designs employ more than one phase[5]; there are multiple phases to the study and each encompasses all of the stages from conceptualization through inference.

Following are definitions regarding stages:

- Stage – refers to a step or component of a strand/phase of a study
- Conceptualization stage – the sphere of concepts (abstract operations), which includes the formulation of research purposes, questions, etc.
- Experiential (methodological/analytical) stage – the experiential sphere (concrete observations and operations), which includes methodological operations, data generation, analysis, etc.
- Inferential stage – the sphere of inferences (abstract explanations and understandings), which includes emerging theories, explanations, inferences, etc. (Tashakkori & Teddlie, 2003, p. 681)

A simplified outline of the strand-stage terminology is presented in Figure 1 in which there in one strand (QUAL or QUAN) in a monomethod design, with three stages:

1. Conceptualization stage
2. Experiential (methodological/analytical) stage
    a. Methodological
    b. Analytical
3. Inferential stage

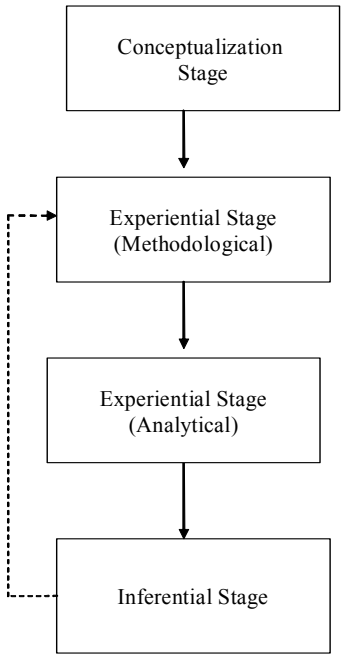

Figure 1
Graphic Presentation of Traditional QUAN or QUAL Designs (Monomethod Monostrand design)

Dividing a strand into distinct stages allows for the transformation of one methodological approach to another within a strand; that is, a strand might start out as a QUAL, but then become QUAN, or vice versa.

Type of Implementation Process (Concurrent, Sequential, Conversion). This decision point involves answers to two questions: "Will the QUAN and QUAL data collection occur sequentially or concurrently? Will data conversion occur?"

Concurrent and sequential designs been employed by numerous authors writing in the MM tradition (e.g., Creswell et al., 2003; Johnson & Onwuegbuzie, 2004; Morse, 1991, 2003). In concurrent designs, the strands of a study occur in parallel or synchronous manner, whereas in sequential designs they occur in chronological order with one strand emerging from the other.

The third way to implement a MM study is to use a conversion design. These designs are a unique feature of MM research and include the following terms:

- Data conversion (transformation): collected QUAN data types are converted into narratives that can be analyzed qualitatively, and/or QUAL data types are converted into numerical codes that can be statistically analyzed.
- Quantitizing: converting QUAL data into numerical codes that can be statistically analyzed (e.g., Miles & Huberman, 1994).
- Qualitizing: the process by which QUAN data are transformed into data that can be analyzed qualitatively (e.g., Tashakkori & Teddlie, 1998).

Following the discussion above, if there is no integration of both types of analysis (i.e. if only QUAN or QUAL type of analysis is performed on the converted data), the design should be considered a *quasi-mixed design*.

Stage of Integration of Approaches. The final decision point is the least important for most researchers: does the integration of approaches occur in the experiential (methodological/analytical) stage only, or does it occur across stages, or other combinations? The most dynamic and innovative of the MM designs contained in the matrix are mixed across stages, so why should we consider selecting a design that is mixed in only the experiential stage?

The answer is simple–because these designs have been described in the literature and because at least one of them (what we label the Concurrent Quasi-Mixed Design in Table 2) is a popular one. In these designs, researchers who are working within one approach primarily (e.g., the QUAN approach) might elect to gather and analyze data associated with the other approach (e.g., the QUAL approach) in order to triangulate data sources, or in order to answer different aspects of the same research question. If the design is "mixed" only in the methodological/analytical stage of the study, without deliberate integration, it should be called a *quasi-mixed design*.

Designs in The Methods-Strands Matrix

The remainder of this article presents some of the more important and widely used designs from the matrix, together with some illustrative diagrams. The illustrative diagrams were first presented in Tashakkori and Teddlie (2003), p. 684-690. The general features of these figures are presented in Box 1.

