

RESEARCH PATHWAYS

WRITING PROFESSIONAL PAPERS,
THESES, AND DISSERTATIONS
IN WORKFORCE EDUCATION

Edited by
Edgar I. Farmer
Jay W. Rojewski

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Dissertations in Workforce Education*

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Chapter 7

Mixed Method Research Designs

Ernest W. Brewer

In my experience as a professor, researcher, and journal editor, I have observed few instructors teach students to use mixed methodologies. In fact, most texts and classes deal with either quantitative or qualitative methods, not expanding beyond one basic approach (Bernard, 2000; Goodwin, 1995; Leary, 1995; Marshall & Rossman, 1999; McBurney, 1994; Miles & Huberman, 1994). Moreover, many committee chairs and members do not believe they have enough expertise in both areas to guide students or to conduct personal research using both qualitative and quantitative methods. Some, due to the research topic or perhaps just out of conviction, place their emphasis on one methodology or the other. Therefore, they typically advocate that students use one method—one all committee members agree upon. Usually, this is the methodology of the members' professional research. These personal observations are confirmed by Strauss and Corbin (1998), who stated, "A researcher's own preference, familiarity, and ease with a research mode inevitably will influence choices" (p. 33)

From this development there has come what some authors have described as the paradigm war (Mertens, 1998; Miles & Huberman, 1994; Tashakkori & Teddlie, 1998), with researchers on each side of the quantitative-qualitative battle, each group claiming to have the superior method. However, there appears to be a growing number of researchers calling for use of a combination of quantitative and qualitative designs. This may well be the beginning of a more reasoned approach, since each method has specific strengths and weaknesses.

In this chapter, the terms of the paradigm debate are defined, a brief historical overview of the two traditional research methodologies is presented, and the various purposes of research designs are discussed. Finally, the use of mixed methodologies and a discussion of the advantages and disadvantages of mixed designs are explored.

Definitions of Terms

Although definitions have been offered by others in this text, I define a few basic terms to establish a common background of understanding. These terms are presented in Table 7.1.

TABLE 7.1
Basic Terms Related to Mixed Methods

Constructivist: An individual who believes that reality is mainly subjective. Constructivists generally ask questions that can best be answered through qualitative research.

Mixed methods: An approach that applies both qualitative and quantitative methods to an investigation.

Mixed models: An approach that applies qualitative and quantitative methods to each phase of a research study.

Paradigm: A way of viewing the world that is basic to a particular research design. Paradigms influence researchers' questions or hypotheses, research methods, and outcomes and interpretations.

Positivist: A researcher who views the world as objectively real and, therefore, quantifiable.

Qualitative design: A study characterized by narrative data and the collection of data from relatively few cases, usually in natural settings.

Quantitative design: A study characterized by numeric data and the collection of data from a large number of participants.

Scientific research: The investigation of a problem under specified circumstances to discover a definitive answer or answers to a problem. Research may occur in either natural or controlled environments, and requires that researchers (a) recognize their assumptions and limitations in conducting a study, (b) objectively develop and follow a design that facilitates the gathering of sufficient and appropriate data, (c) conduct and evaluate appropriate analyses, and (d) arrive at sound conclusions.

Triangulation: The convergence of multiple sets of data to interpret a single problem.

Historical Overview of Traditional Research Methodologies

Two traditional research methodologies have derived from different paradigms, and generally one or the other has dominated in various scientific disciplines (Creswell, 1994; Mertens, 1998; Neuman, 2000; Tashakkori & Teddlie, 1998). Both basic and applied research, including evaluation studies (Gay & Airasian, 2000), have employed a quantitative approach (Creswell, 1994; Reinard, 1998) and found it useful for detached, objective investigations. On the other hand, disciplines that have asked subjective questions—studies of the human *experience* of the objective world—have turned to qualitative research (Creswell; Neuman; Mertens).

