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Mixed Methods Sampling

A Typology With Examples

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This article presents a discussion of mixed methods (MM) sampling techniques. MM sampling involves combining well-established qualitative and quantitative techniques in creative ways to answer research questions posed by MM research designs. Several issues germane to MM sampling are presented including the differences between probability and purposive sampling and the probability-mixed-purposive sampling continuum. Four MM sampling prototypes are introduced: basic MM sampling strategies, sequential MM sampling, concurrent MM sampling, and multilevel MM sampling. Examples of each of these techniques are given as illustrations of how researchers actually generate MM samples. Finally, eight guidelines for MM sampling are presented.

Keywords: *mixed methods sampling; mixed methods research; multilevel mixed methods sampling; representativeness/saturation trade-off*

Taxonomy of Sampling Strategies in the Social and Behavioral Sciences

Although sampling procedures in the social and behavioral sciences are often divided into two groups (probability, purposive), there are actually four broad categories as illustrated in Figure 1. Probability, purposive, and convenience sampling are discussed briefly in the following sections to provide a background for mixed methods (MM) sampling strategies.

Probability sampling techniques are primarily used in quantitatively oriented studies and involve “selecting a relatively large number of units from a population, or from specific subgroups (strata) of a population, in a random manner where the probability of inclusion for every member of the population is determinable” (Tashakkori & Teddlie, 2003a, p. 713). Probability samples aim to achieve representativeness, which is the degree to which the sample accurately represents the entire population.

Purposive sampling techniques are primarily used in qualitative (QUAL) studies and may be defined as selecting units (e.g., individuals, groups of individuals, institutions) based on specific purposes associated with answering a research study’s questions. Maxwell (1997) further defined purposive sampling as a type of sampling in which, “particular settings, persons, or events are deliberately selected for the important information they can provide that cannot be gotten as well from other choices” (p. 87).

Authors’ Note: This article is partially based on a paper presented at the 2006 annual meeting of the American Educational Research Association, San Francisco.

Figure 1
Taxonomy of Sampling Techniques for the Social and Behavioral Sciences

- I. Probability Sampling**
 - A. Random Sampling
 - B. Stratified Sampling
 - C. Cluster Sampling
 - D. Sampling Using Multiple Probability Techniques
 - II. Purposive Sampling**
 - A. Sampling to Achieve Representativeness or Comparability
 - B. Sampling Special or Unique Cases
 - C. Sequential Sampling
 - D. Sampling Using Multiple Purposive Techniques
 - III. Convenience Sampling**
 - A. Captive Sample
 - B. Volunteer Sample
 - IV. Mixed Methods Sampling**
 - A. Basic Mixed Methods Sampling
 - B. Sequential Mixed Methods Sampling
 - C. Concurrent Mixed Methods Sampling
 - D. Multilevel Mixed Methods Sampling
 - E. Combination of Mixed Methods Sampling Strategies
-

Convenience sampling involves drawing samples that are both easily accessible and willing to participate in a study. Two types of convenience samples are captive samples and volunteer samples. We do not discuss convenience samples in any detail in this article, which focuses on how probability and purposive samples can be used to generate MM samples.

MM sampling strategies involve the selection of units¹ or cases for a research study using both probability sampling (to increase external validity) and purposive sampling strategies (to increase transferability).² This fourth general sampling category has been discussed infrequently in the research literature (e.g., Collins, Onwuegbuzie, & Jiao, 2006; Kemper, Stringfield, & Teddlie, 2003), although numerous examples of it exist throughout the behavioral and social sciences.

The article is divided into four major sections: a description of probability sampling techniques, a discussion of purposive sampling techniques, general considerations concerning MM sampling, and guidelines for MM sampling. The third section on general considerations regarding MM sampling contains examples of various techniques, plus illustrations of how researchers actually generate MM samples.

Traditional Probability Sampling Techniques

An Introduction to Probability Sampling

There are three basic types of probability sampling, plus a category that involves multiple probability techniques:

- Random sampling—occurs when each sampling unit in a clearly defined population has an equal chance of being included in the sample.
- Stratified sampling—occurs when the researcher divides the population into subgroups (or strata) such that each unit belongs to a single stratum (e.g., low income, medium income, high income) and then selects units from those strata.
- Cluster sampling—occurs when the sampling unit is not an individual but a group (cluster) that occurs naturally in the population such as neighborhoods, hospitals, schools, or classrooms.
- Sampling using multiple probability techniques—involves the use of multiple quantitative (QUAN) techniques in the same study.

Probability sampling is based on underlying theoretical distributions of observations, or sampling distributions, the best known of which is the normal curve.

Random Sampling

Random sampling is perhaps the most well known of all sampling strategies. A simple random sample is one in which each unit (e.g., persons, cases) in the accessible population has an equal chance of being included in the sample, and the probability of a unit being selected is not affected by the selection of other units from the accessible population (i.e., the selections are made independently). Simple random sample selection may be accomplished in several ways including drawing names or numbers out of a box or using a computer program to generate a sample using random numbers that start with a “seeded” number based on the program’s start time.

Stratified Sampling

If a researcher is interested in drawing a random sample, then she or he typically wants the sample to be representative of the population on some characteristic of interest (e.g., achievement scores). The situation becomes more complicated when the researcher wants various subgroups in the sample to also be representative. In such cases, the researcher uses stratified random sampling,³ which combines stratified sampling with random sampling.

For example, assume that a researcher wanted a stratified random sample of males and females in a college freshman class. The researcher would first separate the entire population of the college class into two groups (or strata): one all male and one all female. The researcher would then independently select a random sample from each stratum (one random sample of males, one random sample of females).

Cluster Sampling

The third type of probability sampling, cluster sampling, occurs when the researcher wants to generate a more efficient probability sample in terms of monetary and/or time resources. Instead of sampling individual units, which might be geographically spread over great distances, the researcher samples groups (clusters) that occur naturally in the population, such as neighborhoods or schools or hospitals.

Sampling Using Multiple Probability Techniques

Researchers often use the three basic probability sampling techniques in conjunction with one another to generate more complex samples. For example, multiple cluster sampling is a technique that involves (a) a first stage of sampling in which the clusters are randomly selected and (b) a second stage of sampling in which the units of interest are sampled within the clusters. A common example of this from educational research occurs when schools (the clusters) are randomly selected and then teachers (the units of interest) in those schools are randomly sampled.

Traditional Purposive Sampling Techniques

An Introduction to Purposive Sampling

Purposive sampling techniques have also been referred to as nonprobability sampling or purposeful sampling or “qualitative sampling.” As noted above, purposive sampling techniques involve selecting certain units or cases “based on a specific purpose rather than randomly” (Tashakkori & Teddlie, 2003a, p. 713). Several other authors (e.g., Kuzel, 1992; LeCompte & Preissle, 1993; Miles & Huberman, 1994; Patton, 2002) have also presented typologies of purposive sampling techniques.

