The Qualitative Report Volume 12 Number 2 June 2007 281-316
http://www.nova.edu/ssss/QR/QR12-2/onwuegbuzie2.pdf

A Typology of Mixed Methods Sampling Designs in Social Science Research

Anthony J. Onwuegbuzie
Sam Houston State University, Huntsville, Texas

Kathleen M. T. Collins
University of Arkansas, Fayetteville, Arkansas

This paper provides a framework for developing sampling designs in mixed methods research. First, we present sampling schemes that have been associated with quantitative and qualitative research. Second, we discuss sample size considerations and provide sample size recommendations for each of the major research designs for quantitative and qualitative approaches. Third, we provide a sampling design typology and we demonstrate how sampling designs can be classified according to time orientation of the components and relationship of the qualitative and quantitative sample. Fourth, we present four major crises to mixed methods research and indicate how each crisis may be used to guide sampling design considerations. Finally, we emphasize how sampling design impacts the extent to which researchers can generalize their findings. Key Words: Sampling Schemes, Qualitative Research, Generalization, Parallel Sampling Designs, Pairwise Sampling Designs, Subgroup Sampling Designs, Nested Sampling Designs, and Multilevel Sampling Designs

Sampling, which is the process of selecting "a portion, piece, or segment that is representative of a whole" (The American Heritage College Dictionary, 1993, p. 1206), is an important step in the research process because it helps to inform the quality of inferences made by the researcher that stem from the underlying findings. In both quantitative and qualitative studies, researchers must decide the number of participants to select (i.e., sample size) and how to select these sample members (i.e., sampling scheme). While the decisions can be difficult for both qualitative and quantitative researchers, sampling strategies are even more complex for studies in which qualitative and quantitative research approaches are combined either concurrently or sequentially. Studies that combine or mix qualitative and quantitative research techniques fall into a class of research that are appropriately called mixed methods research or mixed research. Sampling decisions typically are more complicated in mixed methods research because sampling schemes must be designed for both the qualitative and quantitative research components of these studies.

Despite the fact that mixed methods studies have now become popularized, and despite the number of books (Brewer & Hunter, 1989; Bryman, 1989; Cook & Reichardt, 1979; Creswell, 1994; Greene & Caracelli, 1997; Newman & Benz, 1998; Reichardt & Rallis, 1994; Tashakkori & Teddlie, 1998, 2003a), book chapters (Creswell, 1999, 2002; Jick, 1983; Li, Marquart, & Zercher, 2000; McMillan & Schumacher, 2001; Onwuegbuzie,

Jiao, & Bostick, 2004; Onwuegbuzie & Johnson, 2004; Smith, 1986), and methodological articles (Caracelli & Greene, 1993; Dzurec & Abraham, 1993; Greene, Caracelli, & Graham, 1989; Greene, & McClintock, 1985; Gueulette, Newgent, & Newman, 1999; Howe, 1988, 1992; Jick, 1979; Johnson & Onwuegbuzie, 2004; Laurie & Sullivan, 1991; Morgan, 1998; Morse, 1991, 1996; Onwuegbuzie, 2002a; Onwuegbuzie & Leech, 2004b, 2005a; Rossman & Wilson, 1985; Sandelowski, 2001; Sechrest & Sidana, 1995; Sieber, 1973; Tashakkori & Teddlie, 2003b; Waysman & Savaya, 1997) devoted to mixed methods research, relatively little has been written on the topic of sampling. In fact, at the time of writing1, with the exception of Kemper, Stringfield, and Teddlie (2003) and Onwuegbuzie and Leech (2005a), discussion of sampling schemes has taken place in ways that link research paradigm to method. Specifically, random sampling schemes are presented as belonging to the quantitative paradigm, whereas non-random sampling schemes are presented as belonging to the qualitative paradigm. As noted by Onwuegbuzie and Leech (2005a), this represents a false dichotomy. Rather, both random and non-random sampling can be used in quantitative and qualitative studies.

Similarly, discussion of sample size considerations tends to be dichotomized, with small samples being associated with qualitative research and large samples being associated with quantitative studies. Although this represents the most common way of linking sample size to research paradigm, this representation is too simplistic and thereby misleading. Indeed, there are times when it is appropriate to use small samples in quantitative research, while there are occasions when it is justified to use large samples in qualitative research.

With this in mind, the purpose of this paper is to provide a framework for developing sampling designs in mixed methods research. First, we present the most common sampling schemes that have been associated with both quantitative and qualitative research. We contend that although sampling schemes traditionally have been linked to research paradigm (e.g., random sampling has been associated with quantitative research) in research methodology textbooks (Onwuegbuzie & Leech, 2005b), this is not consistent with practice. Second, we discuss the importance of researchers making sample size considerations in both quantitative and qualitative research. We then provide sample size recommendations for each of the major research designs for both approaches. Third, we provide a typology of sampling designs in mixed methods research. Here, we demonstrate how sampling designs can be classified according to: (a) the time orientation of a study's components (i.e., whether the qualitative and quantitative components occur simultaneously or sequentially) and (b) the relationship of the qualitative and quantitative samples (e.g., identical vs. nested). Fourth, we present the four major crises or challenges to mixed methods research: representation, legitimation, integration, and politics. These crises are then used to provide guidelines for making sampling design considerations. Finally, we emphasize how choice of sampling design helps to determine the extent to which researchers can generalize their findings and make what Tashakkori and Teddlie (2003c, p. 687) refer to as "meta-inferences;" namely, the term they give to describe the integration of generalizable inferences that are derived on the basis of findings stemming from the qualitative and quantitative components of a mixed methods study.

---

1 Since this article was accepted for publication, the following three articles in the area of mixed methods sampling have emerged: Teddlie and Yu (2007) and Collins et al. (2006, 2007). Each of these three articles cites the present article, and the latter two articles used the framework of the current article. However, despite these additions to the literature, it is still accurate for us to state that relatively little has been written in this area.

For the purposes of the present article, we distinguish between sampling schemes and sampling designs. We define sampling schemes as specific strategies used to select units (e.g., people, groups, events, settings). Conversely, sampling designs represent the framework within which the sampling takes place, including the number and types of sampling schemes as well as the sample size.

The next section presents the major sampling schemes. This is directly followed by a section on sample size considerations. After discussing sampling schemes and sample sizes, a presentation of sampling designs ensues. Indeed, a typology of sampling designs is outlined that incorporates all of the available sampling schemes.

Sampling Schemes

According to Curtis, Gesler, Smith, and Washburn (2000) and Onwuegbuzie and Leech (2005c, 2007a), some kind of generalizing typically occurs in both quantitative and qualitative research. Quantitative researchers tend to make "statistical" generalizations, which involve generalizing findings and inferences from a representative statistical sample to the population from which the sample was drawn. In contrast, many qualitative researchers, although not all, tend to make "analytic" generalizations (Miles & Huberman, 1994), which are "applied to wider theory on the basis of how selected cases 'fit' with general constructs" (Curtis et al., 2000, p. 1002); or they make generalizations that involve case-to-case transfer (Firestone, 1993; Kennedy, 1979). In other words, statistical generalizability refers to representativeness (i.e., some form of universal generalizability), whereas analytic generalizability and case-to-case transfer relate to conceptual power (Miles & Huberman, 1994). Therefore, the process of sampling is important to both quantitative and qualitative research. Unfortunately, a false dichotomy appears to prevail with respect to sampling schemes available to quantitative and qualitative researchers. As noted by Onwuegbuzie and Leech (2005b), random sampling tends to be associated with quantitative research, whereas non-random sampling typically is linked to qualitative research. However, choice of sampling class (i.e., random vs. non-random) should be based on the type of generalization of interest (i.e., statistical vs. analytic). In fact, qualitative research can involve random sampling. For example, Carrese, Mullaney, and Faden (2002) used random sampling techniques to select 20 chronically ill housebound patients (aged 75 years or older), who were subsequently interviewed to examine how elderly patients think about and approach future illness and the end of life. Similarly, non-random sampling techniques can be used in quantitative studies. Indeed, although this adversely affects the external validity (i.e., generalizability) of findings, the majority of quantitative research studies utilize non-random samples (cf. Leech & Onwuegbuzie, 2002). Breaking down this false dichotomy significantly increases the options that both qualitative and quantitative researchers have for selecting their samples.

Building on the work of Patton (1990) and Miles and Huberman (1994), Onwuegbuzie and Leech (2007a) identified 24 sampling schemes that they contend both qualitative and quantitative researchers have available for use. All of these sampling schemes fall into one of two classes: random sampling (i.e., probabilistic sampling) schemes or non-random sampling (i.e., non-probabilistic sampling) schemes. These sampling schemes encompass methods for selecting samples that have been traditionally associated with the qualitative paradigm (i.e., non-random sampling schemes) and those that have been typically

associated with the quantitative paradigm (i.e., random sampling schemes). Table 1 (below) presents a matrix that crosses type of sampling scheme (i.e., random vs. non-random) and research approach (qualitative vs. quantitative). Because the vast majority of both qualitative and quantitative studies use non-random samples, Type 4 (as shown in Table 1) is by far the most common combination of sampling schemes in mixed methods used, regardless of mixed methods research goal (i.e., to predict; add to the knowledge base; have a personal, social, institutional, and/or organizational impact; measure change; understand complex phenomena; test new ideas; generate new ideas; inform constituencies; or examine the past; Newman, Ridenour, Newman, & DeMarco, 2003), research objective (i.e., exploration, description, explanation, prediction, or influence; Johnson & Christensen, 2004), research purpose (i.e., triangulation, or seeking convergence of findings; complementarity, or examining different overlapping aspects of a phenomenon; initiation, or discerning paradoxes and contradictions; development, or using the results from the first method to inform the use of the second method; or expansion, adding breath and scope to a study; Greene et al., 1989), and research question. Conversely, Type 1, involving random sampling for both the qualitative and quantitative components of a mixed methods study, is the least common. Type 3, involving random sampling for the qualitative component(s) and non-random sampling for the quantitative component(s) also is rare. Finally, Type 2, consisting of non-random sampling for the qualitative component(s) and random sampling for the quantitative component(s) is the second most common combination.

Table 1

Matrix Crossing Type of Sampling Scheme by Research Approach

		Qualitative Component(s)	
		Random Sampling	Non-Random Sampling
Quantitative Component(s)	Random Sampling	Rare Combination (Type 1)	Occasional Combination (Type 2)
	Non-Random Sampling	Very Rare Combination (Type 3)	Frequent Combination (Type 4)

Random (Probability) Sampling

Before deciding on the sampling scheme, mixed methods researchers must decide what the objective of the study is. For example, if the objective of the study is to generalize the quantitative and/or qualitative findings to the population from which the sample was drawn (i.e., make inferences), then the researcher should attempt to select a sample for that component that is random. In this situation, the mixed method researcher can select one of five random (i.e., probability) sampling schemes at one or more stages of the research process: simple random sampling, stratified random sampling, cluster random sampling, systematic random sampling, and multi-stage random sampling. Each of these strategies is summarized in Table 2.

Table 2

Major Sampling Schemes in Mixed Methods Research

Sampling Scheme	Description
Simple[a]	Every individual in the sampling frame (i.e., desired population) has an equal and independent chance of being chosen for the study.
Stratified[a]	Sampling frame is divided into sub-sections comprising groups that are relatively homogeneous with respect to one or more characteristics and a random sample from each stratum is selected.
Cluster[a]	Selecting intact groups representing clusters of individuals rather than choosing individuals one at a time.
Systematic[a]	Choosing individuals from a list by selecting every *kth* sampling frame member, where *k* typifies the population divided by the preferred sample size.
Multi-Stage Random[a]	Choosing a sample from the random sampling schemes in multiple stages.
Maximum Variation	Choosing settings, groups, and/or individuals to maximize the range of perspectives investigated in the study.
Homogeneous	Choosing settings, groups, and/or individuals based on similar or specific characteristics.
Critical Case	Choosing settings, groups, and/or individuals based on specific characteristic(s) because their inclusion provides the researcher with compelling insight about a phenomenon of

Theory-Based	interest.
Confirming Disconfirming	Choosing settings, groups, and/or individuals because their inclusion helps the researcher to develop a theory.
Snowball/Chain	After beginning data collection, the researcher conducts subsequent analyses to verify or contradict initial results.
Extreme Case	Participants are asked to recruit individuals to join the study.
	Selecting outlying cases and conducting comparative analyses.