Quantitative Research

Positivists have generally relied upon quantitative research to address their hypotheses (Bernard, 2000; Gay & Airasian, 2000; Tulloch, 2000). Their world is an objective place, one where researchers attempt to determine, for example, the best teaching method for a particular class or a cure for a specific illness. This perspective had its origins in rationalism and empiricism and derived from the thinking of such philosophers as Aristotle, Bacon, Locke, and Kant (Brewer, Campbell, & Petty, 2000; Brewer & Marmon, 2000). Quantitative researchers assume that variables within a single research problem can be isolated for examination and that all else remains intact (Salomon, 1987). To solve research problems, positivists collect numerical data on their observations (Reinard, 1998). From their perspective, controlled investigations garner hard data that provides reliable evidence for solutions to problems. Types of studies within this broad category include quasi-experimental, experimental, correlational, causal-comparative, and quantitative (see Chapter 11). Quantitative design is also the choice for meta-analyses and for many single subject studies. The methodologies for these studies are typically either survey or experimental.

According to some researchers (Gall, Gall, & Borg, 1999; Patten, 1997; Reinard, 1998), quantitative research is characterized by deductive reasoning, large random samples, use of formal instruments, and the collection and analysis of numerical data. Quantitative studies isolate variables for study; participation often is anonymous. The total research design is developed prior to initiation of the study. Gay and Airasian (2000) reported that educational researchers have often

combined basic and applied designs, although each has its own characteristics and purposes.

Quantitative studies have been divided into two categories: *basic research* and *applied research*, although methods are identical for both (Reinard, 1998). Fraenkel and Wallen (1996) enumerated those identical factors to include a preference for [1] precise hypotheses and definitions stated before the research begins, [2] numerical data, [3] precise explanations of research procedures, [4] control over extraneous variables, [5] control for procedural bias, [6] statistical statement of findings, and [7] random selection of appropriate participants.

Since both basic and applied research methods collect numeric data, use similar research designs, and require objectivity, it may be difficult to determine whether a study is an example of one or the other. The key is to understand the purpose of a particular study. A brief discussion of each category follows.

Basic research. Basic research is also called pure research or academic research. It is used to investigate theory or to advance fundamental or theoretical knowledge of either the physical or social world. According to Neuman (2000), explanatory research is the most common form of basic research, that is, it is used to explain, describe, and sometimes predict the occurrence of phenomena. Theoretical research methods generate, verify, expand, or contradict current theoretical assumptions or beliefs. There is little emphasis on application of knowledge gained.

Applied research. The ultimate purpose of applied research is to use findings to solve real-world problems. These problems may deal with behavior and attitudes, policy, or natural phenomena. Types of applied research include action research, social impact assessment, and evaluation studies (Neuman, 2000). Applied research has a theoretical framework but is not theory focused. Examples of appropriate applied research questions include: "Which of three methods of teaching basic concepts of statistics is most effective?" "Why did the number of auto fatalities increase nationally during the past 12 months?" "Is this training program achieving the purpose for which it was designed?"

Qualitative Research

Constructivists have relied on qualitative research to solve research problems (Marshall & Rossman, 1999; Mertens, 1998; Taylor & Bogdon, 2000; Tesch, 1990). Working from a paradigm that reality is a construct of an individual's or group's experience, constructivists ask

different types of research questions. Research issues are considered complex and multi-textual, require inductive thinking, and involve exploration and discovery. To answer these types of research questions has called for different methods such as observations in natural settings, field experiences, and open-ended interviews. This approach to data collection contrasts with positivists' preference for controlled settings and close-ended queries. Constructivists favor a holistic approach because they see reality as systemic, that is, composed of interrelated parts that can not be isolated for examination without changing the whole (Salomon, 1987). Qualitative investigations are interested in how people interpret their own experiences. Research methods include grounded theory, ethnographic studies, historical research, and phenomenological studies (LoBiondo-Wood & Haber, 1998).

Characteristics of all qualitative studies include a preference for (a) definitions that may change as the study progresses, (b) narrative data, (c) assumptions of reliability of inferences, (d) purposive sampling, (e) less than precise discussion of procedures, (f) reliance on the researcher to be alert to and to control for procedural bias, (g) narrative discussion of results, and (h) logical analysis in controlling or accounting for extraneous variables" (Fraenkel & Wallen, 1996).