As detailed in Figure 2, there are three broad categories of purposive sampling techniques (plus a category involving multiple purposive techniques), each of which encompass several specific types of strategies:

- Sampling to achieve representativeness or comparability—these techniques are used when the researcher wants to (a) select a purposive sample that represents a broader group of cases as closely as possible or (b) set up comparisons among different types of cases.
- Sampling special or unique cases—employed when the individual case itself, or a specific group of cases, is a major focus of the investigation (rather than an issue).
- Sequential sampling—uses the gradual selection principle of sampling when (a) the goal of the research project is the generation of theory (or broadly defined themes) or (b) the sample evolves of its own accord as data are being collected. Gradual selection may be defined as the sequential selection of units or cases based on their relevance to the research questions, not their representativeness (e.g., Flick, 1998).
- Sampling using multiple purposive techniques—involves the use of multiple QUAL techniques in the same study.

Sampling to Achieve Representativeness or Comparability

The first broad category of purposive sampling techniques involves two goals:

- sampling to find instances that are *representative* or *typical* of a particular type of case on a dimension of interest, and
- sampling to achieve comparability across different types of cases on a dimension of interest.

Figure 2 A Typology of Purposive Sampling Strategies

A. Sampling to Achieve Representativeness or Comparability

1. Typical Case Sampling
2. Extreme or Deviant Case Sampling (also known as Outlier Sampling)
3. Intensity Sampling
4. Maximum Variation Sampling
5. Homogeneous Sampling
6. Reputational Case Sampling

B. Sampling Special or Unique Cases

7. Revelatory Case Sampling
8. Critical Case Sampling
9. Sampling Politically Important Cases
10. Complete Collection (also known as Criterion Sampling)

C. Sequential Sampling

11. Theoretical sampling (also known as Theory-Based Sampling)
12. Confirming and Disconfirming Cases
13. Opportunistic Sampling (also known as Emergent Sampling)
14. Snowball Sampling (also known as Chain Sampling)

D. Sampling Using Combinations of Purposive Techniques

Source: These techniques were taken from several sources, such as Kuzel (1992), LeCompte and Preissle (1993), Miles and Huberman (1994), and Patton (2002).

There are six types of purposive sampling procedures that are based on achieving representativeness or comparability: typical case sampling, extreme or deviant case sampling, intensity sampling, maximum variation sampling, homogeneous sampling, and reputational sampling. Although some of these purposive sampling techniques are aimed at generating representative cases, most are aimed at producing contrasting cases. Comparisons or contrasts are at the very core of QUAL data analysis strategies (e.g., Glaser & Strauss, 1967; Mason, 2002; Spradley, 1979, 1980), including the contrast principle and the constant comparative technique.

An example of this broad category of purposive sampling is extreme or deviant case sampling, which is also known as “outlier sampling” because it involves selecting cases near the “ends” of the distribution of cases of interest. It involves selecting those cases that are the most outstanding successes or failures related to some topic of interest. Such extreme successes or failures are expected to yield especially valuable information about the topic of interest.

Extreme or deviant cases provide interesting contrasts with other cases, thereby allowing for comparability across those cases. These comparisons require that the investigator first determine a dimension of interest, then visualize a distribution of cases or individuals or some other sampling unit on that dimension (which is the QUAL researcher’s informal sampling frame), and then locate extreme cases in that distribution. (Sampling frames are

formal or informal lists of units or cases from which the sample is drawn, and they are discussed in more detail later in this article.)

Sampling Special or Unique Cases

These sampling techniques include special or unique cases, which have long been a focus of QUAL research, especially in anthropology and sociology. Stake (1995) described an intrinsic case study as one in which the case itself is of primary importance, rather than some overall issue. There are four types of purposive sampling techniques that feature special or unique cases: revelatory case sampling, critical case sampling, sampling politically important cases, and complete collection.

An example of this broad category is revelatory case sampling, which involves identifying and gaining entrée to a single case representing a phenomenon that had previously been “inaccessible to scientific investigation” (Yin, 2003, p. 42). Such cases are rare and difficult to study, yet yield very valuable information about heretofore unstudied phenomena.

There are several examples of revelatory cases spread throughout the social and behavioral sciences. For example, Ward’s (1986) *Them Children: A Study in Language Learning* derives its revelatory nature from its depiction of a unique environment, the “Rosepoint” community, which was a former sugar plantation that is now a poor, rural African American community near New Orleans. Ward described how the Rosepoint community provided a “total environment” for the families she studied (especially for the children) that is quite different from the mainstream United States.

Sequential Sampling

These techniques all involve the principle of gradual selection, which was defined earlier in this article. There are four types of purposive sampling techniques that involve sequential sampling:

- theoretical sampling,
- confirming and disconfirming cases,
- opportunistic sampling (also known as emergent sampling), and
- snowball sampling (also known as chain sampling).

An example from this broad category is theoretical sampling, in which the researcher examines particular instances of the phenomenon of interest so that she or he can define and elaborate on its various manifestations. The investigator samples people, institutions, documents, or wherever the theory leads the investigation.

“Awareness of dying” research provides an excellent example of theoretical sampling utilized by the originators of grounded theory (Glaser & Strauss, 1967). Glaser and Strauss’s research took them to a variety of sites relevant to their emerging theory regarding different types of awareness of dying. Each site provided unique information that previous sites had not. These sites included premature baby services, neurological services with comatose patients, intensive care units, cancer wards, and emergency services. Glaser

and Strauss followed the dictates of gradual selection to that site or case that would yield the most valuable information for the further refinement of the theory.

Sampling Using Multiple Purposive Techniques

Sampling using combinations of purposive techniques involves using two or more of those sampling strategies when selecting units or cases for a research study. Many QUAL studies reported in the literature utilize more than one purposive sampling technique due to the complexities of the issues being examined.

For example, Poorman (2002) presented an example of multiple purposive sampling techniques from the literature related to the abuse and oppression of women. In this study, Poorman used four different types of purposive sampling techniques (theory based, maximum variation, snowball, and homogeneous) in combination with one another in selecting the participants for a series of four focus groups.

General Considerations Concerning Mixed Methods Sampling

Differences Between Probability and Purposive Sampling

Table 1 presents comparisons between probability and purposive sampling strategies. There are a couple of similarities between purposive and probability sampling: They both are designed to provide a sample that will answer the research questions under investigation, and they both are concerned with issues of generalizability to an external context or population (i.e., transferability or external validity).