Typical Case	Selecting and analyzing average or normal cases.
Intensity	Choosing settings, groups, and/or individuals because their experiences relative to the phenomena of interest are viewed as intense but not extreme.
Politically Important Case	Choosing settings, groups, and/or individuals to be included or excluded based on their political connections to the phenomena of interest.
Random Purposeful	Selecting random cases from the sampling frame and randomly choosing a desired number of individuals to participate in the study.
Stratified Purposeful	Sampling frame is divided into strata to obtain relatively homogeneous sub-groups and a purposeful sample is selected from each stratum.
Criterion	Choosing settings, groups, and/or individuals because they represent one or more criteria.
Opportunistic	Researcher selects a case based on specific characteristics (i.e., typical, negative, or extreme) to capitalize on developing events occurring during data collection.
Mixed Purposeful	Choosing more than one sampling strategy and comparing the results emerging from both samples.
Convenience	Choosing settings, groups, and/or individuals that are conveniently available and willing to participate in the study.

Quota	Researcher identifies desired characteristics and quotas of sample members to be included in the study.
Multi-Stage Purposeful Random	Choosing settings, groups, and/or individuals representing a sample in two or more stages. The first stage is random selection and the following stages are purposive selection of participants.
Multi-Stage Purposeful	Choosing settings, groups, and/or individuals representing a sample in two or more stages in which all stages reflect purposive sampling of participants.

[a] Represent random (i.e., probabilistic) sampling schemes. All other schemes are non-random.

Non-Random (Non-Probability) Sampling

If the goal is not to generalize to a population but to obtain insights into a phenomenon, individuals, or events (as will often be the case in the qualitative component of a mixed methods study), then the researcher purposefully selects individuals, groups, and settings for this phase that maximize understanding of the underlying phenomenon. Thus, many mixed methods studies utilize some form of purposeful sampling. Here, individuals, groups, and settings are considered for selection if they are "information rich" (Patton, 1990, p. 169). There are currently 19 purposive sampling schemes. These schemes differ with respect to whether they are implemented before data collection has started or after data collection begins (Creswell, 2002). Also, the appropriateness of each scheme is dependent on the research goal, objective, purpose, and question. Each of these non-random sampling schemes is summarized in Table 2.

Thus, mixed methods researchers presently have 24 sampling schemes from which to choose. These 24 designs comprise 5 probability sampling schemes and 19 purposive sampling schemes. For a discussion of these sampling schemes, we refer readers to Collins, Onwuegbuzie, and Jiao (2006, in press), Kemper et al. (2003), Miles and Huberman (1994), Onwuegbuzie and Leech (2007a), Patton (1990), and Teddlie and Yu (2007). As Kemper et al. concluded, "the understanding of a wide range of sampling techniques in one's methodological repertoire greatly increases the likelihood of one's generating findings that are both rich in content and inclusive in scope" (p. 292).

Sample Size

In addition to deciding how to select the samples for the qualitative and quantitative components of a study, mixed methods researchers also should determine appropriate sample sizes for each phase. The choice of sample size is as important as is the choice of sampling scheme because it also determines the extent to which the researcher can make statistical and/or analytic generalizations. Unfortunately, as has been the case with sampling schemes, discussion of sample size considerations has tended to be dichotomized, with small samples being associated with qualitative research and large samples being linked to quantitative

studies. Yet, small samples can be used in quantitative research that represents exploratory research or basic research. In fact, single-subject designs, which routinely utilize quantitative approaches, are characterized by small samples. Conversely, qualitative research can utilize large samples, as in the case of program evaluation research. Moreover, to associate qualitative data analyses with small samples is to ignore the growing body of literature in the area of text mining, the process of analyzing naturally occurring text in order to discover and capture semantic information (see, for example, Del Rio, Kostoff, Garcia, Ramirez, & Humenik, 2002; Liddy, 2000; Powis & Cairns, 2003; Srinivasan, 2004).

The size of the sample should be informed primarily by the research objective, research question(s), and, subsequently, the research design. Table 3 presents minimum sample sizes for several of the most common research designs. The sample sizes corresponding to the traditional quantitative research designs (i.e., correlational, causal-comparative, experimental) are the result of the statistical power analysis undertaken by Onwuegbuzie et al. (2004). According to Onwuegbuzie et al. (2004), many of the sample size guidelines provided in virtually every introductory research methodology and statistics textbook, such as the recommendation of sample sizes of 30 for both correlational and causal-comparative designs (e.g., Charles & Mertler, 2002; Creswell, 2002; Gall, Borg, & Gall, 1996; Gay & Airasian, 2003; McMillan & Schumacher, 2001), if followed, would lead to statistical tests with inadequate power because they are not based on power analyses. For example, for correlational research designs, a minimum sample size of 30 represents a statistical power of only .51 for one-tailed tests for detecting a moderate relationship (i.e., r = .30) between two variables at the 5% level of statistical significance, and a power of .38 for two-tailed tests of moderate relationships (Erdfelder, Faul, & Buchner, 1996; Onwuegbuzie et al., 2004). Therefore, the proposed sample sizes in Table 3 represent sizes for detecting moderate effect sizes with .80 statistical power at the 5% level of significance.

Table 3

Minimum Sample Size Recommendations for Most Common Quantitative and Qualitative Research Designs

Research Design/Method	Minimum Sample Size Suggestion
Research Design[1]	
Correlational	64 participants for one-tailed hypotheses; 82 participants for two-tailed hypotheses (Onwuegbuzie et al., 2004)
Causal-Comparative	51 participants per group for one-tailed hypotheses; 64 participants for two-tailed hypotheses (Onwuegbuzie et al., 2004)
Experimental	21 participants per group for one-tailed hypotheses (Onwuegbuzie et al., 2004)
Case Study	3-5 participants (Creswell, 2002)

Phenomenological	≤ 10 interviews (Creswell, 1998); ≥ 6 (Morse, 1994)
Grounded Theory	15-20 (Creswell, 2002); 20-30 (Creswell, 2007)
Ethnography	1 cultural group (Creswell, 2002); 30-50 interviews (Morse, 1994)
Ethological	100-200 units of observation (Morse, 1994)
Sampling Design	
Subgroup Sampling Design	≥ 3 participants per subgroup (Onwuegbuzie & Leech, 2007c)
Nested Sampling Design	≥ 3 participants per subgroup (Onwuegbuzie & Leech, 2007c)
Data Collection Procedure	
Interview	12 participants (Guest, Bunce, & Johnson, 2006)
Focus Group	6-9 participants (Krueger, 2000); 6-10 participants (Langford, Schoenfeld, & Izzo, 2002; Morgan, 1997); 6-12 participants (Johnson & Christensen, 2004); 6-12 participants (Bernard, 1995); 8–12 participants (Baumgartner, Strong, & Hensley, 2002) 3 to 6 focus groups (Krueger, 1994; Morgan, 1997; Onwuegbuzie, Dickinson, Leech, & Zoran, 2007)

[1] For correlational, causal-comparative, and experimental research designs, the recommended sample sizes represent those needed to detect a medium (using Cohen's [1988] criteria), one-tailed statistically significant relationship or difference with .80 power at the 5% level of significance.

As Sandelowski (1995) stated, "a common misconception about sampling in qualitative research is that numbers are unimportant in ensuring the adequacy of a sampling strategy" (p. 179). However, some methodologists have provided guidelines for selecting samples in qualitative studies based on the research design (e.g., case study, ethnography, phenomenology, grounded theory), sampling design (i.e., subgroup sampling design, nested sampling design), or data collection procedure (i.e., interview, focus group). These recommendations also are summarized in Table 3. In general, sample sizes in qualitative research should not be so small as to make it difficult to achieve data saturation, theoretical saturation, or informational redundancy. At the same time, the sample should not be so large that it is difficult to undertake a deep, case-oriented analysis (Sandelowski, 1995).

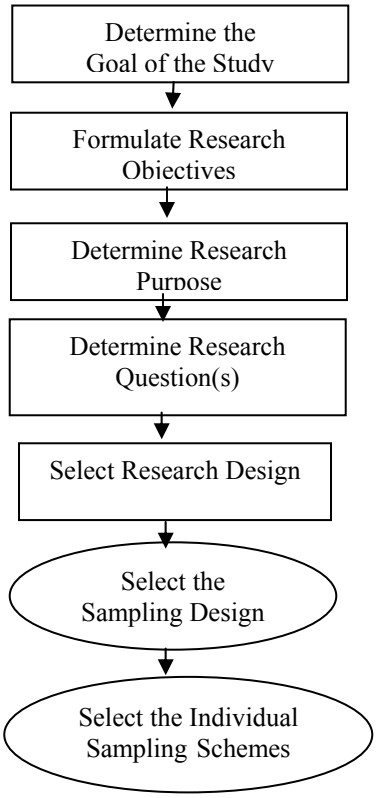
Mixed Methods Sampling Designs

The sampling schemes described in previous sections could be used in isolation. Indeed, each of these sampling schemes could be used in monomethod research that characterizes either solely qualitative or quantitative studies. That is, both qualitative and quantitative researchers can use any of the 24 sampling schemes, as appropriate, to address their research questions. However, in mixed methods research, sampling schemes must be chosen for both the qualitative and quantitative components of the study. Therefore, sampling typically is much more complex in mixed methods studies than in monomethod studies.

In fact, the mixed methods sampling process involves the following seven distinct steps: (a) determine the goal of the study, (b) formulate the research objective(s), (c) determine the research purpose, (d) determine the research question(s), (e) select the research design, (f) select the sampling design, and (g) select the sampling scheme. These steps are presented in Figure 1. From this figure, it can be seen that these steps are linear. That is, the study's goal (e.g., understand complex phenomena, test new ideas) leads to the research objective(s) (e.g., exploration, prediction), which, in turn, leads to a determination of the research purpose (e.g., triangulation, complementarity), which is followed by the selection of the mixed methods research design.

Currently, there are many mixed methods research designs in existence. In the Tashakkori and Teddlie (2003a) book alone, approximately 35 mixed methods research designs are outlined. Thus, in order to simplify researchers' design choices, several typologies have been developed (e.g., Creswell, 1994, 2002; Creswell, Plano Clark, Guttmann, & Hanson, 2003; Greene & Caracelli, 1997; Greene et al., 1989; Johnson & Onwuegbuzie, 2004; Maxwell & Loomis, 2003; McMillan & Schumacher, 2001; Morgan, 1998; Morse, 1991, 2003; Onwuegbuzie & Johnson, 2004; Patton, 1990; Tashakkori & Teddlie, 1998, 2003c). These typologies differ in their levels of complexity. However, most mixed method designs utilize time orientation dimension as its base. Time orientation refers to whether the qualitative and quantitative phases of the study occur at approximately the same point in time such that they are independent of one another (i.e., concurrent) or whether these two components occur one after the other such that the latter phase is dependent, to some degree, on the former phase (i.e., sequential). An example of a concurrent mixed methods design is a study examining attitudes toward reading and reading strategies among fifth-grade students that involves administering a survey containing both closed-ended items (e.g., Likert-format responses that measure attitudes toward reading) and open-ended questions (i.e., that elicit qualitative information about the students' reading strategies). Conversely, an example of a sequential mixed methods design is a descriptive assessment of reading achievement levels among 30 fifth-grade students (quantitative phase), followed by an interview (i.e., qualitative phase) of the highest and lowest 3 fifth-grade students who were identified in the quantitative phase in order to examine their reading strategies. Thus, in order to select a mixed method design, the researcher should decide whether one wants to conduct the phases concurrently (i.e., independently) or sequentially (i.e., dependently). As noted earlier, another decision that the researcher should make relates to the purpose of mixing the quantitative and qualitative approaches (e.g., triangulation, complementarity, initiation, development, expansion).

Figure 1. Steps in the mixed methods sampling process.