A qualitative approach can be used for either interpretive or critical research studies. The approach employs an holistic approach to problem-solving and emphasizes inductive processing and the collection and analysis of narrative data. The researcher's initial plan often is incomplete with no initial hypotheses. The plan is flexible and mainly descriptive. When possible, the "laboratory" is the field setting. "Qualitative researchers tend to spend a great deal of time in the settings they study" (Gay & Airasian, 2000, p. 19).

Summary of Quantitative and Qualitative Research Characteristics

Many contrasts exist between quantitative and qualitative methods. Gay and Airasian (2000) and Patten (1997) presented the following summative characteristics to differentiate these methods:

1. Reasoning for quantitative research is deductive; for qualitative it is inductive.
2. The purposes for quantitative are: testing of theory and hypotheses, establishing facts and using them to predict; for qualitative purposes included describing complex levels of reality and gaining understanding of human experiences.

3. Quantitative research focuses on large samples, using formal instruments to collect numeric data, and controlled studies that isolate variables of interest; for qualitative, the focus is on examining the full context and on face-to-face human interactions.
4. Quantitative research designs are structured and are developed prior to initiation of the study; qualitative designs begin with an idea that evolves during the research.
5. Data analysis in quantitative studies is statistical; qualitative analysis is interpretive analysis of narrative data.

Quantitative researchers seek to collect data that is representative of a specified population and where results are generalizable to that population. Qualitative researchers seek to find the unique, rather than the common, and have little interest in the generalizability of results.

Understanding the Paradigm War

A paradigm may be thought of as the lens through which one views the world. This lens represents a viewer's philosophical assumptions, affecting perception and the interpretation of what is seen. Positivists have long scorned the qualitative work of their constructivist colleagues and vice versa (Bernard, 2000; Mertens, 1998). In fact, the prominence of one approach in a particular academic discipline has frequently resulted in either the eclipse or demise of the other in that area of study. Perhaps, however, another issue has helped fuel this debate.

Ethnographic studies had a recognized place in early history. These *pre-scientific* studies, precursors to modern qualitative research, were relatively unsystematic observations and vulnerable to naiveté and personal bias. Examples include the recorded observations of Native Americans conducted by explorers from the 16th through early 20th centuries (see Brinton, 1891; Brownell, 1864; Morton, 1846; Wissler, 1938). Although such studies were simply preludes to true scientific investigations, they may have led some to view even modern-day qualitative research with cynicism. Thus, numerous authors (e.g., Bernard; Denzin & Lincoln, 1994; Strauss & Corbin, 1998) have noted a lack of professional respect between the two methodologies.

Triangulation Treaty

According to Wimmer and Dominick (2000), most researchers have come to understand the futility of the *paradigm war* and to recognize

that both qualitative and quantitative methodologies are necessary "to fully understand the nature of a research problem" (p. 49). Those authors reported that convergent triangulation was frequently discussed in the research conducted on the field of communications.

Mixed Studies

During the past two decades, numerous researchers have moved beyond paradigm wars to a new paradigm that allows for the integration of both perspectives (Creswell, 1994; LoBiondo-Wood & Haber, 1998; Strauss & Corbin, 1998; Tashakkori & Teddlie, 1998). This view, leading to mixed studies, has resulted in the creation of two subcategories: *mixed methods* and *mixed models* (Tashakkori & Teddlie). An important point to remember is that mixed studies designs may call for data collection from different sources simultaneously or throughout two or more phases of the same study (Strauss & Corbin). In this section, I consider this issue and its potential for 21st century scientific research.

Mixed Methods

In mixed methods approaches, a single research issue is addressed by incorporating multiple forms of data collection in the research design. For example, a mail survey might also include field observations or open-ended telephone interviews. Generally, mixed methods supplement quantitative data taken from a larger sample with qualitative data from a smaller representation of the population. According to Miles and Huberman (1994), the purpose for employing this type of mixed design could be to add depth to the information gathered in the mail survey, to uncover any weaknesses in the quantitative data, or possibly to complement the objective data. Other mixed methods are also possible such as [1] addressing both quantitative and qualitative research questions, [2] quantifying narrative findings (i.e., counting the number of times various themes arise in interviews), and [3] qualifying some of the quantitative findings (e.g., writing a narrative profile of the mean participant based on the statistical data).