On the other hand, the remainder of Table 1 presents a series of dichotomous differences between the characteristics of purposive and probability sampling. For example, a purposive sample is typically designed to pick a small number of cases that will yield the most information about a particular phenomenon, whereas a probability sample is planned to select a large number of cases that are collectively representative of the population of interest. There is a classic methodological trade-off involved in the sample size difference between the two techniques: Purposive sampling leads to greater depth of information from a smaller number of carefully selected cases, whereas probability sampling leads to greater breadth of information from a larger number of units selected to be representative of the population (e.g., Patton, 2002).

Another basic difference between the two types of sampling concerns the use of sampling frames, which were defined earlier in this article. As Miles and Huberman (1994) noted, "Just thinking in sampling-frame terms is good for your study's health" (p. 33). Probability sampling frames are usually formally laid out and represent a distribution with a large number of observations. Purposive sampling frames, on the other hand, are typically informal ones based on the expert judgment of the researcher or some available resource identified by the researcher. In purposive sampling, a sampling frame is "a resource from which you can select your smaller sample" (Mason, 2002, p. 140). (See Table 1 for more differences between probability and purposive sampling.)

Table 1
Comparisons Between Purposive and Probability Sampling Techniques

Dimension of Contrast	Purposive Sampling	Probability Sampling
Other names	Purposeful sampling Nonprobability sampling Qualitative sampling	Scientific sampling Random sampling Quantitative sampling
Overall purpose of sampling	Designed to generate a sample that will address research questions	Designed to generate a sample that will address research questions
Issue of generalizability	Sometimes seeks a form of generalizability (transferability)	Seeks a form of generalizability (external validity)
Rationale for selecting cases/units	To address specific purposes related to research questions The researcher selects cases she or he can learn the most from	Representativeness The researcher selects cases that are collectively representative of the population
Sample size	Typically small (usually 30 cases or less)	Large enough to establish representativeness (usually at least 50 units)
Depth/breadth of information per case/unit	Focus on depth of information generated by the cases	Focus on breadth of information generated by the sampling units
When the sample is selected	Before the study begins, during the study, or both	Before the study begins
How selection is made	Utilizes expert judgment	Often based on application of mathematical formulas
Sampling frame	Informal sampling frame somewhat larger than sample	Formal sampling frame typically much larger than sample
Form of data generated	Focus on narrative data Numeric data can also be generated	Focus on numeric data Narrative data can also be generated

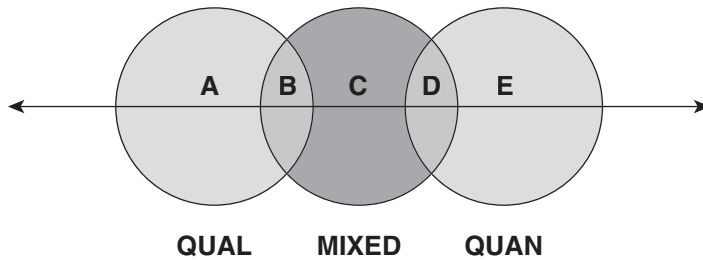
The Purposive-Mixed-Probability Sampling Continuum

The dichotomy between probability and purposive becomes a continuum when MM sampling is added as a third type of sampling strategy technique. Many of the dichotomies presented in Table 1 are better understood as continua with purposive sampling techniques on one end, MM sampling strategies in the middle, and probability sampling techniques on the other end. The “Purposive-Mixed-Probability Sampling Continuum” in Figure 3 illustrates this continuum.

Characteristics of Mixed Methods Sampling Strategies

Table 2 presents the characteristics of MM sampling strategies, which are combinations of (or intermediate points between) the probability and purposive sampling positions. The information from Table 2 could be inserted into Table 1 between the columns describing purposive and probability sampling, but we have chosen to present it separately here so that we can focus on the particular characteristics of MM sampling.

Figure 3
Purposive-Mixed-Probability Sampling Continuum



Source: Teddlie (2005).

Note: Zone A consists of totally qualitative (QUAL) research with purposive sampling, whereas Zone E consists of totally quantitative (QUAN) research with probability sampling. Zone B represents primarily QUAL research, with some QUAN components. Zone D represents primarily QUAN research, with some QUAL components. Zone C represents totally integrated mixed methods (MM) research and sampling. The arrow represents the purposive-mixed-probability sampling continuum. Movement toward the middle of the continuum indicates a greater integration of research methods and sampling. Movement away from the center (and toward either end) indicates that research methods and sampling (QUAN and QUAL) are more separated or distinct.

MM sampling strategies may employ all the probability and purposive techniques discussed earlier in this article. Indeed, the researcher's ability to creatively combine these techniques in answering a study's questions is one of the defining characteristics of MM research.⁴

The strand of a research design is an important construct that we use when describing MM sampling procedures. This term was defined in Tashakkori and Teddlie (2003b) as a phase of a study that includes three stages: the conceptualization stage, the experiential stage (methodological/analytical), and the inferential stage. These strands are typically either QUAN or QUAL, although transformation from one type to another can occur during the course of a study. A QUAL strand of a research study is a strand that is QUAL in all three stages, whereas a QUAN strand of a research study is a strand that is QUAN in all three stages.

The MM researcher sometimes chooses procedures that focus on generating representative samples, especially when addressing a QUAN strand of a study. On the other hand, when addressing a QUAL strand of a study, the MM researcher typically utilizes sampling techniques that yield information rich cases. Combining the two orientations allows the MM researcher to generate complementary databases that include information that has both depth and breadth regarding the phenomenon under study.

There are typically multiple samples in an MM study, and these samples may vary in size (dependent on the research strand and question) from a small number of cases to a large number of units. Using an educational example, one might purposively select four schools for a study, then give surveys to all 100 teachers in those schools, then conduct six focus groups of students, followed by interviewing 60 randomly selected students.

Both numeric and narrative data are typically generated from MM samples, but occasionally MM sampling strategies may yield only narrative or only numeric data. Hence, it

Table 2
Characteristics of Mixed Methods Sampling Strategies

Dimension of Contrast	Mixed Methods Sampling
Overall purpose of sampling	Designed to generate a sample that will address research questions.
Issue of generalizability	For some strands of a research design, there is a focus on external validity issues. For other strands, the focus is on transferability issues.
Number of techniques	All those employed by both probability and purposive sampling.
Rationale for selecting cases/units	For some strands of a research design, there is a focus on representativeness. For other strands, the focus is on seeking out information rich cases.
Sample size	There are multiple samples in the study. Samples vary in size dependent on the research strand and question from a small number of cases to a large number of units of analysis.
Depth/breadth of information per case/unit	Focus on both depth and breadth of information across the research strands.
When the sample is selected	Most sampling decisions are made before the study starts, but QUAL-oriented questions may lead to the emergence of other samples during the study.
How selection is made	There is a focus on expert judgment across the sampling decisions, especially because they interrelate with one another. Some QUAN-oriented strands may require application of mathematical sampling formulae.
Sampling frame	Both formal and informal frames are used.
Form of data generated	Both numeric and narrative data are typically generated. Occasionally, mixed methods sampling strategies may yield only narrative or only numeric data.