Box 1
The General Features of Figures 1-7

Rectangles and ovals represent either a QUAL or a QUAN stage of a research strand. If the stages are all rectangles, this indicates that the figure represents a monomethod design. If some of the stages are rectangles and some are ovals, this indicates that the figure represents a MM design.

Each strand found in the figures has three stages (conceptualization, experiential, inferential). The experiential stage is broken into two parts (methodological and analytical) to allow for conversion designs. We have divided the experiential stage into two parts methodological/analytical on all figures for the sake of consistency.

There is a broken line arrow in each figure going from the inferential stage to the methodological stage. This indicates that conclusions emerging from the inferential stage of a study may lead to the gathering of further data and further analysis in the same study. The methodological-analytical-inferential loop of each diagram is iterative.

These figures were first presented in Tashakkori and Teddlie (2003), pp. 684-690.

Monomethod Designs

There are two types of monomethod research designs, those with only one strand (Cell One in Table 2) and those with more than one strand (Cell Two in Table 2). Cell One designs are Monomethod Monostrand designs, while Cell Two designs are Monomethod Multistrand designs.

Monomethod Monostrand Designs. Cell One designs use a single research method or data collection technique (QUAN or QUAL) and corresponding data analysis procedures to answer research questions employing one strand only. This strand may be either QUAN or QUAL, but not both. All stages within the strand (conceptualization, experiential, inferential) are

consistently either QUAN or QUAL. (Refer to Figure 1 for an illustration of Monomethod Monostrand Designs.) Figure 1, presented in a previous section of this article, is an example of such a design.

These designs appear to be the simplest of those presented in Table 2, yet they can be quite complex (e.g., multilevel QUAN designs, detailed ethnographic QUAL designs) and have been written about in numerous books on QUAN and QUAL design. For example, the methodology for ethnographic studies has been discussed in detail in several texts (e.g., Fetterman, 1998; LeCompte & Preissle, 1993).

We will present only one example here, because our focus is on the MM designs in Cells Three and Four. Among the most well known of the QUAN designs in the social and behavioral sciences are the quasi-experimental designs first presented by Campbell and Stanley (1963) and revised in later texts (Cook & Campbell, 1979; Shadish et al., 2002). These authors used a simple notational system in which treatments were designated as X, observations were designated as O (e.g., O_1, O_2), R represented random assignment to treatment, and a dashed line between groups (-----) indicated nonrandom assignment to treatment. For example, the following quasi-experimental design was presented in Campbell and Stanley (1963) as the nonequivalent control group design:

O_1	X	O_2
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O_1		O_2

When quasi-experimental studies involve the collection of QUAN data only, they are examples of Monomethod Monostrand Designs.

Monomethod Multistrand Designs. Cell Two designs employ a single method or data collection technique (QUAN or QUAL) and corresponding data analysis procedures to answer research questions. These designs use two or more strands, which may be either QUAN or QUAL, but not both. There are two types of Monomethod Multistrand Designs:

- Concurrent Monomethod Multistrand Designs. In Cell Two of Table 2 these designs are designated as QUAN + QUAN or QUAL + QUAL. In these designs, there are multiple strands of the research design which occur in a parallel manner. All stages within the strands (conceptualization, experiential, inferential) are consistently either QUAN or QUAL.
- Sequential Monomethod Multistrand Designs. In Table 2, these are designated as QUAN→QUAN or QUAL→QUAL. In these designs, there are multiple strands of the research design which occur in a sequential or chronological order. All stages within the strands (conceptualization, experiential, inferential) are consistently either QUAN or QUAL. The second (or subsequent) strand(s) of the study emerge from the outcome and inferences of a previous strand.

The Concurrent Monomethod Multistrand Design is illustrated in Figure 2. The designs in Cell Two were foreshadowed by the multimethod-multitrait matrix of Campbell and Fiske (1959). Their study presented one of the first explicit "multimethod" designs in the social and behavioral sciences. Specifically, it utilized more than one QUAN method (e.g., a structured interview that yielded QUAN data, a structured observation protocol that also yielded QUAN data) to measure a single psychological trait.[6] (Refer to Figure 2 for an illustration of Concurrent Monomethod multistrand Designs.)

Mixed Methods Designs

There are two types of MM designs, those with only one strand (Cell Three in Table 2) and those with more than one strand (Cell Four in Table 2). Cell Three designs are Mixed Methods Monostrand Designs, while Cell Four designs are Mixed Methods Multistrand designs.

Mixed Methods Monostrand Designs. These are the simplest of the MM designs, involving only one strand of a research study, yet including both QUAL and QUAN components. Because only one type of data is analyzed and only one type of inference (QUAL or QUAN) is made, we labeled these designs as *quasi-mixed* above.