Crossing these two dimensions (i.e., time order and purpose of mixing) produces a 2 (concurrent vs. sequential) x 5 (triangulation vs. complementarity vs. initiation vs. development vs. expansion) matrix that produces 10 cells. This matrix is presented in Table 4. This matrix matches the time orientation to the mixed methods purpose. For instance, if the purpose of the mixed methods research is triangulation, then a concurrent design is appropriate such that the quantitative and qualitative data can be triangulated. As noted by Creswell et al. (2003),

> In concurrently gathering both forms of data at the same time, the researcher seeks to compare both forms of data to search for congruent findings (e.g., how the themes identified in the qualitative data collection compare with the statistical results in the quantitative analysis, pp. 217-218).

However, sequential designs are not appropriate for triangulation because when they are utilized either the qualitative or quantitative data are gathered first, such that findings from the first approach might influence those from the second approach, thereby positively biasing any comparisons. On the other hand, if the mixed methods purpose is development, then sequential designs are appropriate because development involves using the methods sequentially, such that the findings from the first method inform the use of the second method. For this reason, concurrent designs do not address development purposes. Similarly, sequential designs only are appropriate for expansion purposes. Finally, both concurrent and

sequential designs can be justified if the mixed method purpose either is complementarity or initiation.

Table 4

Matrix Crossing Purpose of Mixed Methods Research by Time Orientation

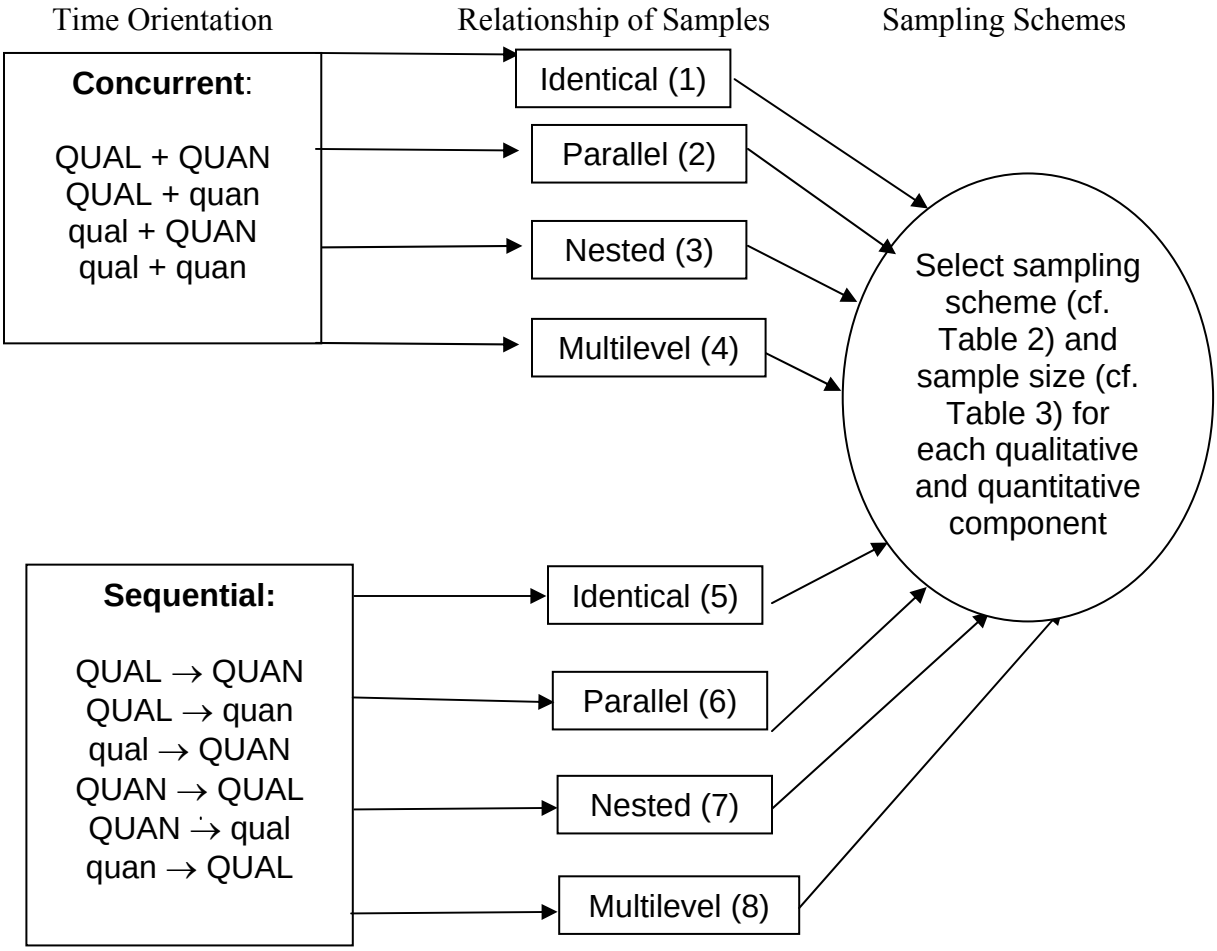
Purpose of Mixed Methods Research	Concurrent Design Appropriate?	Sequential Design Appropriate?
Triangulation	Yes	No
Complementarity	Yes	Yes
Development	No	Yes
Initiation	Yes	Yes
Expansion	No	Yes

Once a decision has been made about the mixed method purpose and design type (i.e., time orientation), the next step is for the researcher to select a mixed methods sampling design. Two criteria are useful here: time orientation (i.e., concurrent vs. sequential) and relationship of the qualitative and quantitative samples. These relationships either can be identical, parallel, nested, or multilevel. An identical relationship indicates that exactly the same sample members participate in both the qualitative and quantitative phases of the study (e.g., administering a survey of reading attitudes and reading strategies to a class of fourth graders that contains both closed- and open-ended items, yielding quantitative and qualitative phases that occur simultaneously). A parallel relationship specifies that the samples for the qualitative and quantitative components of the research are different but are drawn from the same population of interest (e.g., administering a quantitative measure of reading attitudes to one class of third-grade students for the quantitative phase and conducting in-depth interviews and observations examining reading strategies on a small sample of third-grade students from another class within the same school, or from another school for the qualitative phase). A nested relationship implies that the sample members selected for one phase of the study represent a subset of those participants chosen for the other facet of the investigation (e.g., administering a quantitative measure of reading attitudes to one class of third-grade students for the quantitative phase and conducting in-depth interviews and observations examining reading strategies on the lowest- and highest-scoring third-grade students from the same class). Finally, a multilevel relationship involves the use of two or more sets of samples that are extracted from different levels of the study (i.e., different populations). For example, whereas one phase of the investigation (e.g., quantitative phase) might involve the sampling of students within a high school, the other phase (e.g., qualitative) might involve the sampling of their teachers, principal, and/or parents. Thus, the multilevel relationship is similar to what Kemper et al. (2003) call multilevel sampling in mixed methods studies, where Kemper et al. define it as occurring "when probability and purposive sampling techniques are used on different levels of the

study (e.g., student, class, school district)" (p. 287), while in the present conceptualization, multilevel sampling could involve combining probability and purposive sampling techniques in any of the four ways described in Table 1 (i.e., Type 1 - Type 4). Thus, for example, multilevel sampling in mixed methods studies could involve sampling on all levels being purposive or sampling on all levels being random. Therefore, our use of the multilevel is more general and inclusive than that of Kemper et al. The two criteria, time orientation and sample relationship, yield eight different types of major sampling designs that a mixed methods researcher might use. These designs, which are labeled as Design 1 to Design 8, are outlined in our *Two-Dimensional Mixed Methods Sampling Model* in Figure 2.

Design 1 involves a concurrent design using identical samples for both qualitative and quantitative components of the study. An example of a Design 1 sampling design is the study conducted by Daley and Onwuegbuzie (2004). These researchers examined male juvenile delinquents' causal attributions for others' violent behavior, and the salient pieces of information they utilize in arriving at these attributions. A 12-item questionnaire called the Violence Attribution Survey, which was designed by Daley and Onwuegbuzie, was used to assess attributions made by juveniles for the behavior of others involved in violent acts. Each item consisted of a vignette, followed by three possible attributions (i.e., person, stimulus, circumstance), presented using a multiple-choice format (i.e., quantitative component), and an open-ended question asking the juveniles their reasons for choosing the responses that they did (i.e., qualitative component). Participants included 82 male juvenile offenders who were drawn randomly from the population of juveniles incarcerated at correctional facilities in a large southeastern state. By collecting quantitative and qualitative data within the same time frame from the same sample members, the researchers used a concurrent, identical sampling design. Simple random sampling was used to select the identical samples. Because these identical samples were selected randomly, Daley and Onwuegbuzie's combined sampling schemes can be classified as being Type 1 (cf. Table 1).

Figure 2. Two-dimensional mixed methods sampling model providing a typology of mixed methods sampling designs.



Notation: "qual" stands for qualitative, "quan" stands for quantitative, "+" stands for concurrent, "→" stands for sequential, capital letters denote high priority or weight, and lower case letters denote lower priority or weight.

Design 2 involves a concurrent design using parallel samples for the qualitative and quantitative components of the study. An example of a Design 2 sampling design is the study conducted by Collins (2007). The study's purpose was to assess the relationship between college students' reading abilities (i.e., reading vocabulary and reading comprehension scores obtained on a standardized reading test) and students' responses to three questionnaires that measured their attitudes about reading-based assignments, such as writing papers, using library resources, and implementing effective study habits. To triangulate students' responses to the questionnaires, an open-ended interview protocol also was administered. The sample consisted of two sets of undergraduate students enrolled in two developmental reading courses. Both samples completed the standardized test. The first sample completed the three questionnaires that measured their attitudes about reading-based assignments. The second sample completed the open-ended interview protocol. Collins' combined sampling schemes can be classified as being Type 4 (cf. Table 1) because these samples were selected purposively (i.e., homogeneous sampling scheme).

Design 3 involves a concurrent design using nested samples for the qualitative and quantitative components of the study. An example of a Design 3 sampling design is the study conducted by Hayter (1999), whose purpose was to: (a) describe the prevalence and nature of burnout in clinical nurse specialists in HIV/AIDS care working in community settings and (b) examine the association between burnout and HIV/AIDS care-related factors among this group. In the first stage of the study, the quantitative phase, 32 community HIV/AIDS nurse specialists were administered measures of burnout and the psychological impact of working with people with HIV/AIDS, as well as a demographic survey. In the second stage, the qualitative phase, five nurse specialists were randomly sampled for semi-structured interview. Because the quantitative phase involved convenient sampling and the qualitative phase involved random sampling, Hayter's combined sampling schemes can be classified as being Type 3 (cf. Table 1).

Design 4 involves a concurrent design using multilevel samples for the qualitative and quantitative components of the study. An example of a Design 4 sampling design is the study conducted by Savaya, Monnickendam, and Waysman (2000). The purpose of the study was to evaluate a decision support system (DSS) designed to assist youth probation officers in choosing their recommendations to the courts. In the qualitative component, analysis of documents and interviews of senior administrators were conducted. In the quantitative component, youth probation officers were surveyed to determine their utilization of DSS in the context of their work. Savaya et al.'s combined sampling schemes can be classified as being Type 4 (cf. Table 1) because these samples were selected purposively (i.e., maximum variation).

Design 5 involves a sequential design using identical samples for both qualitative and quantitative components of the study. An example of a Design 5 sampling design is Taylor and Tashakkori's (1997) investigation, in which teachers were classified into four groups based on their quantitative responses to measures of: (a) efficacy (low vs. high) and (b) locus of causality for student success (i.e., internal vs. external). Then these four groups of teachers were compared with respect to obtained qualitative data, namely, their reported desire for and actual participation in decision making. Thus, the quantitative data collection and analysis represented the first phase, whereas the qualitative data collection and analysis represented the second phase. Because these identical samples were selected purposively, Taylor and Tashakkori's combined sampling schemes can be classified as being Type 4 (cf. Table 1).

Design 6 involves a sequential design using parallel samples for the qualitative and quantitative components of the study. An example of a Design 6 sampling design is the study conducted by Scherer and Lane (1997). These researchers conducted a mixed methods study to determine the needs and preferences of consumers (i.e., individuals with disabilities) regarding rehabilitation services and assistive technologies. In the quantitative phase of the study, consumers were surveyed to identify the assistive products that they perceived as needing improvement. In the qualitative component of the study, another sample of consumers participated in focus groups to assess the quality of the assistive products, defined in the quantitative phase, according to specific criteria (e.g., durability, reliability, affordability). Scherer and Lane's combined sampling schemes can be classified as being Type 4 (cf. Table 1) because these samples were selected purposively (i.e., homogeneous samples).