Note: QUALqualitative; QUANquantitative.

is important to present a brief discussion of the relationship between sampling techniques and the generation of different types of data.

Table 3 presents a theoretical matrix that crosses type of sampling technique (probability, purposive, mixed) by type of data generated by the study (QUAN only, QUAL only, mixed).⁵ This 3 × 3 matrix illustrates that certain types of sampling techniques are theoretically more frequently associated with certain types of data: probability samples with QUAN data (Cell 1), purposive samples with QUAL data (Cell 5), and mixed samples with mixed data (Cell 9). The diagonal cells (1, 5, and 9) represent the most frequently occurring combination of sampling techniques and types of data generated. Despite these general tendencies, there are other situations where sampling techniques occasionally (Cells 3, 6, 7, and 8) or rarely (Cells 2 and 4) are associated with studies that generate different types of data.

The Representativeness/Saturation Trade-Off

Researchers often have to make sampling decisions based on available resources (e.g., time, money). Researchers conducting MM research sometimes make a compromise between the requirements of the QUAN and QUAL samples in their study, which we call

Table 3
Theoretical Matrix Crossing Type of Sampling Technique by Type of Data Generated

Type of Sampling Technique	Generation of Quantitative Data Only	Generation of Qualitative Data Only	Generation of Both Qualitative and Quantitative Data
Probability sampling techniques	Happens often (Cell 1)	Happens rarely (Cell 2)	Happens occasionally (Cell 3)
Purposive sampling techniques	Happens rarely (Cell 4)	Happens often (Cell 5)	Happens occasionally (Cell 6)
Mixed methods sampling strategies	Happens occasionally (Cell 7)	Happens occasionally (Cell 8)	Happens often (Cell 9)

Source: Kemper, Stringfield, and Teddlie (2003, p. 285).

the representativeness/saturation trade-off. This trade-off means that the more emphasis that is placed on the representativeness of the QUAN sample, the less emphasis there is that can be placed on the saturation of the QUAL sample, and vice versa.

As noted earlier in this article, the aim of sampling in QUAN research is to achieve representativeness. That is, the researcher wants the sample to reflect the characteristics of the population of interest, and typically this requires a sample of a certain size relative to the population (e.g., Wunsch, 1986).

An important sample size issue in QUAL research involves saturation of information (e.g., Glaser & Strauss, 1967; Strauss & Corbin, 1998).⁶ For example, in focus group studies the new information gained from conducting another session typically decreases as more sessions are held. Krueger and Casey (2000) expressed this guideline as follows:

The rule of thumb is, plan three or four focus groups with any one type of participant. Once you have conducted these, determine if you have reached saturation. *Saturation* is a term used to describe the point when you have heard the range of ideas and aren't getting new information. If you were still getting new information after three or four groups, you would conduct more groups. (p. 26)

Figure 4 presents an illustration of this representativeness/saturation trade-off. In this example, a student conducting her dissertation research with limited resources had to compromise between the requirements of (a) the representatives of her survey sample and (b) the saturation of information gained from her interview study.

Types of Mixed Methods Sampling Strategies

We now turn our attention to descriptions of different types of MM sampling strategies with examples. We have defined MM sampling as involving the selection of units of analysis for a MM study through both probability and purposive sampling strategies. There is not a large literature on MM sampling strategies per se at this time, so we reviewed the scant literature devoted to the topic (e.g., Collins et al., 2006;⁷ Kemper et al., 2003) and

Figure 4 Example of the Representativeness/Saturation Rule

Aaron (2005) was interested in studying the leadership characteristics of the directors of programs in radiologic technology. She had both quantitatively and qualitatively oriented research questions. The QUAN questions were answered using an online survey administered to all radiologic program directors. The QUAL questions were answered using a telephone interview with a small sample of directors whose responses to the online survey indicated that they differed on two important dimensions [type of program administered (baccalaureate, associate, certificate) and type of leadership style (transformational, transactional)], resulting in six cells. Aaron wanted the survey study to have a representative sample and the interview study to result in "saturated" QUAL data.

Of the 590 program directors that were sent surveys, 284 responded for a 48% response rate. Extrapolating from the samples and population sizes (Wunsch, 1986), it appears that Aaron could be confident that her sample reflected the population within plus or minus 5%.

There were no clearly established standards for how large the interview sample should be to generate trustworthy results. Aaron selected 12 program directors to be interviewees based on her intuitions, plus the expert advice of her dissertation committee. This number also allowed her to select a stratified purposive sample (see description later in this chapter) in which program type and leadership style were the strata. She selected two interviewees for each of the six cells, resulting in 12 program directors and then (undeterred by superstition) selected a 13th interviewee whom she felt was a particularly information rich case (extreme or deviant case sampling).

If Aaron had attempted to increase the sample size of her survey data to reflect the population within plus or minus 1%, she would have had to send out at least one more round of surveys to all who had not already participated, thereby decreasing the time she had left to select and interact with the participants in the interview study. On the other hand, if she had increased the sample size of the interview study to 24, she would have had to reduce the amount of time and resources that she invested in the survey study. Her sampling choices appeared to meet the requirements for representativeness of QUAN sources and saturation of QUAL sources.

then searched for additional examples throughout the social and behavioral sciences. This literature search was often frustrating due to the lack of details presented by many authors with regard to sample selection.

There is no widely accepted typology of MM sampling strategies. In generating the provisional typology for this article, we faced the general issue of nomenclature in MM research (e.g., Teddlie & Tashakkori, 2003). One of the major decisions that mixed methodologists have to make concerning nomenclature is whether to

- utilize a bilingual nomenclature that employs both the QUAL and the QUAN terms for basic issues such as research designs, validity and trustworthiness, sampling, and so forth;
- create a new language for mixed methodology that gives a common name for the existing sets of QUAL and QUAN terms; or
- combine the first two options by presenting new MM terms that are integrated with well-known QUAL/QUAN terms in the definition of the overall sampling strategy.