We discuss only one design from Cell Three in detail in this section: the Monostrand Conversion Design. (Refer to Figure 3 for an illustration of Monostrand Conversion Designs.) There are some important points regarding the Monostrand Conversion Design:

- In general, conversion designs allow for data transformation where one data form is converted into the other and then analyzed accordingly. Conversion designs represent the third distinct way to implement MM designs, in addition to concurrent and sequential designs.
- Monostrand Conversion Designs (also known as the Simple Conversion Design) are utilized in single strand studies in which research questions are answered through an analysis of transformed data (i.e., quantitized or qualitized data). These studies are mixed because they switch approach in the experiential phase of the

study, when the data that were originally collected (narrative, numeric) are converted into the other form (numeric, narrative). Figure 3 depicts the monostrand conversion designs, with the transformation of data type occurring between the methodological and the analytical components of the experiential stage.

- Monostrand conversion designs may be planned before the study actually occurs, but many applications of this design occur serendipitously as a study unfolds. For instance, a researcher may determine that there are emerging patterns in the information gleaned from narrative interview data that can be converted into numerical form and then analyzed statistically, thereby allowing for a more thorough analysis of the data. Monostrand conversion designs are often serendipitously occurring, unplanned, emerging designs that may be employed together with other preplanned research strands.

An interesting attribute of the Monostrand Conversion Design is that it has been used extensively in both the QUAN and QUAL traditions, without being recognized as "mixed" (for examples, see Hunter & Brewer, 2003; Maxwell & Loomis, 2003; Waszak & Sines, 2003). Some of the explicit descriptions of quantitizing data in the MM research literature include:

- Morse's (1989) study of teenage mothers and the frequency of their use of the word "stuff", converting that word into a frequency count that demonstrated the childish mode of speech used by young women with adult responsibilities.
- Miles and Hubernan's (1994) conversion of narrative data from their school improvement studies into frequency counts or rating scales; for example, their conversion of the described "roughness" or "smoothness" of the implementation process into three-to-five point scales.
- Sandelowski, Harris, and Holditch-Davis' (1991) transformation of interview data into a frequency distribution that compared the "numbers of couples having and not having an amniocentesis with the number of physicians encouraging or not encouraging them to have the procedure" which was then analyzed statistically to determine the "relationship between physician encouragement and couple decision to have an amniocentesis" (Sandelowski, 2003, p. 327).

Mixed Methods Multistrand Designs. Cell Four of Table 2 contains the Mixed Methods Multistrand Designs, which are the most complex of the designs in the matrix. All of these designs contain mixed methods and at least two research strands. Mixing of the QUAL and QUAN approaches may occur both within and across all three stages of the study. There are four of these designs, which we consider to be the most valuable

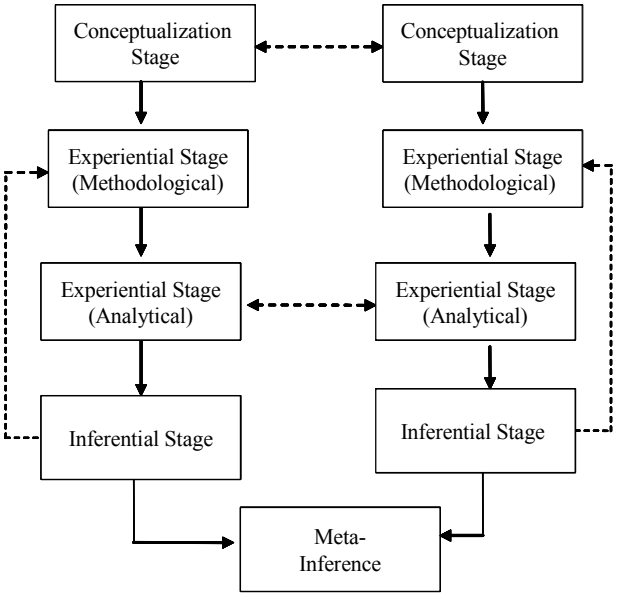

Figure 2. Graphic Presentation of Concurrent Monomethod Multistrand Designs (two QUAN strands or two QUAL strands)

of the MM designs presented in Table 2[7]:

- Concurrent Mixed Design
- Sequential Mixed Designs
- Conversion Mixed Designs
- Fully Integrated Mixed Designs

These four types of designs are families of designs. There may be several permutations of members of these families based on other design criteria (e.g., priority of methodological approach).