Design 7 involves a sequential design using nested samples for the qualitative and quantitative components of the study. An example of a Design 7 sampling design is the study conducted by Way, Stauber, Nakkula, and London (1994). These researchers administered questionnaires that focused in the areas of depression and substance use/abuse to students in urban and suburban high schools (quantitative phase). On finding a positive relationship between depression and substance use only in the suburban sample, the researchers undertook in-depth interviews of the most depressed urban and suburban students (qualitative phase). Here, the selection of study participants who represented the most depressed students yielded a nested sample. The quantitative phase utilized a convenience sample, whereas the qualitative phase employed extreme case sampling. Because both of these sampling techniques are purposive, Way et al.'s combined sampling schemes can be classified as being Type 4 (cf. Table 1).

Finally, Design 8 involves a sequential design using multilevel samples for the qualitative and quantitative components of the study. An example of a Design 8 sampling design is the study conducted by Blattman, Jensen, and Roman (2003). The study's purpose was to evaluate the possible socio-economic development opportunities available in a rural community located in India. These researchers conducted both field interviews of individuals from a variety of professional backgrounds (e.g., farmers, laborers, government workers, educators, students) and focus groups (i.e., men, women, farmers, laborers) to obtain their perspectives regarding the sources of development opportunities available for various community agents, specifically farmers. Data obtained from the qualitative component were utilized to develop a household survey questionnaire (i.e., quantitative component). The questionnaire was distributed in two stages to two samples. The first sample (i.e., purposive; homogeneous sampling scheme) was drawn from households representing a cross-section of selected villages that typified the region and reflected villages of varying size, caste composition, and access to telecommunications and agricultural and non agricultural activities. In the second stage, random sampling procedures were used to select a different subset of households that represented approximately 10% of the population of the selected villages. Blattman et al.'s combined sampling schemes can be classified as being Type 2 (cf. Table 1) because the qualitative phase involved purposive sampling, utilizing a maximum variation sampling schema, and the quantitative phase involved stratified random sampling.

Overview of Two-Dimensional Mixed Methods Sampling Model

As can be seen from these mixed methods sampling examples, each of these eight designs could involve any of the four combinations of types of sampling schemes presented in Table 1, which, in turn could involve a combination of any of the 24 sampling schemes presented in Table 2. Whichever of the eight sampling designs is used, careful consideration must be made of the sample sizes needed for both the quantitative and qualitative components of the study, depending on the type and level of generalization of interest (cf. Table 3).

The two-dimensional mixed methods sampling model is extremely flexible because it can be extended to incorporate studies that involve more than two components or phases. For example, the mixed methods sampling model can be extended for a study that incorporates a sandwich design (Sandelowski, 2003), also called a bracketed design (Greene et al., 1989), comprising two qualitative/quantitative phases and one quantitative/qualitative phase

occurring sequentially that involves either: (a) a qualitative phase followed by a quantitative phase followed by a qualitative phase (i.e., qual → quan → qual) or (b) a quantitative phase followed by a qualitative phase followed by a quantitative phase (i.e., quan → qual → quan). In either case, at the third stage, the mixed methods researcher also must decide on the relationship of the sample to the other two samples, as well as the sampling scheme and sample size.

The exciting aspect of mixed methods sampling model is that a researcher can create more tailored and/or more complex sampling designs than the ones outlined here to fit a specific research context, as well as the research goal, research objective(s), research purpose, and research question(s). Also, it is possible for a sampling design to emerge during a study in new ways, depending on how the research evolves. However, many of these variants can be subsumed within these eight sampling designs.

Sampling Tenets Common to Qualitative and Quantitative Research

Onwuegbuzie (2007) identified the following four crises or challenges that researchers face when undertaking mixed methods research: representation, legitimation, integration, and politics. The crisis of representation refers to the fact that sampling problems characterize both quantitative and qualitative research. With respect to quantitative research, the majority of quantitative studies utilize sample sizes that are too small to detect statistically significant differences or relationships. That is, in the majority of quantitative inquiries, the statistical power for conducting null hypothesis significance tests is inadequate. As noted by Cohen (1988), the power of a null hypothesis significance test (i.e., statistical power) is "the probability [assuming the null hypothesis is false] that it will lead to the rejection of the null hypothesis, i.e., the probability that it will result in the conclusion that the phenomenon exists" (p. 4). In other words, statistical power refers to the conditional probability of rejecting the null hypothesis (i.e., accepting the alternative hypothesis) when the alternative hypothesis actually is true (Cohen, 1988, 1992). Simply stated, power represents how likely it is that the researcher will find a relationship or difference that really prevails (Onwuegbuzie & Leech, 2004a).

Disturbingly, Schmidt and Hunter (1997) reported that "the average [hypothesized] power of null hypothesis significance tests in typical studies and research literature is in the .40 to .60 range (Cohen, 1962, 1965, 1988, 1992; Schmidt, 1996; Schmidt, Hunter, & Urry, 1976; Sedlmeier & Gigerenzer, 1989)…[with] .50 as a rough average" (p. 40). Unfortunately, an average hypothetical power of .5 indicates that more than one-half of all null hypothesis significance tests in the social and behavioral science literature will be statistically non-significant. As noted by Schmidt and Hunter (p. 40), "This level of accuracy is so low that it could be achieved just by flipping a (unbiased) coin!" Moreover, as declared by Rossi (1997), it is possible that "at least some controversies in the social and behavioral sciences may be artifactual in nature" (p. 178). This represents a crisis of representation.

This crisis of representation still prevails in studies in which null hypothesis significance testing does not take place, as is the case where only effect-size indices are reported and interpreted. Indeed, as surmised by Onwuegbuzie and Levin (2003), effect-size statistics represent random variables that are affected by sampling variability, which is a function of sample size. Thus, "when the sample size is small, the discrepancy between the sample effect size and population effect size is larger (i.e., large bias) than when the sample

size is large" (p. 140). Even in descriptive research, in which no inferential analyses are undertaken and only descriptive statistics are presented, as long as generalizations are being made from the sample to some target population, the small sample sizes that typify quantitative research studies still create a crisis of representation. In addition, the fact that the majority of studies in the social and behavioral sciences do not utilize random samples (Shaver & Norton, 1980a, 1980b), even though "inferential statistics is based on the assumption of random sampling from populations" (Glass & Hopkins, 1984, p. 177), affects the external validity of findings; again, yielding a crisis of representation.

In qualitative research, the crisis of representation refers to the difficulty for researchers in capturing lived experiences. As noted by Denzin and Lincoln (2005),

> Such experience, it is argued, is created in the social text written by the researcher. This is the representational crisis. It confronts the inescapable problem of representation, but does so within a framework that makes the direct link between experience and text problematic. (p. 19)

Further, according to Lincoln and Denzin (2000), the crisis of representation asks who the Other is and whether qualitative researchers can use text to represent authentically the experience of the Other. If this is not possible, how do interpretivists establish a social science that includes the Other? As noted by Lincoln and Denzin, these questions can be addressed by "including the Other in the larger research processes that we have developed" (p. 1050), which, for some, involves various types of research (e.g., action research, participatory research, evaluation research, clinical research, policy research, racialized discourse, ethnic epistemologies) that can occur in a variety of settings (e.g., educational, social, clinical, familial, corporate); for some, this involves training Others to conduct their own research of their own communities; for some, this involves positioning Others as co-authors; and for some, this involves Others writing auto-ethnographic accounts with the qualitative researcher assuming the role of ensuring that the Others' voices are heard directly. In any case, there appears to be general agreement that there is a crisis of representation in qualitative research.

The second crisis in mixed methods research pertains to legitimation or validity. The importance of legitimation or what is more commonly referred to as "validity," has been long acknowledged by quantitative researchers. For example, extending the seminal works of Campbell and Stanley (Campbell, 1957; Campbell & Stanley, 1963), Onwuegbuzie (2003) presented 50 threats to internal validity and external validity that occur at the research design/data collection, data analysis, and/or data interpretation stages of the quantitative research process. These threats are presented in Figure 3, in what was later called the *Quantitative Legitimation Model*. As illustrated in Figure 3, Onwuegbuzie identified 22 threats to internal validity and 12 threats to external validity at the research design/data collection stage of the quantitative research process. At the data analysis stage, 21 threats to internal validity and 5 threats to external validity were conceptualized. Finally, at the data interpretation stage, 7 and 3 threats to internal validity and external validity were identified, respectively. In Figure 4, Onwuegbuzie, Daniel, and Collins' (in press) schematic representation of instrument score validity also is provided for interested readers. Onwuegbuzie et al. build on Messick's (1989, 1995) conceptualization of validity to yield what they refer to as a meta-validity model that subdivides content-, criterion-, and

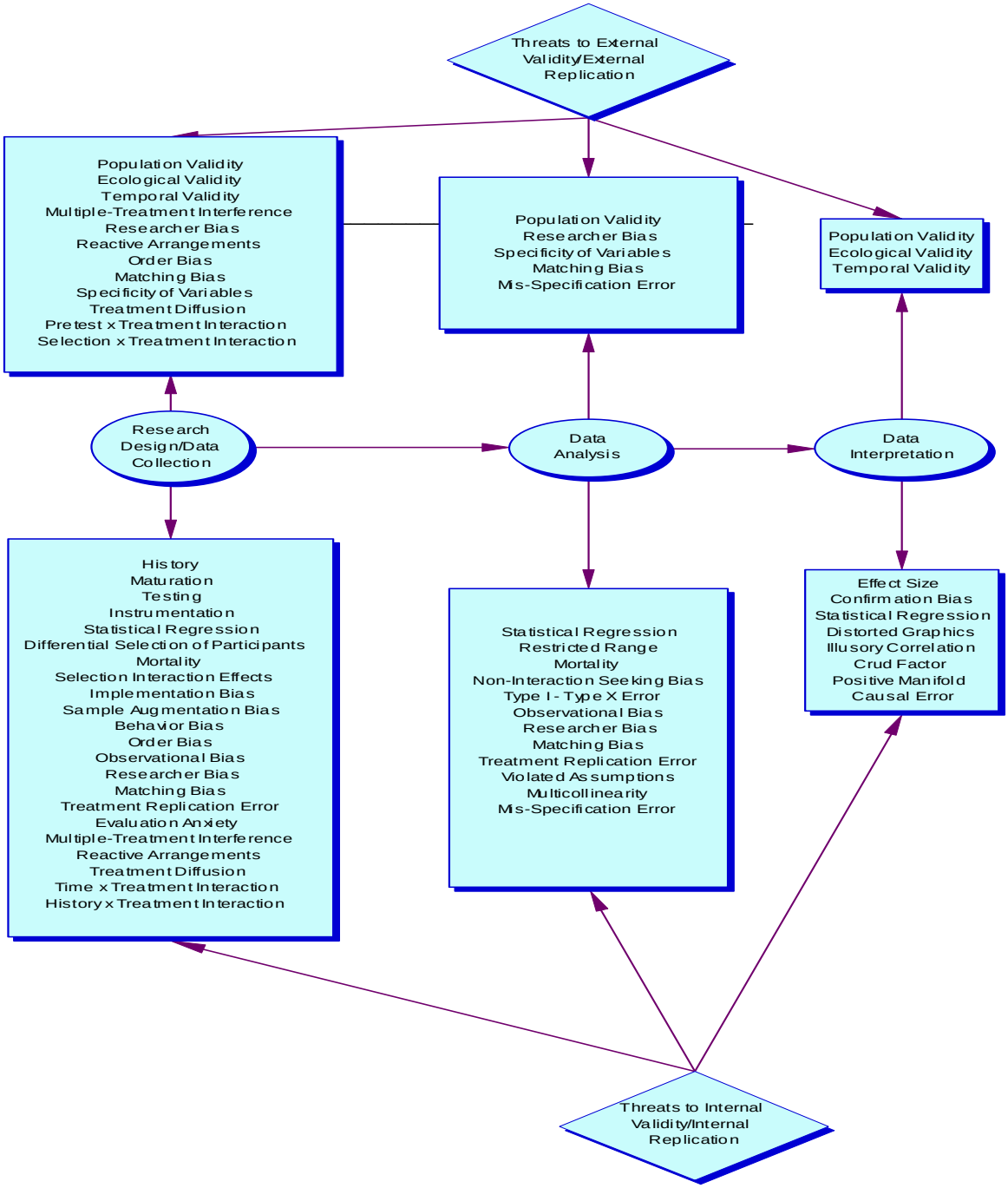
construct-related validity into several areas of evidence. Another useful conceptualization of validity is that of Shadish, Cook, and Campbell (2001). These authors also build on Campbell's earlier work and classify research validity into four major types: statistical conclusion validity, internal validity, construct validity, and external validity. Other selected seminal works showing the historical development of validity in quantitative research can be found in the following references: American Educational Research Association, American Psychological Association, and National Council on Measurement in Education (1999); Bracht and Glass (1968); Campbell (1957); Campbell and Stanley (1963); Cook and Campbell (1979); Messick (1989, 1995); and Smith and Glass (1987).