Sampling in the social and behavioral sciences has so many well-defined and specified QUAL and QUAN techniques, with commonly understood names, that it would be foolhardy to try to develop a new terminology. On the other hand, the literature indicates that mixed methodologists have combined probability and purposive sampling techniques in certain unique prescribed manners to meet the specification of popular MM designs (e.g., concurrent, sequential designs). In such cases, it seems reasonable to overlay the probability and purposive sampling terms with MM metaterms that encompass the totality of the sampling techniques used in the research projects.

The following is our provisional typology of MM sampling strategies:

- basic MM sampling strategies,
- sequential MM sampling,
- concurrent MM sampling,
- multilevel MM sampling, and
- sampling using multiple MM sampling strategies.

The “backgrounds” of the techniques presented in our typology are interesting. The basic MM sampling strategies discussed in the following section (i.e., stratified purposive sampling, purposive random sampling) are typically discussed as types of purposive sampling techniques (e.g., Patton, 2002), yet by definition they also include a component of probability sampling (stratified, random). These basic MM techniques may be used to generate narrative data only in QUAL oriented research (Cell 8 in Table 3) or to generate MM data (Cell 9 in Table 3).

Sequential and concurrent MM sampling follow from the well-known design types described by several authors (e.g., Creswell, Plano Clark, Gutmann, & Hanson, 2003; Johnson & Onwuegbuzie, 2004). Sequential MM sampling involves the selection of units of analysis for an MM study through the sequential use of probability and purposive sampling strategies (QUAN-QUAL), or vice versa (QUAL-QUAN). Sequential QUAN-QUAL sampling is the most common technique that we have encountered in our exploration of the MM literature, as described by Kemper et al. (2003):

In sequential mixed models studies, information from the first sample (typically derived from a probability sampling procedure) is often required to draw the second sample (typically derived from a purposive sampling procedure). (p. 284)

Detailed examples of concurrent MM sampling are more difficult to find in the existing literature, at least from our review of it. Concurrent MM sampling involves the selection of units of analysis for an MM study through the simultaneous use of both probability and purposive sampling. One type of sampling procedure does not set the stage for the other in concurrent MM sampling studies; instead, both probability and purposive sampling procedures are used at the same time.

Multilevel MM sampling is a general sampling strategy in which probability and purposive sampling techniques are used at different levels of the study (Tashakkori & Teddlie, 2003a, p. 712).⁸ This sampling strategy is common in contexts or settings in which different units of analysis are “nested” within one another, such as schools, hospitals, and various types of bureaucracies.

Basic Mixed Methods Sampling Strategies

One well-known basic MM sampling strategy is stratified purposive sampling (quota sampling). The stratified nature of this sampling procedure is characteristic of probability sampling, whereas the small number of cases typically generated through it is characteristic of purposive sampling. In this technique, the researcher first divides the group of interest into strata (e.g., above average, average, below average students) and then selects a small number of cases to study intensively within each strata based on purposive sampling techniques. This allows the researcher to discover and describe in detail characteristics that are similar or different across the strata or subgroups. Patton (2002) described this technique as selecting “samples within samples.”

An example of stratified purposive sampling comes from Kemper and Teddlie (2000), who in one phase of a multiphase study generated six strata based on two dimensions (three levels of community type crossed by two levels of implementation of innovation). Their final sample had only six schools in it (one purposively selected school per stratum): one “typical” urban, one “typical” suburban, one “typical” rural, one “better” urban, one “better” suburban, and one “better” rural. This sampling scheme allowed the researchers to discuss the differences between “typical” and “better” schools at program implementation across a variety of community types. What differentiated a pair of schools in one strata or context (e.g., urban) could be quite different from what differentiated a pair of schools in another (e.g., rural).

Purposive random sampling involves taking a random sample of a small number of units from a much larger target population (Kemper et al., 2003). Kalafat and Illback (1999) presented an example of purposive random sampling in their evaluation of a large statewide program that used a school-based family support system to enhance the educational experiences of at-risk students. There were almost 600 statewide sites in this program, and a statistically valid sample would have required in-depth descriptions of more than 200 cases (Wunsch, 1986), which was well beyond the resources allocated to the evaluation. In an early stage of the study before the intervention began, the researchers utilized a purposive random sampling approach to select 12 cases from the overall target population. The researchers then closely followed these cases throughout the life of the project. This purposive random sample of a small number of cases from a much larger target population added credibility to the evaluation by generating QUAL, process-oriented results to complement the large-scale QUAN-oriented research that also took place.

Sequential Mixed Methods Sampling

There are examples of QUAN-QUAL and QUAL-QUAN MM sampling procedures throughout the social and behavioral sciences. Typically, the methodology and results from the first strand inform the methodology employed in the second strand.⁹ In our examination of the literature, we found more examples of QUAN-QUAL studies in which the methodology and/or results from the QUAN strand influenced the methodology subsequently employed in the QUAL strand. In many of these cases, the final sample used in the QUAN strand was then used as the sampling frame for the subsequent QUAL strand. In these studies, the QUAL strand used a subsample of the QUAN sample.

One example of QUAN-QUAL mixed methods sampling comes from the work of Hancock, Calnan, and Manley (1999) in a study of perceptions and experiences of residents concerning dental service in the United Kingdom. In the QUAN portion of the study, the researchers conducted a postal survey that involved both cluster and random sampling: (a) The researchers selected 13 wards out of 365 in a county in southern England using cluster sampling, and (b) they randomly selected 1 out of every 28 residents in those wards resulting in an accessible population of 2,747 individuals, from which they received 1,506 responses (55%). The researchers could be confident that their sample reflected the accessible population within plus or minus 5% (Wunsch, 1986).

The questionnaires included five items measuring satisfaction with dental care (DentSat scores). The researchers next selected their sample for the QUAL strand of the study using intensity and homogeneous sampling: (a) 20 individuals were selected who had high DentSat scores through intensity sampling, (b) 20 individuals were selected who had low DentSat scores through intensity sampling, and (c) 10 individuals were selected who had not received dental care in the past 5 years, but also who did not have full dentures, using homogeneous sampling. In this study, the information generated through the QUAN strand was necessary to select participants with particular characteristics for the QUAL strand.

An example of a QUAL-QUAN sampling procedure comes from the work of Nieto, Mendez, and Carrasquilla (1999) in a study of malaria control in Colombia. The study was conducted in the area of Colombia where the incidence of the disease is the highest. In the QUAL strand of the study, the research team asked leaders from five urban districts to select individuals for participation in focus groups. The focus groups were formed using the following criteria: (a) The participants should belong to one of the local community organizations; (b) they should represent different geographical and age groups; (c) they should recognize the community's leadership and be fully committed to the community; and (d) the groups should be as homogeneous as possible with regard to educational level and socioeconomic and cultural status, which involved face-to-face interviews.