Concurrent Mixed Designs are designs in which there are at least two relatively independent strands: one with QUAL questions and data collection and analysis techniques and the other with QUAN questions and data collection and analysis techniques. Inferences made on the basis of the results from each strand are synthesized to form meta-inferences at the end of the study. (Refer to Figure 4 for an illustration of Concurrent Mixed Designs.)

A major advantage of MM research is that it enables researchers simultaneously to ask confirmatory and exploratory questions, and therefore verify and generate theory in the same study. Concurrent Mixed Designs use QUAL and QUAN data and analyses in independent strands to answer exploratory (typically, but not always, QUAL) and confirmatory (typically, but not always, QUAN) questions.

An example of such a design is a World Bank Guatemala Poverty Assessment (described in Rao & Woolcock, 2003). The QUAN strand of the study included survey data. Based on these (survey) data, a purposive sample of five pairs of villages was selected for QUAL study. The two strands of the study were kept independent (including the investigator teams) until after all data analyses were finished. Mixing happened at the inference stage. The integration provided:

> … a more accurate map of the spatial and demographic diversity of the poor, as well as, crucially, a sense of the immediate context within which poverty was experienced by different ethnic groups, details of the local mechanisms that excluded them from participation in mainstream economic and civic activities, and the nature of the barriers they encountered in their efforts to advance their interests and aspirations. (Rao & Woolcock, 2003, p. 173)

Lopez and Tashakkori (2006) provide another example of a concurrent mixed study of the effects of two types of bilingual education programs on attitudes and academic achievement of fifth-grade students. The QUAN strand of the study included standardized achievement tests in various academic subjects, as well as linguistic competence in English and Spanish, and utilized a Likert-type scale measuring self-perceptions as well as self-beliefs in relation to bilingualism. The QUAL strand consisted of interviews with a random sample of

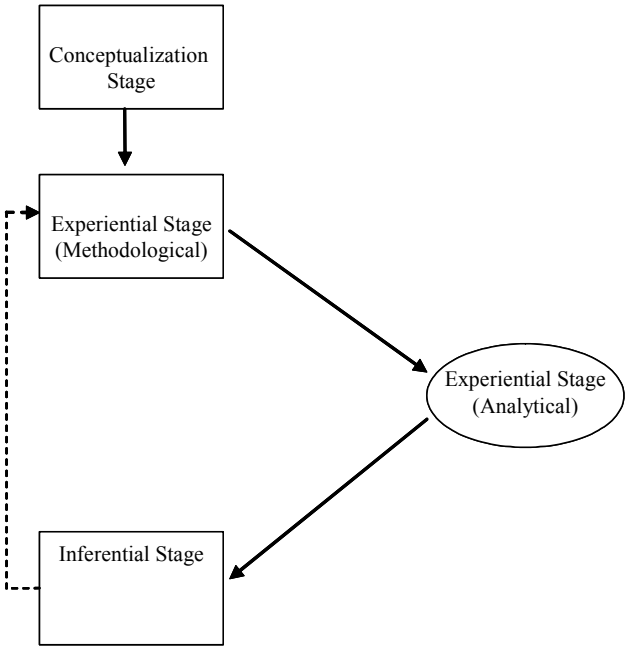

Figure 3. Graphic Presentation of Monostrand Conversion Design (Quasi-Mixed design)

32 students in the two programs. Each set of data were analyzed independently, and conclusions were drawn. The findings of the two studies were integrated by (a) comparing and contrasting the conclusions, and (b) by trying to construct a more comprehensive understanding of how the two programs impacted the children.

While Concurrent Mixed Designs are very powerful, they are challenging to conduct due to the complexity of running multiple strands of research simultaneously. As in the World Bank study mentioned above, different teams of researchers may be required to conduct these studies as was the case with a study described by Trend (1978). This study involved the concurrent, but separate, collection of QUAN and QUAL data on a federal housing-subsidy program. In this study, which was set up as a Concurrent Mixed Design[8], a team of quantitatively oriented evaluators conducted the QUAN strand, whereas anthropologists conducted the QUAL strand. The components of the study were as follows:

1. The QUAN strand was set up to determine if the use of direct cash housing allowance payments would assist low-income families to obtain decent housing on the open market. The QUAN strand involved an analysis of three "pre-experiments" (Campbell & Stanley, 1963) that generated mostly survey data on agency activities, expenses, demographic characteristics of clients, and housing quality.
2. The QUAL strand involved the generation of case studies by observers using field observations, interviews, and documents. The purpose of the case studies was to provide a holistic description of what actually occurred at the program sites.