With respect to the qualitative research paradigm, Denzin and Lincoln (2005) argue for "a serious rethinking of such terms as *validity*, *generalizability*, and *reliability*, terms already retheorized in postpositivist…, constructivist-naturalistic…, feminist…, interpretive…, poststructural…, and critical…discourses. This problem asks, 'How are qualitative studies to be evaluated in the contemporary, poststructural moment?'" (pp. 19-20). Part of their solution has been to reconceptualize traditional validity concepts by new labels (Lincoln & Guba, 1985, 1990). For example, Lincoln and Guba (1985) presented the following types: credibility (replacement for quantitative concept of internal validity), transferability (replacement for quantitative concept of external validity), dependability (replacement for quantitative concept of reliability), and confirmability (replacement for quantitative concept of objectivity).

Another popular classification for validity in qualitative research was provided by Maxwell (1992), who identified the following five types of validity:

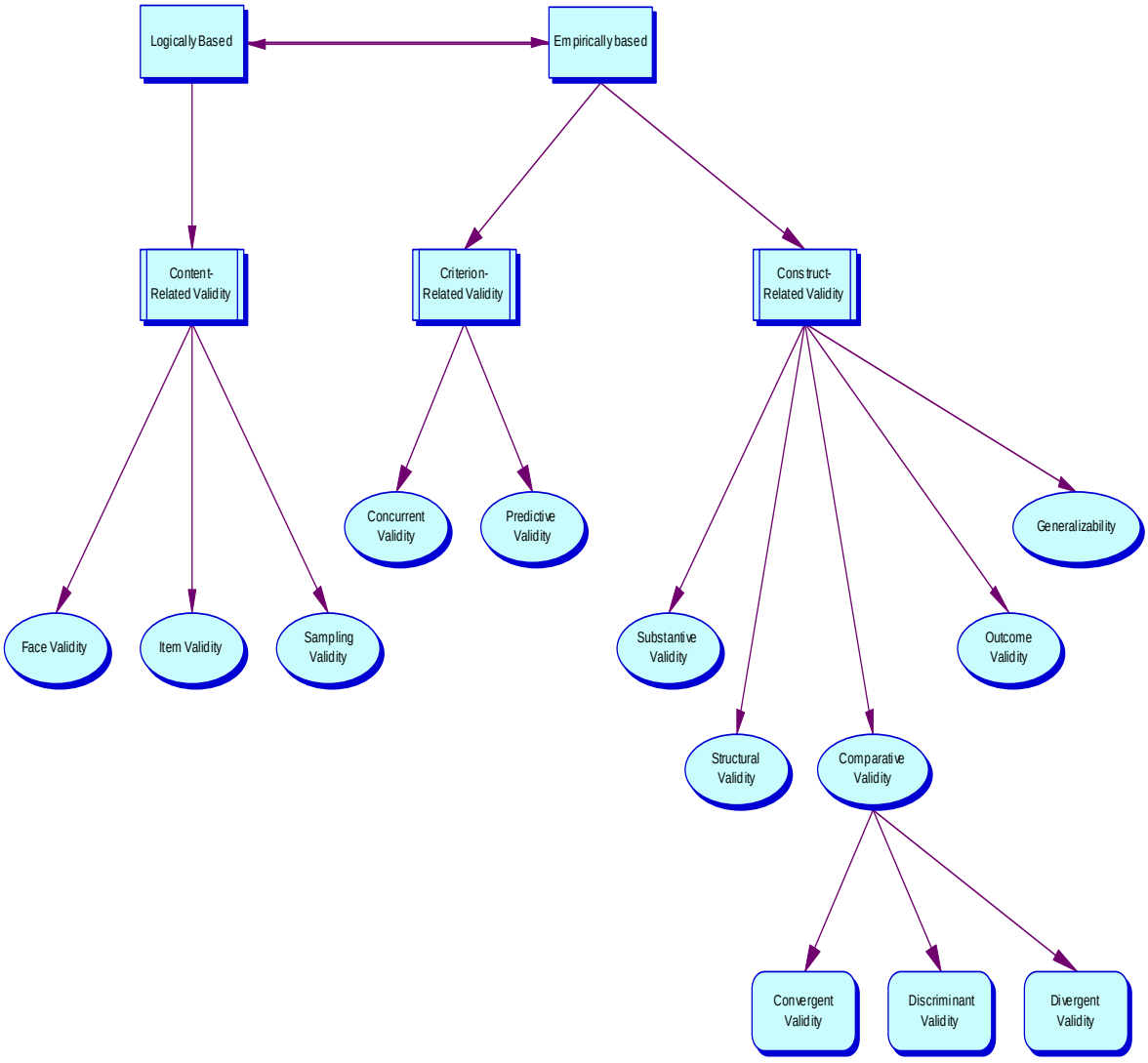
- descriptive validity (i.e., factual accuracy of the account as documented by the researcher);
- interpretive validity (i.e., the extent to which an interpretation of the account represents an understanding of the perspective of the underlying group and the meanings attached to the members' words and actions);
- theoretical validity (i.e., the degree to which a theoretical explanation developed from research findings is consistent with the data);
- evaluative validity (i.e., the extent to which an evaluation framework can be applied to the objects of study, as opposed to a descriptive, interpretive, or explanatory one); and
- generalizability (i.e., the extent to which a researcher can generalize the account of a particular situation, context, or population to other individuals, times, settings, or context).

Figure 3. Threats to internal and external validity.



With regard to the latter validity type, Maxwell differentiates internal generalizability from external generalizability, with the former referring to the generalizability of a conclusion within the underlying setting or group, and the latter pertaining to generalizability beyond the group, setting, time, or context. According to Maxwell, internal generalizability is typically more important to qualitative researchers than is external generalizability.

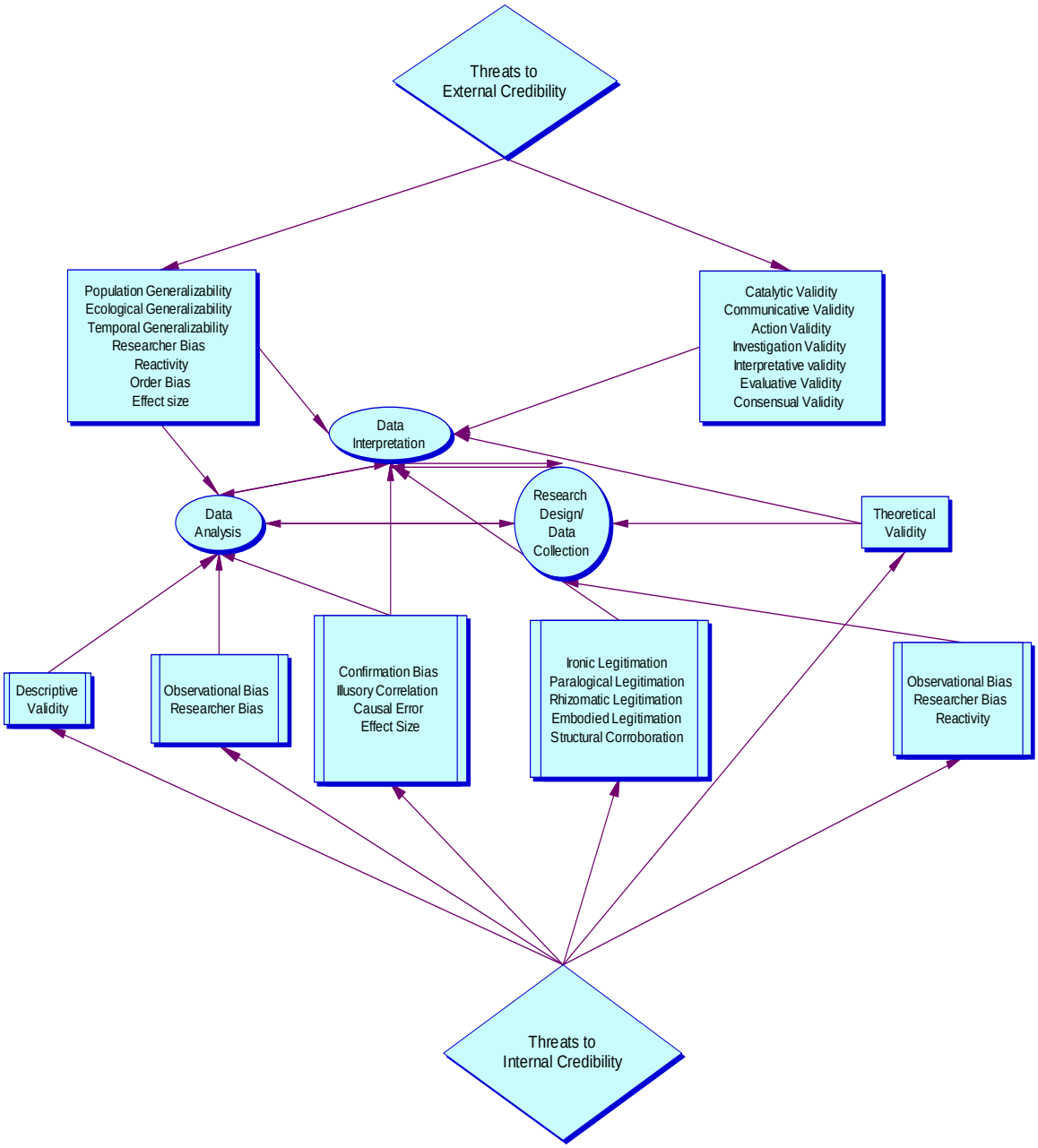
Figure 4. Schematic representation of instrument score validity.



Onwuegbuzie (2000) conceptualized what he called the *Qualitative Legitimation Model*, which contains 29 elements of legitimation for qualitative research at the following three stages of the research process: research design/data collection, data analysis, and data interpretation. As illustrated in Figure 5, the following threats to internal credibility are pertinent to qualitative research: ironic legitimation, paralogical legitimation, rhizomatic legitimation, voluptuous (i.e., embodied) legitimation, descriptive validity, structural corroboration, theoretical validity, observational bias, researcher bias, reactivity, confirmation bias, illusory correlation, causal error, and effect size. Also in this model, the following threats to external credibility have been identified as being pertinent to qualitative research: catalytic validity, communicative validity, action validity, investigation validity, interpretive validity, evaluative validity, consensual validity, population generalizability, ecological generalizability, temporal generalizability, researcher bias, reactivity, order bias,

and effect size. (For an in-depth discussion of each of these threats to internal credibility and external credibility, we refer the reader to Onwuegbuzie & Leech, 2007b.)

Figure 5. Qualitative legitimation model.



Because of the association with the quantitative conceptualization of the research process, qualitative researchers have, by and large, replaced the term validity by terms such as *legitimation*, *trustworthiness*, and *credibility*. The major works in the area of legitimation in qualitative research include the following: Creswell (1998), Glaser and Strauss (1967), Kvale (1995), Lather (1986, 1993), Lincoln and Guba (1985, 1990), Longino (1995), Maxwell (1992, 1996), Miles and Huberman (1984, 1994), Onwuegbuzie and Leech (2007b), Schwandt (2001), Strauss and Corbin (1998), and Wolcott (1990).