The five focus groups met for three sessions each and discussed a wide range of issues related to health problems in general and malaria in particular. The groups ranged in size from 15 to 18 members, and subgroups were formed during the sessions to encourage greater participation in the process. The focus group results were then used by the research team to design the QUAN survey, which was subsequently given to a large sample of households. The research team used stratified random sampling, with three geographical zones constituting the strata. The total sample for the QUAN strand was 1,380 households, each of which was visited by a member of the researcher team.

The QUAL and QUAN data gathered through the overall MM sampling strategy was very comparable in terms of the participants' knowledge of symptoms, perceptions of the causes of malaria transmission, and prevention practices. The QUAN strand of this study could not have been conducted without the information initially gleaned from the QUAL strand.

Concurrent Mixed Methods Sampling

We analyzed numerous MM articles while writing this article, but the lack of details regarding sampling in many of them precluded their inclusion in this article. In particular, very few articles that we analyzed included a concurrent MM design with an explicit

discussion of both the purposive and probability sampling techniques that were used to generate it. Concurrent MM designs allow researchers to triangulate the results from the separate QUAN and QUAL components of their research, thereby allowing them to “confirm, cross-validate, or corroborate findings within a single study” (Creswell et al., 2003, p. 229).

Nevertheless, we were successful in locating a few articles that enhanced our understanding of how researchers actually combine probability and purposive sampling in their concurrent MM studies. We have delineated two basic overall concurrent MM sampling procedures, but we are certain that there are others. These two basic procedures are as follows:

1. Concurrent MM sampling in which probability sampling techniques are used to generate data for the QUAN strand and purposive sampling techniques are used to generate data for the QUAL strand. *These sampling procedures occur independently.*
2. Concurrent MM sampling utilizing *a single sample generated through the joint use of probability and purposive techniques* to generate data for both the QUAN and QUAL strands of a MM study. This occurs, for example, when a sample of participants, selected through the joint application of probability and purposive techniques, responds to a MM survey that contains both closed-ended and open-ended questions.

Lasserre-Cortez (2006) presented a study that is an example of the first type of concurrent MM sampling procedure in which a probability sample addresses the QUAN strand and a purposive sample addresses the QUAL strand independently. The goals of the Lasserre-Cortez study were twofold:

- She wanted to test some QUAN research hypotheses regarding the differences in the characteristic of teachers and schools participating in professional action research collaboratives (PARCs) as opposed to matched control schools, and
- she wanted to answer QUAL research questions about the manner in which school climate affects teacher effectiveness in PARC schools.

Lasserre-Cortez (2006) drew two different samples, a probability sample to answer the QUAN research hypotheses and a purposive sample to answer the QUAL research questions. The probability sample involved a multiple cluster sample of schools participating in PARC programs and a set of control schools, which were matched to the PARC schools with regard to socioeconomic status of students and community type. A total of 165 schools (approximately half being PARC schools and half being control schools) were selected, and three teachers were then randomly selected within each school to complete school climate surveys.

The purposive sample involved 8 schools (4 PARC schools matched with 4 control schools) from the larger, 165-school sample. These 8 schools were chosen using maximum variation sampling, a purposive technique “that documents diverse variations and identifies common patterns” (Miles & Huberman, 1994, p. 28). The two selection variables were schoolwide achievement on a state test and community type (urban, rural). This purposive sampling process resulted in four types of schools: urban–high achievement, urban–low achievement, rural–high achievement, and rural–low achievement.

Lasserre-Cortez (2006) used two very different sampling procedures (one probability, one purposive) to separately answer her QUAN hypotheses and QUAL questions. The only point of commonality between the two samples was that the purposively drawn sample was a subset of the probability drawn sample. The data were collected concurrently and triangulated in the final phases of the data analysis.

Parasnis, Samar, and Fischer (2005) presented a study that is an example of the second type of concurrent MM sampling procedure: the single sample servicing the requirements of both the QUAL and QUAN strands. Their study was conducted on a college campus where there were a relatively large number of deaf students (around 1,200). Selected students were sent surveys that included both closed-ended and open-ended items; therefore, data for the QUAN and QUAL strands were gathered simultaneously. The analysis of data from each strand informed the analysis of the other.

The MM sampling procedure included both purposive and probability sampling techniques. First, all the individuals in the overall sample were deaf college students, which is an example of homogeneous sampling. The research team had separate sampling procedures for selecting racial/ethnic minority deaf students and for selecting Caucasian deaf students. There were a relatively large number of Caucasian deaf students on the campus, and a randomly selected number of them were sent surveys through regular mail and e-mail. Because there were a much smaller number of racial/ethnic minority deaf students, the purposive sampling technique known as complete collection (criterion sampling) was used. In this technique, all members of a population of interest are selected who meet some special criterion, in this case being a deaf racial/ethnic minority student on a certain college campus.

Altogether, the research team distributed 500 surveys and received a total of 189 responses, 32 of which were eliminated because they were foreign students. Of the remaining 157 respondents, 81 were from racial/ethnic minority groups (African Americans, Asians, Hispanics), and 76 were Caucasians. The combination of purposive (complete collection) and probability (random) sampling techniques in this concurrent MM study yielded a sample that allowed interesting comparisons between the two racial subgroups on a variety of issues, such as their perception of the social psychological climate on campus and the availability of role models.

Multilevel Mixed Methods Sampling

Multilevel MM sampling strategies are very common in research examining organizations in which different units of analysis are “nested within one another.” In studies of these nested organizations, researchers are often interested in answering questions related to two or more levels or units of analysis.

Multilevel MM sampling from K-12 educational settings often involve the following five levels: state school systems, school districts, schools, teachers or classrooms, and students. Figure 5 presents an illustration of the structure of the sampling decisions required in studies conducted in K-12 settings. The resultant overall sampling strategy quite often requires multiple sampling techniques, each of which is employed to address one of more of the research questions.