The QUAN data were expected to determine the success of the program, while the QUAL case studies were used to provide a picture of program process. Meta-inferences across the two independent strands were employed to reconcile the information gleaned from the two concurrent strands.

Concurrent Mixed Designs are difficult for novice researchers or researchers working alone to conduct for several reasons:

- In general, it requires considerable expertise to examine simultaneously and separately the same phenomenon using two different approaches.
- Specifically, the simultaneous analysis of QUAN and QUAL data sources and then the integration of those results into a coherent set of findings and inferences is difficult.
- Particular problems may develop when the results are discrepant, and the novice and/or solo investigator may be unable to interpret and/or resolve these inconsistencies in order to make meta-inferences.

Hence, the very powerful Concurrent Mixed Designs are best accomplished using a collaborative team approach in which each member of the group can contribute to the complex, simultaneously evolving research design.

Sequential Mixed Designs are designs in which there are at least two strands that occur chronologically (QUAN→QUAL or QUAL→QUAN). The conclusions that are made on the basis of the results of the first strand lead to formulation of questions, data collection, and data analysis for the next strand. The final inferences are

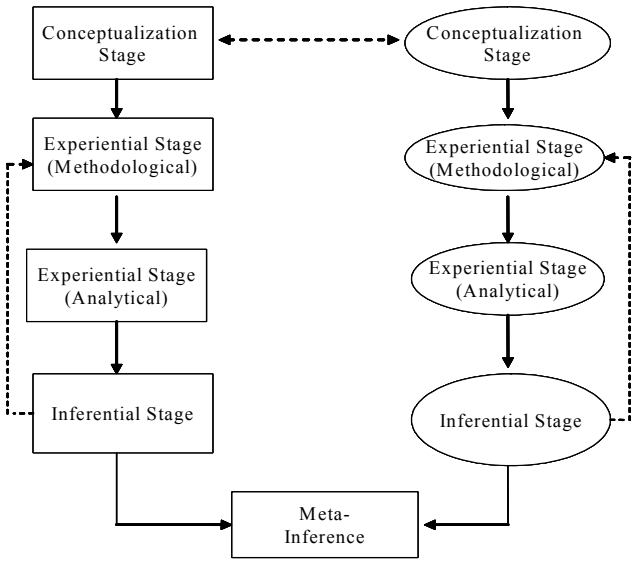

Figure 4. Graphic Presentation of Concurrent Mixed Design

based on the results of both strands of the study. The second strand of the study is conducted either to confirm/disconfirm the inferences of the first strand or to provide further explanation for findings from the first strand (Tashakkori & Teddlie, 2003, p. 715). (Refer to Figure 5 for an illustration of Sequential Mixed Designs.)

Sequential Mixed Designs answer exploratory and confirmatory questions chronologically in a pre-specified order. While still difficult, these designs are easier to conduct by the solo investigator than the Concurrent Mixed Designs, because it is easier to keep the strands separate and the studies typically unfold slower and in a more predictable manner.

We have had a series of graduate students conduct dissertations with Sequential Mixed Designs over the past several years (e.g., Aaron, 2005; Cakan, 1999; Kochan, 1998; Lasserre-Cortez, 2006; Stevens, 2001; Wu, 2005). Some of these dissertations used more complex combinations of the two approaches rather than a simple sequential study. For example, Wu's (2005) dissertation consisted of a QUAL strand (administrator interviews) as well as a quantitative (survey) one. In each strand, data were collected and analyzed independently, similar to a concurrent mixed design. However, the strongest inferences were gleaned when a sequential data analysis was performed in which the themes obtained from the QUAL strand were used for comparison of the QUAN data. The inconsistency between the inferences of the two strands was the most striking conclusion from the study, in that it revealed a gap between the student applicants' and college administrators' perceptions of factors impacting college choice in Taiwan.

It is often difficult for students to think both retrospectively and prospectively when developing and defending a proposal, especially when they are just beginning to master the knowledge base in a given area. Students like the Sequential Mixed Designs because they allow them to address some issues already discussed in the literature in one phase of the study and then contribute to the knowledge base in an exploratory manner in another phase of the study.