To summarize, when using mixed designs researchers perform both qualitative and quantitative techniques either *sequentially* or *simultaneously*. Another possibility is using a multiple-phase design where data is first collected and analyzed from either a qualitative or quantitative design. The next phase of data collection and analysis uses techniques

from the remaining paradigm. Finally, data from both phases are integrated and summarized.

Mixed Models

Mixed models research combines quantitative and qualitative data collection techniques throughout the entire research plan. The purpose of mixed models research is the same as for the mixed methods approach. However, mixed models is more complex and offers interesting opportunities such as investigating both the objective and subjective worlds of human phenomena (e.g., everyday life in a war zone).

Tashakkori and Teddlie (1998) discussed a way of conducting a mixed model design that did not require incorporating both qualitative and quantitative methodologies into the same research plan. With respect to time frame, their idea utilized two types of mixed model designs: *simultaneous* (also referred to as parallel) and *sequential*. Each contained both qualitative and quantitative techniques within the data collection and analyses phases and in inferential statistics. General hypotheses research could be fitted into these mixed model designs. According to Tashakkori and Teddlie, qualitative and quantitative studies could be conducted by using either simultaneous (parallel) or phased (sequential) investigations, rather than by incorporating both basic types of research in the same research project.

Simultaneous (parallel) designs. LoBiondo-Wood and Haber (1998), Tashakkori and Teddlie (1998), and Morse (1991) each discussed simultaneous, or parallel, models. Morse described simultaneous designs as ones that gather quantitative and qualitative data from different samples within a population. The two sets of data are collected independently, and are analyzed and compared afterward. Triangulation can be achieved through the convergence of findings from the two data sets. Thus, simultaneous designs consist of two independent studies (one qualitative and one quantitative) conducted at the same time, using two samples from the same population, with each methodology having equal status. Triangulation, if achieved, results from the convergence of data (Denzin & Lincoln, 1994; Tashakkori & Teddlie). The choice of a simultaneous design might depend on convenience, the availability of funding, concerns regarding contamination of data by conducting one study first then returning for the second phase, or hope of one using one set of data to complement the other.

In contrast to Morse's (1991) approach of using separate research samples, LoBiondo-Wood and Haber (1998) described several different designs that used the same research sample. One design called for conducting a qualitative study to serve as the foundation of the study with quantitative data being collected to provide complementary information. Another model involved the collection of quantitative data followed by the use of qualitative methods to collect data that would complement the basic findings. Strictly speaking, LoBiondo-Wood and Haber's simultaneous models were rapid sequential designs using the same sample for each portion with one basic method dominating and the other being used to for data triangulation.

Sequential designs. A sequential research design might include the collection of numerical data in the first phase of a study followed by field observations and open-ended interviews. The data from each phase would be analyzed and interpreted separately. Then, findings from each phase would be compared. Inferential findings would also be reported for the completed study. LoBiondo-Wood and Haber (1998) discussed sequential studies that involved the use of one method followed by the other, using the same sample. As with their simultaneous models, the first set of data dominated.

Dominance in Mixed Studies

Creswell (1994) discussed the issue of dominance in mixed studies and noted two possibilities. One was using qualitative and quantitative data more or less equally throughout the study. Creswell termed this *equivalent status design*. The second possibility was the use of one methodology, qualitative or quantitative, for most of a study but with some inclusion of the other. Creswell termed this type *dominant-less dominant design*. For example, a quantitative study might examine two modes of instruction in a college freshman algebra course, a traditional classroom and on-line delivery. Data collection might include demographics, homework grades, and pre- and post-tests. If a researcher conducted e-mail interviews with a few students from each class and reported the narrative data that would constitute a dominant-less dominant study.