In mixed method research, the crises of representation and legitimation often are exacerbated because both the quantitative and qualitative components of studies bring to the fore their own unique crises. In mixed methods studies, the crisis of representation refers to the difficulty in capturing (i.e., representing) the lived experience using text in general and words and numbers in particular. The problem of legitimation refers to the difficulty in obtaining findings and/or making inferences that are credible, trustworthy, dependable, transferable, and/or confirmable.

The third crisis in mixed methods research pertains to integration (Onwuegbuzie, 2007). The crisis of integration refers to the extent to which combining qualitative and quantitative approaches can address adequately the research goal, research objective(s), research purpose(s), and research question(s). This crisis compels mixed methods researchers to ask questions such as the following: Is it appropriate to triangulate, consolidate, or compare quantitative data stemming from a large random sample on equal grounds with qualitative data arising from a small purposive sample? How much weight should be placed on qualitative data compared to quantitative data? Are quantitatively confirmed findings more important than findings that emerge during a qualitative study component? When quantitative and qualitative findings contradict themselves, what should the researcher conclude?

The fourth crisis in mixed methods research is the crisis of politics (Onwuegbuzie, 2007). This crisis refers to the tensions that arise as a result of combining quantitative and qualitative approaches. These tensions include any conflicts that arise when different investigators are used for the quantitative and qualitative components of a study, as well as the contradictions and paradoxes that come to the fore when the quantitative and qualitative data are compared and contrasted. The crisis of politics also pertains to the difficulty in persuading the consumers of mixed methods research, including stakeholders and policymakers, to value the results stemming from *both* the quantitative and qualitative components of a study. Additionally, the crisis of politics refers to tensions ensuing when ethical standards are not addressed within the research design. These four crises are summarized in Table 5.

Table 5

Crises Faced by Mixed Methods Researchers

Crisis	Description
Representation	The crisis of representation refers to the fact that sampling problems characterize both quantitative and qualitative research. It refers to the difficulty in capturing (i.e., representing) the lived experience using text in general and words and numbers in particular. *Quantitative Phase*: This crisis prevails when the sample size used is too small to yield adequate statistical power (i.e., reduce external validity) and/or the non-random sampling scheme used adversely affects generalizability (i.e., reduces external validity)

	Qualitative Phase: This crisis refers to the difficulty in capturing lived experiences; the direct link between experience and text is problematic.
Legitimation	The crisis of legitimation refers to the difficulty in obtaining findings and/or making inferences that are credible, trustworthy, dependable, transferable, and/or confirmable. *Quantitative Phase*: This crisis involves the difficulty in obtaining quantitative findings that possess adequate internal validity and external validity. *Qualitative Phase*: This crisis leads to the following question being asked: How are qualitative studies to be evaluated in the contemporary, post-structural moment? It involves the difficulty in obtaining qualitative findings that possess adequate credibility, transferability, dependability, and/or confirmability.
Integration	The crisis of integration refers to the extent to which combining qualitative and quantitative approaches addresses adequately the research goal, research objective(s), research purpose(s), and research question(s).
Politics	This crisis refers to the tensions that arise as a result of combining quantitative and qualitative approaches, including any conflicts that arise when different investigators are used for the quantitative and qualitative components of a study, the contradictions and paradoxes that come to the fore when the quantitative and qualitative data are compared and contrasted, the difficulty in persuading the consumers of mixed methods research (e.g., stakeholders and policymakers) to value the results stemming from both the quantitative and qualitative components of a study, and the tensions ensuing when ethical standards are not addressed within the research design.

Selecting an appropriate sampling design for the qualitative and quantitative components of the study can be a difficult choice. Thus, guidelines are needed to help mixed methods researchers in this selection. However, we believe that keeping in mind these four crises should help mixed methods researchers to select optimal sampling designs. That is, we believe that an optimal sampling design in a mixed methods study is one that allows the researcher to address simultaneously the four aforementioned crises as adequately as possible. In particular, representation can be enhanced by ensuring that sampling decisions stem from the research goal (e.g., predict, understand complex phenomena), research objective (e.g., exploration, prediction), research purpose (e.g., triangulation, complementarity), and research question(s). As displayed in Figure 1, decisions about the research goal, research objective, research purpose, and research questions(s) are sequential in nature. Thus, research questions arise from the research purpose, which arise from the research objective, which, in turn, arise from the research goal. (The importance of the

research question in sampling decisions is supported by Curtis et al., 2000; Kemper et al., 2003; and Miles & Huberman, 1994.) For example, with respect to the research goal, testing new ideas compared to understanding complex phenomena likely will lead to a different research objective (i.e., prediction or influence vs. exploration, description, or explanation), research purpose (e.g., triangulation vs. expansion), and research questions; and, hence, result in different sampling designs, sampling schemes, and sample sizes being optimal. Representation also can be enhanced by ensuring that the sample selected for each component of the mixed methods study is compatible with the research design (cf. Table 3).

In addition, the selected samples should generate sufficient data pertaining to the phenomenon of interest to allow thick, rich description (Curtis et al., 2000; Kemper et al., 2003; Miles & Huberman, 1994), thereby increasing descriptive validity and interpretive validity (Maxwell, 1992). Such samples also should help to improve representation. Borrowing the language from qualitative researchers, both the qualitative and quantitative components of a study should yield data that have a realistic chance of reaching data saturation (Flick, 1998; Morse, 1995), theoretical saturation (Strauss & Corbin, 1990), or informational redundancy (Lincoln & Guba, 1985). Representation can be further improved by selecting samples that allow the researcher to make statistical and/or analytical generalizations. That is, the sampling design should allow mixed methods researchers to make generalizations to other participants, populations, settings, contexts, locations, times, events, incidents, activities, experiences, and/or processes; that is, the sampling design should facilitate internal and/or external generalizations (Maxwell, 1992).

Legitimation can be enhanced by ensuring that inferences stem directly from the extracted sample of units (Curtis et al., 2000; Kemper et al., 2003; Miles & Huberman, 1994). The selected sampling design also should increase theoretical validity, where appropriate (Maxwell, 1992). The sampling design can enhance legitimation by incorporating audit trails (Halpern, 1983; Lincoln & Guba, 1985).

Further, the crisis of integration can be reduced by utilizing sampling designs that help researchers to make meta-inferences that adequately represent the quantitative and qualitative findings and which allow the appropriate weight to be assigned. Even more importantly, the sampling design should seek to enhance what Onwuegbuzie and Johnson (2006) refer to as "sample integration legitimation." This legitimation type refers to situations in which the mixed methods researcher wants to make statistical generalizations from the sample members to the underlying population. As noted by Onwuegbuzie and Johnson (2006), unless the relationship between the qualitative and quantitative samples is identical (cf. Figure 2), conducting meta-inferences by pulling together the inferences from the qualitative and quantitative phases can pose a threat to legitimation.

Finally, the crisis of politics can be decreased by employing sampling designs that are realistic, efficient, practical, and ethical. Realism means that the data extracted from the samples are collected, analyzed, and interpreted by either: (a) a single researcher who possesses the necessary competencies and experiences in both qualitative and quantitative techniques; (b) a team of investigators consisting of researchers with competency and experience in one of the two approaches such that there is at least one qualitative and one quantitative researcher who are able to compare and contrast effectively their respective findings; or (c) a team of investigators consisting of researchers with minimum competency in both qualitative and quantitative approaches and a highly specialized skill set in one of these two procedures. According to Teddlie and Tashakkori (2003), these combinations

represent the "three current models for professional competency and collaboration" in mixed methods research (p. 44). Moreover, a realistic sampling design is one that "provides a really convincing account and explanation of what is observed" (Curtis et al., 2000, p. 1003).

Efficient sampling designs support studies that can be undertaken using the available resources (e.g., money, time, effort). As such, efficiency refers more to the scope of the researchers (i.e., manageability). In particular, the sampling design should be compatible with the researcher's competencies, experiences, interests, and work style (Curtis et al., 2000; Miles & Huberman, 1994). However, even if resources are available for a chosen sampling design, these must also be within the scope of the potential sample members. That is, the sampling design employed must be one from which all of the data can be collected from the sample members. For example, the sample members should not be unduly inconvenienced. This is what is meant by utilizing a practical sampling design. Indeed, a practical and efficient sampling design should be one that "sets an upper bound on the internal validity/trustworthiness and external validity/transferability of the research project" (Kemper et al., 2003, p. 277).

Finally, an ethical sampling design is one that adheres to the ethical guidelines stipulated by organizations such as Institutional Review Boards in order for the integrity of the research to be maintained throughout and that all sample members are protected (cf. American Educational Research Association [AERA], 2000; Sales & Folkman, 2002). Further, mixed methods researchers should continually evaluate their sampling designs and procedures for ethical and scientific appropriateness throughout the course of their studies. In particular, as specified by the Standard I.B.6 of AERA (2000), mixed methods researchers should provide information about their sampling designs and strategies "accurately and sufficiently in detail to allow knowledgeable, trained researchers to understand and interpret them." In addition, based on their sampling designs, mixed methods researchers should write their reports in such a way that they "Communicate the practical significance for policy, including limits in effectiveness and in generalizability to situations, problems, and contexts" (AERA, 2000, Standard I.B.7). Even more importantly, mixed methods researchers should undertake the following:

1. fully inform all sample members about "the likely risks involved in the research and of potential consequences for participants" (AERA, 2000, Standard II. B.1);
2. guarantee confidentiality (Standard II. B.2) and anonymity (Standard II. B.11);
3. avoid deception (Standard II. B.3);
4. ensure that "participants have the right to withdraw from the study at any time" (Standard II. B.5);
5. "have a responsibility to be mindful of cultural, religious, gender, and other significant differences within the research population in the planning, conduct, and reporting of their research" (Standard II. B.7); and
6. "carefully consider and minimize the use of research techniques that might have negative social consequences" (Standard II. B.7).

Furthermore, mixed method researchers should consider carefully the "implications of excluding cases because they are less articulate or less well documented, of uncertain reliability or difficult to access" (Curtis et al., 2000, p. 1012).

Summary and Conclusions

Sampling is an important step in both the qualitative and quantitative research process. However, sampling is even more important in the mixed methods research process because of its increased complexity arising from the fact that the quantitative and qualitative components bring into the setting their own problems of representation, legitimation, integration, and politics. These combined problems are likely to yield an additive effect or a multiplicative effect that adversely impacts the quality of data collected. Thus, it is somewhat surprising that the issue of sampling was not included as one of Teddlie and Tashakkori's (2003) six issues of concern in mixed methods research. Moreover, with a few exceptions, discussion of sampling schemes has not taken place within a mixed methods framework. Thus, the purpose of this article has been to contribute to the discussion about sampling issues in mixed methods research. In fact, the present essay appears to represent the most in-depth and comprehensive discussion of sampling in mixed methods research to date. First, we presented 24 sampling schemes that have been associated with quantitative and/or qualitative research. We contended that the present trend of methodologists and textbook authors of linking research paradigms to sampling schemes represents a false dichotomy that is not consistent with practice. Second, we discussed the importance of researchers making sample size considerations for both the quantitative and qualitative components of mixed methods studies. We then provided sample size guidelines from the extant literature for each of the major qualitative and quantitative research designs. Third, we provided a typology of sampling designs in mixed methods research. Specifically, we introduced our two-dimensional mixed methods sampling model, which demonstrated how sampling designs can be classified according to: (a) the time orientation of the components (i.e., concurrently vs. sequentially) and (b) the relationship of the qualitative and quantitative samples (e.g., identical vs. nested). Fourth, we presented the four major crises or challenges to mixed methods research: representation, legitimation, integration, and politics. These crises were then used to provide guidelines for making sampling design considerations.

The two-dimensional mixed methods sampling model presented in this paper helps to fulfill two goals. First and foremost, this model can help mixed methods researchers to identify an optimal sampling design. Second, the model can be used to classify mixed methods studies in the extant literature with respect to their sampling strategies. Indeed, future research should build on the work of Collins et al. (2006, 2007) who investigated the prevalence of each of the eight sampling designs presented in Figure 2. Such studies also could identify any potential misuse of sampling designs with respect to the four crises in mixed methods research.