An example of a Sequential QUAL→QUAN Mixed Design comes from the consumer marketing literature (Hausman, 2000). The first part of the study was exploratory in nature utilizing semi-structured interviews to examine several questions related to impulse buying. Results from these interviews were then used to generate a series of hypotheses related to this phenomenon. The semi-structured interviews in the first part of the study examined several research questions:

- What are consumers' attitudes toward shopping?
- How do consumers make buying decisions?
- How do buying decisions result in impulse buying?

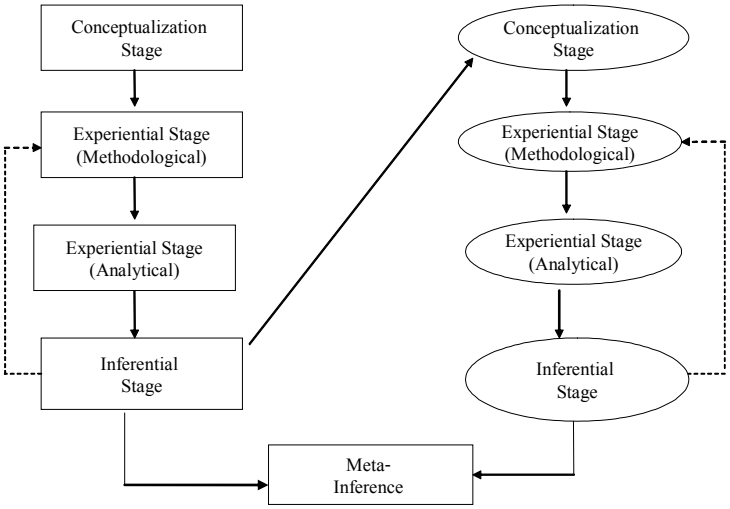

Figure 5. Graphic Presentation of Sequential Mixed Design

Trained interviewers conducted 60 interviews with consumers, and the resultant data were analyzed using grounded theory techniques. Hausman (2000, p. 406) noted that this "methodology yields hypotheses empirically grounded in the data."

Based on these analyses, a series of five hypotheses were developed and tested using a 75-item questionnaire generated for the purposes of this study. A final sample of 272 consumers completed the questionnaire. Hypothesis testing involved both correlational and analysis of variance techniques. Significant results were identified for three of the hypotheses:

- Individual consumers' impulse buying is correlated with their desires to fulfill hedonic needs (e.g., fun, novelty, surprise).
- Individual consumer impulse buying behavior is correlated with desires to satisfy self-esteem considerations.
- Perceptions of decision-making accuracy mediate impulse buying.

The Conversion Mixed Design is a multistrand concurrent design in which mixing of QUAL and QUAN approaches occurs in all components/stages, with data transformed (qualitized or quantitized) and analyzed both qualitatively and quantitatively (Tashakkori & Teddlie, 2003, p. 706). In these designs, one type of data (e.g., QUAL) is gathered and is analyzed accordingly (QUAL) and then transformed and analyzed using the other methodological approach (e.g., quantitized).

Witcher, Onwuegbuzie, Collins, Filer, and Wiedmaier (2003) conducted a Conversion Mixed Design, which was subsequently described by Onwuegbuzie and Leech (2004). In this study, the researchers gathered QUAL data from 912 undergraduate and graduate students regarding their perceptions of the characteristics of effective college teachers. A QUAL thematic analysis revealed nine characteristics of effective college teachers, including student-centeredness and enthusiasm about teaching. The researchers then quantitized the data by assigning binary values for each of the students for each of the themes. Thus, if a female graduate student made responses that indicated that she thought student-centeredness was a characteristic of effective college teaching, that student received a score of "1" for that theme. On the other hand, if another student did not make responses indicating that he thought student-centeredness was a characteristic of effective college students, that student received a score of "0" for that theme. A series of binary codes (1, 0) were assigned to each student for each characteristic of effective teaching, resulting in what Witcher et al. (2003) called an inter-respondent-matrix (participant X theme matrix).

The analysts then subjected these quantitized ("binarized") data to a series of analyses that enabled them to statistically associate each of the nine themes of effective college teaching with four demographic variables (gender, race, undergraduate or graduate status, and preservice service status). The researchers were able to connect students with certain demographic characteristics with preferences for certain effective teaching characteristics (e.g., females were more likely to endorse student-centeredness than were male students).

Thus, one type of data (QUAL) was subjected to both thematic and statistical analysis and meta-inferences were possible using both types of data simultaneously. Onwuegbuzie and Leech (2004) concluded that "… subjecting quantitized data to statistical analysis aided Witcher et al. in the interpretation of the qualitative themes" (p. 784).