Triangulation

Triangulation always includes comparisons of multiple data sets for determining the consistency of evidence (Mertens, 1998). Some confusion could result from the variety of ways to that this term is used

since researchers do not agree on its definition. Denzin and Lincoln (1994) identified four categories of triangulation:

1. *data triangulation*: use of a variety of data sources in a study
2. *investigator triangulation*: use of several different researchers or evaluations
3. *theory triangulation*: use of multiple perspectives to interpret a single problem, and
4. *methodological triangulation*: use of multiple methods to study a single problem. (pp. 214-215)

My personal definition corresponds to Denzin and Lincoln's (1994) fourth point, that is, methodological triangulation. Creswell (1994), referred to methodological triangulation as "triangulation in the classic sense of seeking convergence of results" (p. 175). This definition is shared by numerous other researchers (e.g., Babbie, 2000; Flick, 1998; Greene, Caracelli, & Graham, 1989; Jick, 1979; Neuman, 2000; Tulloch 2000; Wimmer & Dominick, 2000). However, others (e.g., Berg, 1989; Frankfort-Nachmias & Nachmias, 1996; LaBiondo-Wood & Haber, 1998) defined triangulation studies according to Denzin and Lincoln's (1994) methodological triangulation, that is, to include all mixed methods studies.

Triangulation is one possible outcome of using a mixed methods approach or a mixed models design. If data from independent methodologies confirmed the findings for a particular research question, then triangulation is said to have occurred. That finding, however, must never be assumed beforehand.

Other Types of Triangulation

When multiple databases view a single problem from different angles and meet at a particular location, *convergent triangulation* has been reached. Jick (1979) described this phenomenon using the analogy of sailors measuring distance by using multiple methods. Neuman (2000) called this a *triangulation of measures* and noted that it substantially increased researchers' confidence in their findings because the same results are viewed from multiple angles. Another type, *triangulation of observers*, includes multiple interviewers or field observers to gain depth of perspective and to correct biases of a single observer. Newman also recognized *triangulation of theory* utilization of several theoretical perspectives to plan a research study or for the interpretation of results. This type of triangulation could increase

creativity in synthesizing information and in developing new perspectives.

The different methodologies may confirm findings, increase the depth of knowledge gained, or even refute one another. In the latter case, it becomes the researcher's task to conduct additional analyses or to draw inferences from the existing analyses to understand the variant findings. It could also be seen as an alert that further studies are needed.

Across-methods triangulation. Campbell and Fiske (1959) devised the term multiple operationalism when attempting to confirm the validity of specific findings. They argued that an apparent validation of findings could result from variance in the method employed rather than from the variable under investigation. Thus, obtaining confirmatory results using multiple methods provides assurance of the validity of those findings. This design, according to Jick (1979), represents the most often used form of triangulation and the one most trusted when congruent results are obtained.

Within-methods triangulation. Within-methods designs use various techniques within one basic method. An example might be the use of both a questionnaire that is administered immediately following course completion and a mailed questionnaire to determine students' experience with a college course. In such a case, the use of multiple techniques serves to cross-check findings and to increase external validity (Denzin, 1989; Jick, 1979).

Summary of Convergent Triangulation

Triangulation study designs represent a continuum from simple to complex (Jick, 1979). A modest, straight-forward mixed study is useful for validating a scale of a research instrument and also the instrument's reliability. *Convergent triangulation* can strengthen confidence in research findings, and a complex design such as a mixed-models plan can also add depth to findings by supplying multiple levels of information.

Using Mixed Designs

Even when data convergence does not occur, the use of mixed methodologies is recommended because it provides for "complimentarity" of the data obtained from one source, adding depth. This can provide greater understanding of the research topic, especially for theory confirmation and development (LoBiondo-Wood & Haber, 1998; Strauss & Corbin, 1998; Tashakkori & Teddlie, 1998).

Presentation of Three Studies

It may be helpful to consider several examples of mixed design studies. Three studies are presented in this section that represent a variety of mixed methodologies. Two are sequential studies and one is a simultaneous equal-status triangulation study. At the end of each presentation, I provide a brief observation of the study.

Tulloch's (2000) Study

In *The Meaning of Age Differences in the Fear of Crime: Combining Qualitative and Quantitative Approaches*, Tulloch (2000) conducted a two-phase study that used basic quantitative approaches in the first phase and qualitative approaches in a second, smaller phase.