Virtually all researchers (whether qualitative, quantitative, or mixed methods researchers) make some form of generalization when interpreting their data. Typically, they make statistical generalizations, analytic generalizations, and/or generalizations that involve case-to-case transfer (Curtis et al., 2000; Firestone, 1993; Kennedy, 1979; Miles & Huberman, 1994). However, the generalizing process is in no way mechanical (Miles & Huberman, 1994). Indeed, generalization represents an active process of reflection (Greenwood & Levin, 2000). Specifically, because all findings are context-bound; (a) any interpretations stemming from these findings should be made only after being appropriately aware of the context under which these results were constructed, (b) generalizations of any interpretations to another context should be made only after being adequately cognizant of

the new context and how this new context differs from the context from which the interpretations were generated; and (c) generalizations should occur only after the researcher has reflected carefully on the consequences that such a generalization may have. Therefore, choosing an optimal sampling design is an essential part of the reflection process.

Selecting a sampling design involves making a series of decisions not only about how many individuals to include in a study and how to select these individuals, but also about conditions under which this selection will take place. These decisions are extremely important and, as stated by Curtis et al. (2000), "It seems essential to be explicit about these [decisions], rather than leaving them hidden, and to consider the implications of the choice for the way that the…study can be interpreted" (p. 1012). Unfortunately, the vast majority of qualitative and quantitative researchers do not make clear their sampling decisions. Indeed, the exact nature of the sampling scheme rarely is specified (Onwuegbuzie, 2002b). As such, sampling in qualitative and quantitative research appears to be undertaken as a private enterprise that is unavailable for public inspection. However, as noted by Curtis et al. (2000, "careful consideration of… [sampling designs] can enhance the interpretive power of a study by ensuring that the scope and the limitations of the analysis is clearly specified" (p. 1013). Thus, we hope that the framework that we have provided can help mixed methods researchers in their quest to select an optimal sampling design. Further, we hope that our framework will motivate other research methodologists to construct alternative typologies for helping researchers in making their sampling decisions.

References

American Educational Research Association. (2000). *Ethical standards of the American Educational Research Association*. Retrieved August 25, 2007, from http://www.aera.net/AboutAERA/Default.aspx?menu_id=90&id=222

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education (1999). *Standards for educational and psychological testing* (Rev. ed.). Washington, DC: American Educational Research Association.

Baumgartner, T. A., Strong, C. H., & Hensley, L. D. (2002). *Conducting and reading research in health and human performance* (3rd ed.). New York: McGraw-Hill.

Bernard, H. R. (1995). *Research methods in anthropology: Qualitative and quantitative approaches.* Walnut Creek, CA: AltaMira.

Blattman, C., Jensen, R., & Roman, R. (2003). Assessing the need and potential community networking for development in rural India. *The Information Society, 19*, 349-364.

Bracht, G. H., & Glass, G. V. (1968). The external validity of experiments. *American Educational Research Journal, 5*, 437-474.

Brewer, J., & Hunter, A. (1989). *Multimethod research: A synthesis of style*. Newbury Park, CA: Sage.

Bryman, A. (1989). *Quantity and quality in social science research*. London: Routledge.

Campbell, D. T. (1957). Factors relevant to the validity of experiments in social settings. *Psychological Bulletin, 54*, 297-312.

Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally.

Caracelli, V. W., & Greene, J. C. (1993). Data analysis strategies for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis, 15*, 195-207.

Carrese, J. A., Mullaney, J. L., & Faden, R. R. (2002). Planning for death but not serious future illness: Qualitative study of household elderly patients. *British Medical Journal, 325*(7356), 125-130.

Charles, C. M., & Mertler, C. A. (2002). *Introduction to educational research* (4th ed.). Boston, MA: Allyn & Bacon.

Cohen, J. (1962). The statistical power of abnormal social psychological research: A review. *Journal of Abnormal and Social Psychology, 65*, 145-153.

Cohen, J. (1965). Some statistical issues in psychological research. In B. B. Wolman (Ed.), *Handbook of clinical psychology* (pp. 95-121). New York: McGraw-Hill.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159.

Collins, K. M. T. (2007). *Assessing the relationship between college students' reading abilities and their attitudes toward reading-based assignments*. Manuscript submitted for publication.

Collins, K. M. T., Onwuegbuzie, A. J., & Jiao, Q. G. (2006). Prevalence of mixed methods sampling designs in social science research. *Evaluation and Research in Education*, *19*, 83-101.

Collins, K. M. T., Onwuegbuzie, A. J., & Jiao, Q. G. (2007). A mixed methods investigation of mixed methods sampling designs in social and health science research. *Journal of Mixed Methods Research*, 1, 267-294.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Chicago: Rand McNally.

Cook, T. D., & Reichardt, C. S. (Eds.). (1979). *Qualitative and quantitative methods in evaluation research*. Beverly Hills, CA: Sage.

Creswell, J. W. (1994). *Research design: Qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

Creswell, J. W. (1999). Mixed-method research: Introduction and application. In C. Ciznek (Ed.), *Handbook of educational policy* (pp. 455-472). San Diego, CA: Academic Press.

Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson Education.

Creswell, J. W. (2007). *Qualitative inquiry and research method: Choosing among five approaches* (2nd. ed.). Thousand Oaks, CA: Sage.

Creswell, J. W., Plano Clark, V. L., Guttmann, M. L., & Hanson, E. E. (2003). Advanced mixed methods research design. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 209-240). Thousand Oaks, CA: Sage.

Curtis, S., Gesler, W., Smith, G., & Washburn, S. (2000). Approaches to sampling and case selection in qualitative research: Examples in the geography of health. *Social Science and Medicine, 50*, 1001-1014.

Daley, C. E., & Onwuegbuzie, A. J. (2004). Attributions toward violence of male juvenile delinquents: A concurrent mixed methods analysis. *Journal of Social Psychology, 144,* 549-570.

Del Rio, J. A., Kostoff, R. N., Garcia, E. O., Ramirez, A. M., & Humenik, J. A. (2002). Phenomenological approach to profile impact of scientific research: Citation mining. *Advances in Complex Systems*, *5*(1), 19-42.

Denzin. N. K., & Lincoln, Y. S. (2005). The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (3rd ed., pp. 1-32). Thousand Oaks, CA: Sage.

Dzurec, L. C., & Abraham, J. L. (1993). The nature of inquiry: Linking quantitative and qualitative research. *Advances in Nursing Science, 16,* 73-79.

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. Behavior Research Methods, Instruments, & Computers, 28, 1-11.

Firestone, W. A. (1993). Alternative arguments for generalizing from data, as applied to qualitative research. *Educational Researcher, 22*(4), 16-23.

Flick, U. (1998). *An introduction to qualitative research: Theory, method, and applications*. London: Sage.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction* (6th ed.). White Plains, NY: Longman.

Gay, L. R., & Airasian, P. (2003). *Educational research: Competencies foranalysis and application* (7th ed.). Upper Saddle River, NJ: Pearson Education.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine.

Glass, G. V., & Hopkins, K. D. (1984). *Statistical methods in education and psychology*. (2nd ed.) Englewood Cliffs, NJ: Prentice-Hall.

Greene, J. C., & Caracelli, V. J. (Eds.) (1997). *Advances in mixed-method evaluation: The challenges and benefits of integrating diverse paradigms*: *New directions for evaluation* (No. 74). San Francisco: Jossey-Bass.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational Evaluation and Policy Analysis, 11,* 255-274.

Greene, J. C., & McClintock, C. (1985). Triangulation in evaluation: Design and analysis issues. *Evaluation Review, 9*, 523-545.

Greenwood, D. J., & Levin, M. (2000). Reconstructing the relationships between universities and society through action research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 85-106). Thousand Oaks, CA: Sage.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods, 18*, 59-82.

Gueulette, C., Newgent, R., & Newman, I. (1999, December). *How much of qualitative research is really qualitative?* Paper presented at the annual meeting of the Association for the Advancement of Educational Research (AAER), Ponte Vedra, Florida.

Halpern, E. S. (1983). *Auditing naturalistic inquiries: The development and application of a model*. Unpublished doctoral dissertation, Indiana University, Bloomington.

Hayter, M. (1999). Burnout and AIDS care-related factors in HIV community clinical nurse specialists in the north of England. *Journal of Advanced Nursing, 29*, 984-993.

Howe, K. R. (1988). Against the quantitative-qualitative incompatability thesis or dogmas die hard. *Educational Researcher, 17*, 10-16.

Howe, K. R. (1992). Getting over the quantitative-qualitative debate. *American Journal of Education, 100*, 236-256.

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly, 24*, 602-611.

Jick, T. D. (1983). Mixing qualitative and quantitative methods: Triangulation in action. In J. Van Mannen (Ed.), *Qualitative methodology* (pp. 135-148). Beverly Hills, CA: Sage.

Johnson, R. B., & Christensen, L. B. (2004). *Educational research: Quantitative, qualitative, and mixed approaches*. Boston, MA: Allyn and Bacon.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, *33*(7), 14-26.

Kemper, E. A., Stringfield, S., & Teddlie, C. (2003). Mixed methods sampling strategies in social science research. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 273-296). Thousand Oaks, CA: Sage.

Kennedy, M. (1979). Generalizing from single case studies. *Evaluation Quarterly, 3*, 661-678.

Krueger, R. A. (1994). *Focus groups: A practical guide for applied research* (2nd ed.). Thousand Oaks, CA: Sage.

Krueger, R. A. (2000). *Focus groups: A practical guide for applied research* (3rd ed.). Thousand Oaks, CA: Sage.

Kvale, S. (1995). The social construction of validity. *Qualitative Inquiry, 1*, 19-40. Langford, B. E., Schoenfeld, G., & Izzo, G. (2002). Nominal grouping sessions vs. focus groups. *Qualitative Market Research, 5*, 58-70.

Lather, P. (1986). Issues of validity in openly ideological research: Between a rock and a soft place. *Interchange, 17*, 63-84.

Lather, P. (1993). Fertile obsession: Validity after poststructuralism. *Sociological Quarterly, 34*, 673-693.

Laurie, H., & Sullivan, O. (1991). Combining qualitative and quantitative methods in the longitudinal study of household allocations. *Sociological Review, 39*, 113-139.

Leech, N. L., & Onwuegbuzie, A. J. (2002, November). *A call for greater use of nonparametric statistics.* Paper presented at the annual meeting of the Mid-South Educational Research Association, Chattanooga, TN.

Li, S., Marquart, J. M., & Zercher, C. (2000). Conceptual issues and analytical strategies in mixed-method studies of preschool inclusion. *Journal of Early Intervention, 23*, 116-132.

Liddy, E. D. (2000). Text mining. *Bulletin of the American Society for Information Science & Technology, 27*(1), 14-16.

Lincoln, Y. S., & Denzin. N. K. (2000). The seventh moment. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 1047-1065). Thousand Oaks, CA: Sage.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Beverly Hills, CA: Sage.

Lincoln, Y. S., & Guba, E. G. (1990). Judging the quality of case study reports. *International Journal of Qualitative Studies in Education, 3*, 53-59.

Longino, H. (1995). Gender, politics, and the theoretical virtues. *Synthese, 104*, 383-397. Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review, 62*, 279-299.

Maxwell, J. A. (1996). *Qualitative research design*. Newbury Park, CA: Sage.

Maxwell, J. A., & Loomis, D. M. (2003). Mixed methods design: An alternative approach. In A. Tashakkori and C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 241-272). Thousand Oaks, CA: Sage.

McMillan, J. H., & Schumacher, S. (2001). *Research in education: A conceptual introduction* (5th ed.). New York: Longman.

Messick, S. (1989). Validity. In R. L. Linn (Ed.), *Educational measurement* (3rd ed., pp. 13-103). Old Tappan, NJ**:** Macmillan.

Messick, S. (1995). Validity of psychological assessment: Validation of inferences from persons' responses and performances as scientific inquiry into score meaning. *American Psychologist, 50*, 741-749.

Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: A sourcebook of new methods*. Beverly Hills, CA: Sage.

Miles, M., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Morgan, D. L. (1997). *Focus groups as qualitative research* (2nd ed.). Qualitative Research Methods Series 16. Thousand Oaks, CA: Sage.

Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative Health Research, 3*, 362-376.

Morse, J. M. (1991). Approaches to qualitative-quantitative methodological triangulation. *Nursing Research, 40*, 120-123.

Morse, J. M. (1994). Designing funded qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 220-235). Thousand Oaks, CA: Sage.

Morse, J. M. (1995). The significance of saturation. *Qualitative Health Research, 5*, 147-149.

Morse, J. M. (1996). Is qualitative research complete? *Qualitative Health Research, 6*, 3-5.

Morse, J. M. (2003). Principles of mixed methods and multimethod research design. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 189-208)**.** Thousand Oaks, CA: Sage.

Newman, I., & Benz, C. R. (1998). *Qualitative-quantitative research methodology: Exploring the interactive continuum*. Carbondale, Illinois: Southern Illinois University Press.

Newman, I., Ridenour, C. S., Newman, C., & DeMarco, G. M. P. (2003). A typology of research purposes and its relationship to mixed methods. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 167-188)**.** Thousand Oaks, CA: Sage.

Onwuegbuzie, A. J. (2000, November). *Validity and qualitative research: An oxymoron?* Paper presented at the annual meeting of the Association for the Advancement of Educational Research (AAER), Ponte Vedra, Florida.

Onwuegbuzie, A. J. (2002a). Positivists, post-positivists, post-structuralists, and post-modernists: Why can't we all get along? Towards a framework for unifying research paradigms. *Education, 122*, 518-530.

Onwuegbuzie, A. J. (2002b). Common analytical and interpretational errors in educational research: An analysis of the 1998 volume of the British Journal of Educational Psychology. *Educational Research Quarterly, 26*(1), 11-22.

Onwuegbuzie, A. J. (2003). Expanding the framework of internal and external validity in quantitative research. *Research in the Schools, 10*(1), 71-90.

Onwuegbuzie, A. J. (2007). Mixed methods research in sociology and beyond. In G. Ritzer (Ed.), *Encyclopedia of sociology* (Vol. 6, pp. 2978-2981). Oxford, England: Blackwell Publishing.

Onwuegbuzie, A. J., Daniel, L. G., & Collins, K. M. T. (in press). A meta-validation model for assessing the score-validity of student teacher evaluations. *Quality & Quantity: International Journal of Methodology*.

Onwuegbuzie, A. J., Dickinson, W. B., Leech, N. L., & Zoran, A. G. (2007, February). *Toward more rigor in focus group research: A new framework for collecting and analyzing focus group data.* Paper presented at the annual meeting of the Southwest Educational Research Association, San Antonio, TX.

Onwuegbuzie, A. J., Jiao, Q. G., & Bostick, S. L. (2004). *Library anxiety: Theory, research, and applications*. Lanham, MD: Scarecrow Press.

Onwuegbuzie, A. J., & Johnson, R. B**.** (2004). Mixed method and mixed model research. In R. B. Johnson & L. B. Christensen, *Educational research: Quantitative, qualitative, and mixed approaches* (pp. 408-431). Needham Heights, MA: Allyn & Bacon.

Onwuegbuzie, A. J., & Johnson, R. B. (2006). The validity issue in mixed research. *Research in*
the Schools, 13(1), 48-63.

Onwuegbuzie, A. J., & Leech, N. L. (2004a). Post-hoc power: A concept whose time has come. *Understanding Statistics, 3*, 151-180.

Onwuegbuzie, A. J., & Leech, N. L. (2004b). Enhancing the interpretation of "significant" findings: The role of mixed methods research. *The Qualitative Report, 9*(4), 770-792. Retrieved August 27, 2007, from http://www.nova.edu/ssss/QR/QR9-4/ onwuegbuzie.pdf

Onwuegbuzie, A. J., & Leech, N. L. (2005a). Taking the "Q" out of research: Teaching research methodology courses without the divide between quantitative and qualitative paradigms. *Quality & Quantity: International Journal of Methodology, 39*, 267-296**.**

Onwuegbuzie, A. J., & Leech, N. L. (2005b, March 10). A typology of errors and myths perpetuated in educational research textbooks. *Current Issues in Education*, *8*(7). Retrieved May 29, 2007, from http://cie.asu.edu/volume8/number7/index.html

Onwuegbuzie, A. J., & Leech, N. L. (2005c). The role of sampling in qualitative research. *Academic Exchange Quarterly*, *9*, 280-284.

Onwuegbuzie, A. J., & Leech, N. L. (2007a). A call for qualitative power analyses. *Quality & Quantity: International Journal of Methodology, 41*, 105-121.

Onwuegbuzie, A. J., & Leech, N. L. (2007b). Validity and qualitative research: An oxymoron? *Quality & Quantity: International Journal of Methodology, 41*, 233-249.

Onwuegbuzie, A. J., & Leech, N. L. (2007c). Sampling designs in qualitative research: Making the sampling process more public. *The Qualitative Report*, *12*(2), 238-254 Retrieved August 31, 2007 from http://www.nova.edu/ssss/QR/QR12-2/onwuegbuzie1.pdf

Onwuegbuzie, A. J., & Levin, J. R. (2003). Without supporting statistical evidence, where would reported measures of substantive importance lead? To no good effect. *Journal of Modern Applied Statistical Methods, 2,* 133-151.

Patton, M. Q. (1990). *Qualitative research and evaluation methods* (2nd ed.). Newbury Park, CA: Sage.

Powis, T., & Cairns, D. (2003). Mining for meaning*:* Text mining the relationship between social representations of reconciliation and beliefs about Aboriginals*. Australian Journal of Psychology, 55*, 59-62.

Reichardt, C. S., & Rallis, S. F. (1994). *The qualitative-quantitative debate: New directions for program evaluation* (No. 61). San Francisco: Jossey-Bass.

Rossi, J. S. (1997). A case study in the failure of psychology as a cumulative science: The spontaneous recovery of verbal learning. In L. L. Harlow, S. A. Mulaik, & J. H. Steiger (Eds.), *What if there were no significance tests?* (pp. 175-197). Mahwah, NJ: Erlbaum.

Rossman, G. B., & Wilson, B. L. (1985). Numbers and words: Combining quantitative and qualitative methods in a single large-scale evaluation study. *Evaluation Review, 9*, 627-643.

Sales, B. D., & Folkman, S. (2002). *Ethics in research with human participants*. Washington, DC: American Psychological Association.

Sandelowski, M. (1995). Focus on qualitative methods: Sample sizes in qualitative research. *Research in Nursing & Health, 18*, 179-183.

Sandelowski, M. (2001). Real qualitative researchers don't count: The use of numbers in qualitative research. *Research in Nursing & Health, 24*, 230-240.

Sandelowski, M. (2003). Tables or tableaux? The challenges of writing and reading mixed methods studies. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 321-350)*.* Thousand Oaks, CA: Sage.

Savaya, R., Monnickendam, M., & Waysman, M. (2000). An assessment of the utilization of a computerized decision support system for youth probation officers. *Journal of Technology in Human Services, 17*(4), 1-14.

Scherer, M. J., & Lane, J. P. (1997, December). Assessing consumer profiles of "ideal" assistive technologies in ten categories: An integration of quantitative and qualitative methods. *Disability & Rehabilitation: An International Multidisciplinary Journal, 19*(12), 528-535.

Schmidt, F. L. (1996). Statistical significance testing and cumulative knowledge in psychology: Implications for the training of researchers. *Psychological Methods, 1*, 115-129.

Schmidt, F. L., & Hunter, J. E. (1997). Eight common but false objections to the discontinuation of significance testing in the analysis of research data. In L. L. Harlow, S. A. Mulaik, & J. H. Steiger (Eds.), *What if there were no significance tests?* (pp. 37-64). Mahwah, NJ: Erlbaum.

Schmidt, F. L., Hunter, J. E., & Urry, V. E. (1976). Statistical power in criterion-related validation studies. *Journal of Applied Psychology, 61*, 473-485.

Schwandt, T. A. (2001). *Dictionary of qualitative inquiry* (2nd ed.). Thousand Oaks, CA: Sage.

Sechrest, L., & Sidana, S. (1995). Quantitative and qualitative methods: Is there an alternative? *Evaluation and Program Planning, 18*, 77-87.

Sedlmeier, P., & Gigerenzer, G. (1989). Do studies of statistical power have an effect on the power of studies? *Psychological Bulletin, 105*, 309-316.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2001). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin.

Shaver, J. P., & Norton, R. S. (1980a). Populations, samples, randomness, and replication in two social studies journals. *Theory and Research in Social Education, 8*(2), 1-20.

Shaver, J. P., & Norton, R. S. (1980b). Randomness and replication in ten years of the *American Educational Research Journal. Educational Researcher, 9*(1), 9-15.

Sieber, S. D. (1973). The integration of fieldwork and survey methods. *American Journal of Sociology, 73*, 1335-1359.

Smith, M. L. (1986). The whole is greater: Combining qualitative and quantitative approaches in evaluation studies. In D. D. Williams (Ed.), *Naturalistic evaluation* (pp. 37-54). San Francisco: Jossey-Bass.

Smith, M. L., & Glass, G. V. (1987). *Research and evaluation in education and the social sciences*. Englewood Cliffs, NJ: Prentice Hall.

Srinivasan, P. (2004). Generation hypotheses from MEDLINE. *Journal of the American Society for Information Science & Technology, 55*, 396-413.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches.* Thousand Oaks, CA: Sage.

Tashakkori, A., & Teddlie, C. (Eds.). (2003a). *Handbook of mixed methods in social and behavioral research.* Thousand Oaks, CA: Sage.

Tashakkori, A., & Teddlie, C. (2003b). Issues and dilemmas in teaching research methods courses in social and behavioral sciences: A US perspective. International Journal of Social Research Methodology, 6(1), 61 - 77.

Tashakkori, A., & Teddlie, C. (2003c). The past and future of mixed methods research: From data triangulation to mixed model designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 671-701). Thousand Oaks, CA: Sage.

Taylor, D. L., & Tashakkori, A. (1997). Toward an understanding of teachers' desire for participation in decision making. *Journal of School Leadership, 7*, 609-628.

Teddlie, C., & Tashakkori, A. (2003). Major issues and controversies in the use of mixed methods in the social and behavioral sciences. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 3-50). Thousand Oaks, CA: Sage.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling: A typology with examples. *Journal of Mixed Methods Research, 1*, 77-100.

The American Heritage College Dictionary (3rd ed.). (1993). Boston: Houghton Mifflin.

Way, N., Stauber, H. Y., Nakkula, M. J., & London, P. (1994). Depression and substance use in two divergent high school cultures: A quantitative and qualitative analysis. *Journal of Youth and Adolescence, 23*, 331-357.

Waysman, M., & Savaya, R. (1997). Mixed method evaluation: A case study. *Evaluation Practice, 18*, 227-237.

Wolcott, H. F. (1990). On seeking-and rejecting-validity in qualitative research. In E. W. Eisner & A. Peshkin (Eds.), *Qualitative inquiry in education: The continuing debate* (pp. 121-152). New York: Teachers College Press.

Author Note

Anthony Onwuegbuzie, Ph.D., is professor in the Department of Educational Leadership and Counseling at Sam Houston State University. He teaches courses in doctoral-level qualitative research, quantitative research, and mixed methods. His research topics primarily involve disadvantaged and under-served populations such as minorities, children living in war zones, students with special needs, and juvenile delinquents. Also, he writes extensively on qualitative, quantitative, and mixed methodological topics.

Kathleen M. T. Collins, Ph.D., is an associate professor in the Department of Curriculum & Instruction, University of Arkansas. She teaches courses in doctoral-level assessment and mixed methods. Her specializations are special populations, mixed methods research, and education of postsecondary students.

Correspondence should be addressed to Anthony J. Onwuegbuzie, Department of Educational Leadership and Counseling, Box 2119, Sam Houston State University, Huntsville, Texas 77341-2119; Email: tonyonwuegbuzie@aol.com

Article Citation

Onwuegbuzie, A. J., & Collins, K. M. T. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report*, *12*(2), 281-316. Retrieved [Insert date], from http://www.nova.edu/ssss/QR/QR12-2/onwuegbuzie2.pdf

---