The Fully Integrated Mixed Design, to use a British phrase, is the "Full Monty" of MM designs: a multistrand concurrent design in which mixing of QUAL and QUAN approaches occurs in an interactive (i.e., dynamic, reciprocal, interdependent, iterative) manner at all stages of the study. At each stage, one approach (e.g., QUAL) affects the formulation of the other (e.g., QUAN) (Tashakkori & Teddlie, 2003, p. 708). (Refer to Figure 6 for an illustration of Fully Integrated Mixed Design.)

The Louisiana School Effectiveness Study (Teddlie & Stringfield, 1993) included a longitudinal study of eight matched pairs of schools initially classified as either effective or ineffective using baseline achievement score data collected at time one (T_1, 1982-84) across two phases of the study (T_2, 1984-85 and T_3, 1989-90). There were two basic questions that characterized the longitudinal third and fourth phases of the study (LSES-III and IV with data gathering conducted at T_2 and T_3 respectively):

- Would the eight matched pairs of more effective and less effective schools remain differentially effective over time, or would some schools increase or decrease in effectiveness status over time? The major QUAN data used to answer this question were achievement scores and indices of student socioeconomic status.
- What are the processes whereby schools remain the same or change over time with regard to how well they educate their students? The major QUAL data used to answer this question were classroom and school level observations and interviews with students, teachers, and principals.

The LSES employed a Fully Integrated Mixed Design as follows:

- At the conceptualization stage, the formulation of the QUAN oriented questions informed the

formulation of the QUAL oriented questions, and vice versa.
- At the experiential (methodological/analytical) stage, QUAL data were quantitized and analyzed statistically, and QUAN data were qualitized and profiles of schools were generated. The results of these statistical and profile analyses further affected the formulation of additional QUAL and QUAN analyses.
- The two major QUAN and QUAL strands, and their crossover analyses, directly influenced the formulation of the meta-inferences, which resulted in a dozen or so major conclusions, each of which involved triangulated data.
- This complex design was accomplished with the services of a research team that had a wide variety of methodological and experiential backgrounds, as recommended by Shulha and Wilson (2003).

As noted throughout this article, there are also quasi-mixed multi-strand designs in Cell Four of Table 2. It should be evident to the reader that in the multi-strand designs, one approach/strand might only be a small part of the overall study. For example, in a Concurrent Quasi-Mixed Study, limited QUAN survey data might be collected and analyzed, in order to provide insights about a relatively larger group of respondents than the QUAL study was able to generate.

Examples of studies in which one or the other approach minimally contributes to the final inferences are the following:

- A sociological study conducted in the QUAN tradition with hypotheses predicting significant relationships between several predictor variables (e.g., self report items measuring length of marriage, number of children, feelings of affection toward spouse, age, gender) and marital satisfaction (another self report item). In addition to the QUAN self report items, the participants were asked to complete an open-ended item asking them to define what "marital satisfaction" meant to them. The most important data were the participants' responses to the QUAN items which were analyzed statistically to test the predicted relationships, but the complementary QUAL information on what the couples thought "marital satisfaction" meant provided interesting "side bar" results. The inferences from the study were made deductively within the postpositivist framework of sociological prediction studies, but the conclusions also included some anecdotal evidence from the participants.
- An ethnographic study of a large city police force conducted by an anthropologist who had gained entry into the social setting and was operating as a participant observer. The orientation of the study was inductive and constructivist in nature, and the most important data were the observations and interviews that the anthropologist conducted. The researcher also collected some QUAN information in the