Phase one of Tulloch's study. The first phase of the study involved participants from New South Wales, Australia and from Tasmania. There were 11 focus groups from both rural and urban settings in Australia and 4 focus groups from Tasmania, for a total of 148 subjects.

The initial research procedure called for asking close-ended questions centered on interviewees' feelings of safety when they were alone in their own homes. Participants were asked to rate their perceived risk for specific crimes. Using a five-point Likert-type scale, respondents were presented a set of statements regarding the increase of societal violence in Australia. The close-ended questions were followed-up with open-ended, probing questions. Verbal transcripts comprised the data for the follow-up questions. In the focus groups, individuals first completed written forms to provide demographic information. The focus groups then discussed questions similar to those in the individual interviews. Thus, both quantitative and qualitative data were gathered from individuals and from the focus groups.

Tulloch (2000) also conducted a path analysis on the data to model the relationship of predictors with fear of crime. She determined that the greatest predictors for perceived fear were age, gender, and size. The dominant data set was qualitative. Tulloch found that both age and gender were predictors of perceived risk.

Phase two of Tulloch's study. Tulloch (2000) conducted a follow-up after the findings of her primary study had been analyzed. Based on Phase One findings, Tulloch determined that there were differences based on age and gender in the perceptions of being at risk of violent crime and on participants' experiences and behaviors (victimization perceptions). Phase Two of the study sought to determine "how people

use social categories in their narratives about crime threat" (p. 460). In this study, social self-concept was the variable of interest. Qualitative analysis was conducted to examine the narrative data of representatives from distinctive social groups rather than to obtain data from a wide range of persons. The first study dealt with participants' experiences of fear of crime when they were alone at home. This second study dealt with participants' experiences when traveling alone via public transportation. The procedure was similar to that used in the first phase.

Phase Two uncovered some divergent findings. For example, a focus group of gay participants reported that their physical appearance and behavior resulted in being victimized. This contrasted with other young male participants who felt least vulnerable and were more likely to be the aggressors. Another discrepant finding was that aggressors could be older females.

One young male recounted that he was 'minding my own business sitting having a smoke' at a bus stop when he was confronted by a handbag-waving 'loony' old woman who swore at him, telling onlookers that if he hit anyone she would hit him. She followed him on and off the bus and chased him home (Tulloch, 2000, p. 464).

Another participant reported that an elderly female retaliated when three young males annoyed her as they were riding on public transportation. After the third provocation, she pulled out a knife and threatened them. Tulloch reported that the three perpetrators left immediately.

Tulloch's (2000) study provides an excellent example of a sequential study using a dominant-less dominant design. One sees both the complementarity of two approaches (qualitative and quantitative) and the relative weakness of Phase Two due to the omission of a quantitative component from a larger population. Interesting as the divergent incidents are, without quantitative data it is not known whether or not they represent anything beyond anecdotal information.

Aldridge, Fraser, and Tai-Chu's (1999) Study

In this comparative-interpretive study, *Investigating Classroom Environments in Taiwan and Australia with Multiple Research Methods*, Aldridge, Fraser, and Tai-Chu (1999) sought to identify and understand cultural similarities and differences in diverse educational settings. Diverse methods were used to gain a deeper understanding of the variables under study.

The first part of the Aldridge et al. (1999) study was quantitative and provided an overview of the population with a sample of 2,960

students. Participants completed demographic and attitude questionnaires. Based on that information, researchers designed some of their interview questions to determine socio-cultural differences in students' expectations of desirable learning environments. This phase of this study consisted of field observations and in-depth interviews with teachers and "at least three students from each of eight classrooms" (p. 50). Different observation and interview techniques were used in the two countries to permit cross-validation of the information. Data were found to be complementary.

The quantitative part of the study (Aldridge et al., 1999) indicated weaknesses that the investigators attributed to cultural differences. One such weakness was reflected in differences found on the student attitude scale. These differences guided investigators to formulate some of the interview questions used to explore the diverse expectations of students based on cultural factors. Another shortcoming was identified during the interview phase: the Chinese translation of the attitudes scale did not always convey the full meaning of the original (English) text. A third difficulty was that the questionnaire contained some questions that were foreign to the experience of Taiwanese students, such as, "I discuss ideas in class."