Many educational research studies focus on the school and teacher levels because those are the levels that most directly impact students' learning (e.g., Reynolds & Teddlie, 2000;

Figure 5
Illustration of Multilevel Mixed Methods Sampling in K-12 Educational Settings

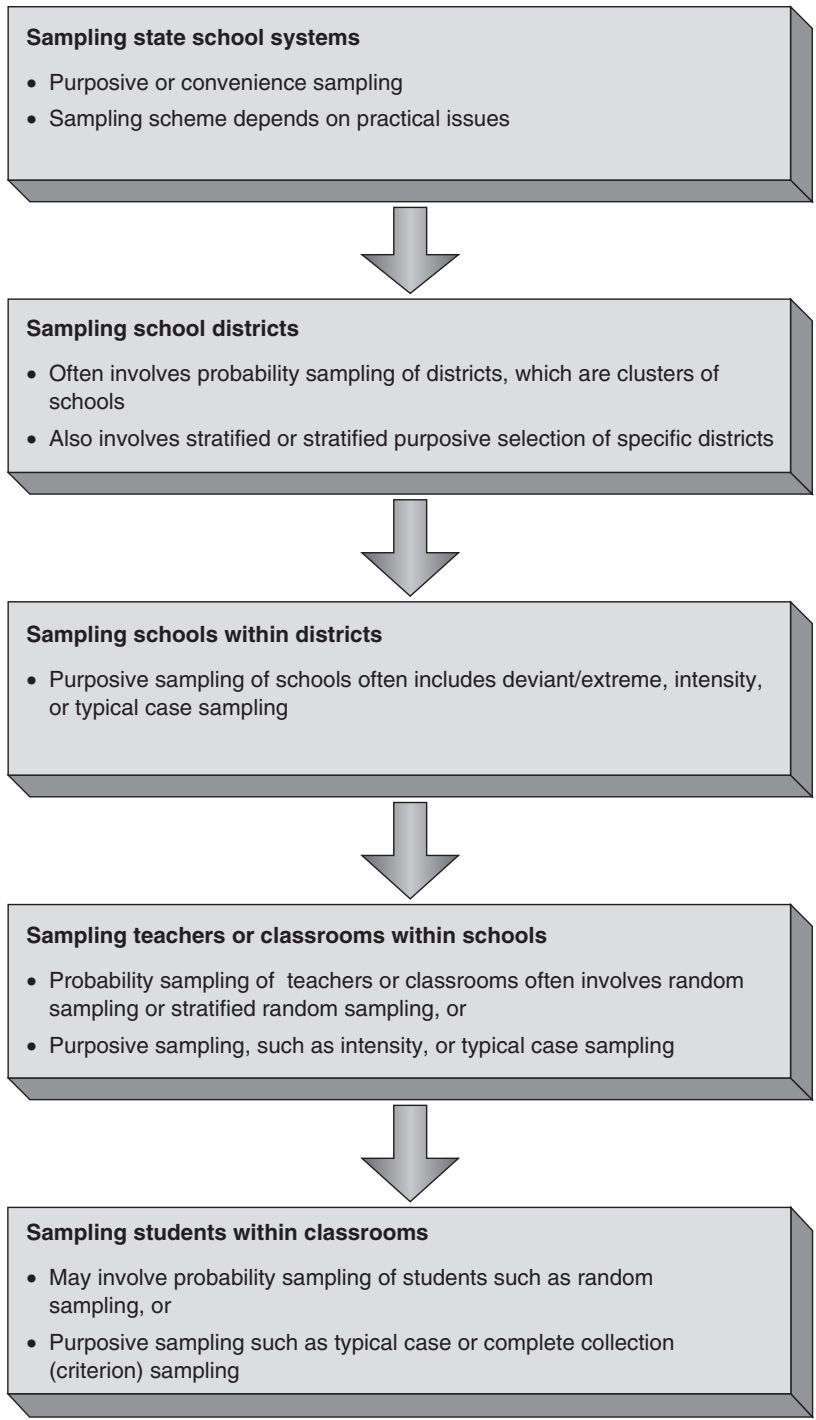


Figure 6
An Example of “Nested” Mixed Methods Sampling Strategies:
The Louisiana School Effectiveness Study, Phases III-V

Teddle and Stringfield (1993) described the following five levels of sampling in two phases of the Louisiana School Effectiveness Study:

1. Twelve school systems were selected based on maximum variation sampling so that a wide range of district conditions were included. An additional school district was included because of pressures to include it from a stakeholder group, thereby introducing sampling politically important cases. A district is a cluster of schools, and cluster sampling is a probability technique.

2. Pairs of school were selected within districts. Each pair of schools included one school that was more effective and one that was less effective, based on their students' scores on standardized tests. Intensity sampling was used in selecting these pairs of more effective or less effective schools, such that the schools were above average or below average, but not extremely so. The schools in each pair were matched on other important dimensions. Among the potential pairs of schools, three pairs were selected to be from rural areas, three from suburban areas, and three from urban areas. This is an example of stratified purposive sampling.

3. The third grade at each school was selected for closer examination. The selection procedure for grade level was homogeneous sampling, used to reduce variation across schools and to simplify data analyses. Other grade levels were also used to gather the classroom observation data, but the student and parental level data were gathered at the third grade level.

4. Classrooms for observation were selected using stratified random sampling such that all grades were selected and classes were randomly selected within grade level.

5. Student test and attitudinal data and parent attitudinal data were collected at the third grade only, and involved criterion or complete collection of information on all third graders and their parents. Of course there was some missing data, but this was kept to a minimum by administering the student tests and questionnaires during regularly scheduled class periods.

Rosenshine & Stevens, 1986). Figure 6 contains an example of a school/teacher effectiveness study that involved a multilevel MM sampling strategy, with purposive sampling at the school level and probability sampling at the classroom level. Altogether, this example involves eight sampling techniques at five levels.

A Final Note on Mixed Methods Sampling Strategies

This section of the article has presented a provisional typology of MM sampling strategies, based on our review of studies using MM sampling throughout the social and behavioral sciences. This typology is, in fact, a simplified version of the range of MM sampling strategies that actually exist.

For instance, concurrent and sequential MM sampling procedures are based on design types, and those design types are based on strands (QUAL and QUAN). These strands as described by Tashakkori and Teddle (2003b) did not take into consideration multiple units

of analysis because that would have further complicated the already complex design typology that they presented. The Methods-Strands Matrix presented by Tashakori and Teddlie (2003b) implicitly limited each QUAN or QUAL research strand to one level of analysis.

Multilevel MM sampling, on the other hand, is based on multiple levels of analysis, not strands, and explicitly indicates that there is more than one unit of analysis per strand. A logical question arises: How are multilevel MM sampling designs combined with concurrent and sequential MM designs? What happens when researchers combine sequential MM sampling with multilevel MM sampling or combine concurrent MM sampling with multilevel MM sampling? This type of complex sampling involves combinations of multiple strands of a research study with multiple levels of sampling within strands.

The Louisiana School Effectiveness Study described in Figure 6 actually included two concurrent strands (one QUAL, one QUAN) along with the following two major research questions of the study:

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

Both the QUAN and QUAL strands of the Louisiana School Effectiveness Study used the same multilevel MM sampling strategy presented in Figure 6 (same school systems, same pairs of schools, same grade level for closer examination, same classrooms for observations) because the QUAL and QUAN questions were so tightly linked. Other research situations with more diverse QUAL and QUAN strands will require multilevel MM strategies that are quite different from one another.