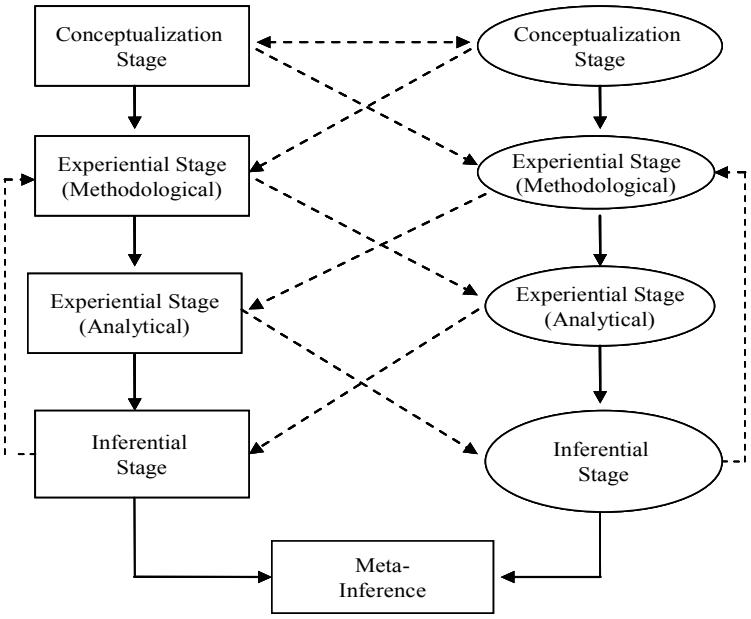

Figure 6. Graphic Presentation of Fully Integrated Mixed Design

form of work time data (number of hours spent in various activities during shifts), percentage of ethnic minorities and women on the police force, percentage of minorities and women among those arrested, and so forth. The inferences from the study were made within the constructivist framework of the ethnographic anthropology, but the conclusions also included interesting QUAN data that helped strengthen some interpretations.

Summary

This article presents the Methods-Strands Matrix, which features MM research designs, especially four families of MM designs: sequential, concurrent, conversion, and fully integrated. Before discussing the matrix, we briefly discussed (a) why typologies of MM research designs are useful and (b) the dimensions that have been used by various authors to create MM design typologies.

We devoted much of the article to an extended discussion of our typology of MM research designs illustrated in the Methods-Strands Matrix. This matrix conceptually includes all designs, but emphasizes the mixed methods ones, which were presented as a family of designs that differ with regard to three key criteria and one less important criterion:

- Number of methodological approaches used
- Number of strands in the research design
- Type of implementation process
- Stage of integration - a distinction was made between Mixed Methods Designs (in which integration happens in more than one stage) and Quasi-Mixed Designs (in which there are two types of data and analysis, but no integration of the inferences occurs).

Four families of mixed methods designs were featured in the matrix. Examples of these families of designs were presented throughout the article.

Based on the information presented in this article and other sources, we (Teddlie & Tashakkori, forthcoming) have developed a seven step process for researchers selecting the best design for their projects from our matrix or another of the available typologies:

1. The researcher must first determine if her research questions require a monomethod or MM design.
2. The researcher should be aware that here are a number of typologies of MM research designs and should know how to access details regarding them.
3. The researcher wants to select the best MM research design for her particular study and assumes that one of the published typologies includes the right design for her project.
4. Typologies may be differentiated by the criteria that are used to distinguish among the research designs within them, and the researcher needs to know those criteria.
5. These criteria should be listed by the researcher, who may then select the criteria that are most important to her for the particular study she is designing.
6. The researcher then applies the selected criteria to potential designs, ultimately selecting the best research design for her study.
7. In some cases, the researcher may have to develop a new mixed methods design, because no one best design exists for her research project.

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Notes

[1]This article is based on a paper presented by the authors at the 2005 Annual Meeting of the American Educational Research Association (Teddlie & Tashakkori, 2005).

[2]Our typology actually emphasizes the first three criteria (number of methodological approaches, number of strands, type of implementation process) as described throughout this text. The fourth criterion, stage of implementation, is retained because it allows for the inclusion of quasi-mixed designs, which are defined later in this article.

[3]Therefore, we have dropped the term "model" to avoid confusion. Our previously defined (Tashakkori & Teddlie, 2003) "mixed model designs" are now simply "mixed designs". Our previously defined "mixed designs" are now "quasi-mixed designs."

[4]See Tashakkori and Teddlie (2003, pp. 685-689) for more details regarding these designs (mixed at the experiential stage only).

[5]It is important to note that multistrand designs are illustrated as having only two strands throughout this chapter for the sake of simplicity. They could be more complex, involving three or more strands (e.g., QUAL→QUAN→QUAL).

[6]What Campbell and Fiske (1959) called "multimethod" is what we call "multistrand " in Cell Two with two exceptions: (1) they referred only to QUAN designs, while we also refer to QUAL methods and (2) their model emphasized the methods stage alone, while we have added the conceptualization and inferential stages in our matrix.

[7]Once again, if mixing occurs in the experiential stage only, then these designs should be considered *quasi-mixed.*

[8]Throughout this chapter, we refer to particular studies as being examples of designs from our matrix. The authors of the original studies did not use these design names, because they were not introduced into the research literature until 2003. Our designation of these

studies as particular types of mixed methods designs is based on an ex post facto analysis of their characteristics.