Since the purpose of Aldridge et al.'s (1999) study was to gain an understanding of learning environments in two diverse settings, the qualitative information was considered dominant. Analysis revealed that each environment was determined by socio-cultural factors including expectations regarding the behavior of children and young people, teachers' behavior toward students, and the education system.

The first part of the study served two purposes. It validated the instruments used in each cultural setting, and it provided an overview of each culture. Investigators used that information to guide their field observations and interviews. In addition to providing information needed for gathering qualitative data, the quantitative data corroborated multiple aspects of the qualitative findings such as student involvement and task orientation. Convergent triangulation was achieved on those aspects of the study.

Floyd's (1993) Study

Floyd's (1993) study, *The Use of Across-Method Triangulation in the Study of Sleep Concerns in Healthy Older Adults*, is an example of simultaneous, equal-status research. The purpose of this study was to identify and evaluate the sleep patterns and sleep concerns of older

adults. Research questions were formulated to determine the influences of age, gender, and sleep concerns on participants' sleep patterns. Floyd's study used the same participants for both qualitative and quantitative aspects. Criteria for selection included an ability to articulate experiences with sleep and an appropriate representation of males and females.

The 173 participants were randomly assigned to different data collection procedures. One group completed the qualitative instrument first and then completed the quantitative instrument. The other group completed instruments in the reverse order. In the interviews, participants responded to semi-structured questions such as, "What do you do to handle aspects of sleep that bother you?" (Floyd, 1993, p. 73). In addition, three quantitative instruments were used to determine participants' level of activity, health status, sleep patterns, and other relevant information. Floyd used *t* tests to compare frequency and intensity scores on the two instruments and found that the order of instrument completion had no significant effect on responses.

Four themes were identified through the qualitative interviews: physical discomfort, external environmental factors, emotional discomfort, and sleep pattern changes. Triangulation of quantitative and qualitative data sets revealed that approximately one-half of all participants were troubled to some extent by sleep concerns. Consistently, 54.8% of females and 45.2% of males reported concerns.

One possible disadvantage with a study like Floyd (1993) is that participants' responses to the second instrument (either interview or questionnaire) can be influenced by experiences with the first instrument. This problem can be circumvented by selecting two groups of participants, perhaps a larger one for the quantitative study and a relatively small group for interviews. However, Floyd elected to use the same participants for both parts of the study and to subdivide them into two groups. One subgroup completed the questions first; the other completed interviews first. The fact that the order of data collection was not significant validated the selection method and answered a question that could not have been considered if a different route had been taken (e.g., using separate samples for each data set).

Disadvantages and Advantages of Mixed Studies

Employing a combination of research methods has both advantages and disadvantages that must be weighed. Thoughtful decisions must be made on need and the availability of resources. Before addressing the disadvantages and advantages of mixed studies, I want to present

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Reinard's (1996) personal challenges that should be considered before undertaking any scientific research.

Personal Challenges

Reinhard's (1996) five challenges apply equally to designers and administrators of mixed research studies.

1. *Orderly thinking*: Faithful, systematic research requires an organized approach.
2. *Clear writing*: Communicating a complex design to others (e.g., funding sponsors, research participants, consumers) requires precise, organized writing.
3. *Objectivity*: A lack of prejudice for one research technique over another is necessary to proceed with objectivity.
4. *Organization and orderly process*: A need exists for orderly thinking and clear writing.
5. *Astute reasoning in developing the research methods*: Logic is necessary for *effective*, complex designs. (p. 12)

After reviewing these, an individual should consider whether or not mixed methodological would be appropriate for his or her use. But before doing that, one should also evaluate the disadvantages and advantages presented in the following paragraphs.

Disadvantages of Using Mixed Studies

Some disadvantages of mixing methods involve the challenges I have mentioned previously. Since complexity is increased with mixed studies, researchers must be especially careful. Keeping studies free of bias in participant selection and interviewing can be difficult. If quantitative data is examined prior to a field study and interviews, for example, researchers could have difficulty remaining bias-free. On the other hand, fine-tuning the design of a supplemental research phase might be facilitated by an understanding of the findings obtained during the primary phase.