Guidelines for Mixed Methods Sampling

The following section borrows from guidelines presented by other authors (e.g., Curtis, Gesler, Smith, & Washburn, 2000; Kemper et al., 2003; Miles & Huberman, 1994), plus consideration of important issues discussed in this article. These are general guidelines that researchers should consider when putting together a sampling procedure for a MM study.

1. *The sampling strategy should stem logically from the research questions and hypotheses that are being addressed by the study.* In most MM studies, this will involve both probability and purposive techniques, but there are some cases where either probability sampling (see Cell 3 in Table 3) or purposive sampling (see Cell 6 in Table 3) alone is appropriate. The researcher typically asks two basic questions:
 - a. Will the purposive sampling strategy lead to the collection of data focused on the QUAL questions under investigation?

- b. Will the probability sampling strategy lead to the collection of data focused on the QUAN hypotheses or questions under investigation?
2. *Researchers should be sure to follow the assumptions of the probability and purposive sampling techniques that they are using.* In several of the MM studies that we have analyzed, the researchers started out with established probability and purposive techniques but violated the assumptions of one or the other during the course of the study. This is particularly the case with the probability sampling component because failure to recruit properly or attrition can lead to a convenience sample.
3. *The sampling strategy should generate thorough QUAL and QUAN databases on the research questions under study.* This guideline relates to the representativeness/saturation trade-off discussed earlier in this article.
 - a. Is the overall sampling strategy sufficiently focused to allow researchers to actually gather the data necessary to answer the research questions?
 - b. Will the purposive sampling techniques utilized in the study generate “saturated” information on the QUAL research questions?
 - c. Will the probability sampling techniques utilized in the study generate a representative sample related to the QUAN research questions?
4. *The sampling strategy should allow the researchers to draw clear inferences from both the QUAL and QUAN data.* This guideline refers to the researchers’ ability to “get it right” with regard to explaining what happened in their study or what they learned from their study. Sampling decisions are important here because if you do not have a good sample of the phenomena of interest, then your inferences related to the research questions will lack clarity or be inadequate.
 - a. From the QUAL design perspective, this guideline refers to the credibility of the inferences.
 - b. From the QUAN design perspective, this guideline refers to the internal validity of the inferences.
5. *The sampling strategy must be ethical.* There are very important ethical considerations in MM research. Specific issues related to sampling include informed consent to participate in the study, whether participants can actually give informed consent to participate, the potential benefits and risks to the participants, the need for absolute assurances that any promised confidentiality can be maintained, and the right to withdraw from the study at any time.
6. *The sampling strategy should be feasible and efficient.* Kemper et al. (2003) noted that “sampling issues are inherently practical” (p. 273).
 - a. The feasibility or practicality of a MM sampling strategy involves several issues. Do the researchers have the time and money to complete the sampling strategy? Do the researchers actually have access to all of the data sources? Is the selected sampling strategy congruent with the abilities of the researchers?
 - b. The efficiency of a MM sampling strategy involves techniques for focusing the finite energies of the research team on the central research questions.
7. *The sampling strategy should allow the research team to transfer or generalize the conclusions of their study to other individuals, groups, contexts, and so forth if that is a purpose of the MM research.* This guideline refers to the external validity and transferability issues that were discussed throughout this article. It should be noted that not all MM studies are intended to be transferred or generalized.

- a. From the QUAL design perspective, this guideline indicates that the researchers should know a lot of information about the characteristics of “*both* sending and receiving contexts” (Lincoln & Guba, 1985, p. 297). Thus, when purposive sampling decisions are made, the researchers should know the characteristics of the study sample (sending context) and the characteristics of other contexts to which they want to transfer their study results (receiving contexts).
 - b. From the QUAN design perspective, this guideline indicates that the researchers would want to increase the representativeness of the study sample as much as possible. Techniques to accomplish this include increasing sample size, using methods to ensure that that all subjects have an equal probability of participating, and so forth.
8. *The researchers should describe their sampling strategy in enough detail so that other investigators can understand what they actually did and perhaps use those strategies (or variants thereof) in future studies.* The literature related to MM sampling strategies is in its infancy, and more detailed descriptions of those strategies in the literature will help guide other investigators in drawing complex samples.

Creativity and flexibility in the practical design of MM sampling schemes are crucial to the success of the research study. The success of a MM research project in answering a variety of questions is a function, to a large degree, of the combination of sampling strategies that are employed. In conclusion, it is important to remember that “in research, sampling is destiny” (Kemper et al., 2003, p. 275).

Notes

1. There are three general types of units that can be sampled: cases (e.g., individuals, institutions), materials, and other elements in the social situation. The mixed methodologist should consider all three data sources in drawing her sample.

2. External validity refers to the generalizability of results from a quantitative (QUAN) study to other populations, settings, times, and so forth. Transferability refers to the generalizability of results from one specific sending context in a qualitative (QUAL) study to another specific receiving context (e.g., Lincoln & Guba, 1985; Tashakkori & Teddlie, 1998).

3. Stratified sampling may be both a probability sampling technique and a purposeful sampling technique. The use of stratified sampling as a purposive technique is discussed later in this article under the topic of basic mixed methods (MM) sampling strategies (stratified purposive sampling or quota sampling).

4. Combining QUAN and QUAL techniques often involves collaborative work between experts with different backgrounds (e.g., psychologists and anthropologists). Shulha and Wilson (2003) described examples of such collaborative mixed methods research.

5. We use the term *theoretical* because the matrix is *not* based on empirical research examining the frequency of sampling techniques by type of data generated. Common sense dictates that the diagonal cells (1, 5, and 9) in Table 3 represent the most frequently occurring combinations of sampling techniques and types of data generated. The information contained in the other cells is based on informed speculation.

6. Other important factors in determining the QUAL sample size include the generation of a variation of ranges, the creation of comparisons among relevant groups, and representativeness.

7. Collins, Onwuegbuzie, and Jiao (2006) presented their own typology of mixed methods sampling designs. They then analyzed a sample of mixed methods studies from electronic databases and calculated the prevalence rate for the designs in their typology.

8. Multilevel MM sampling is different from concurrent MM sampling, although they can both be used in studies that combine MM sampling strategies. Concurrent MM sampling requires at least two strands and

typically focuses on just one level or unit of analysis. On the other hand, multilevel MM sampling may be employed within just one strand of a MM study and requires at least two levels or units of analysis.

9. MM studies may involve more than two strands (e.g., QUAN-QUAL-QUAN), but the discussion in this article is limited to two strands for the sake of simplicity.

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