In addition to personal challenges, some studies may present difficulties because of circumstances only indirectly related to the purpose of the study. Polit and Hungler (1991) noted four items that some researchers consider disadvantages to mixed methods: [1] higher possible costs, [2] a lack of training of those directing or conducting the study, [3] certain professional journals may lean towards one method or other, and [4] epistemological biases of some research consumers.

When considering mixed methods, Morse (1991) pointed out that the greatest threat to the validity of mixed methods is the use of the same sample. She felt that the sample for a qualitative aspect of a study should be separate from the sample of a quantitative component.

In addition to these general disadvantages, certain circumstances—grant proposals, dissertations and theses—can pose other difficulties. When applying for competitive funding, certain issues must be considered with regard to combining methodologies. Writing a proposal requires careful explanation of the purposes for each technique used and, in multi-phase studies, for the separate phases of the study. There should be a clear justification for combining methods beyond the general purpose of providing more confidence in the research findings. While such a goal is useful, it ordinarily would not justify the additional funding needed. In fact, this type of rationale could be interpreted as a revelation of the investigator's insecurity or lack of experience. To ease the problems of requesting funding for phased studies, Strauss and Corbin (1998) recommended breaking down multi-phase research plans into a series of proposals with a specific purpose for each. In this manner, findings from the previous phase/s can be used to justify using a different research technique in the next phase.

In their text, *Secrets for a Successful Dissertation*, Fitzpatrick, Secrist, and Wright (1998) strongly advised graduate students not to embark on mixed methods studies. The authors stated that one of them had done so and encountered monumental difficulties. Among the obstacles they discussed were:

1. The process is time and labor intensive.
2. Conducting two types of research can be doubly expensive.
3. The candidate may lack adequate research skills for the two methods.
4. The candidate's committee may raise more questions concerning results.

Nevertheless, there is a wide range of topics for dissertation and thesis investigation, and candidates have varied experiences and resources. Therefore, I tend to disagree with Fitzpatrick et al. (1998), depending on the topic, student, and committee. I would encourage the "right" student to do a mixed methodological study. Mixed methodologies could add credibility and importance to a proposed study, as well as enhance students' research skills.

Advantages of Using Mixed Studies

There are multiple advantages to using mixed methodologies rather than relying on only one method. Not infrequently, a study benefits from more than one of these advantages.

Complement other findings. Greene et al. (1989) mentioned that complementarity of results can be a positive outcome of mixed studies.

Expand information. Results of mixed studies sometimes increases the scope of knowledge about a problem. This may be the case when different techniques yield conflicting data, as well as when undiscovered aspects or previously unmentioned information is reported (Creswell, 1994).

Overcome bias. Qualitative techniques used in isolation are open to observer bias, and this weakness can be overcome by using quantitative data as a balance. Fine and Elsbach (2000) noted two types of bias that can affect qualitative data. "What one 'observes' is filtered through one's experience (bias is interpretive), and one's presence in a situation inevitably affects—to a greater or lesser extent—how participants respond (observer bias) (p. 53). This observation was supported by Wimmer and Dominick (2000) who noted that field studies were vulnerable to reactivity (observer bias). Use of multiple observers or interviewers can also be used to correct bias.

Uncover need for further study. Firestone (1987), referring to the use of one method alone, stated that there is a need to assess findings for strength and stability. In two-phase studies, the risks of these weaknesses are minimized. For example, in the second phase of Tulloch's (2000) study, information from an elderly woman and gay participants was at variance with the quantitative findings of phase one. Even though the results had come from a mixed study, the qualitative data appeared to need further investigation. If only the second phase had been conducted, Tulloch would have been blinded to its inadequacy.

Confirm hypotheses. Triangulation studies are advantageous for hypothesis testing. Frankfort-Nachmias and Nachmias (1996) advocated using mixed studies whenever feasible for this theory building.

Show development. Sequential design may show development of the phenomenon under investigation.

Add texture. Findings from one technique may be enriched by those of the alternate technique—uncovering paradoxes, contradictory findings, or other information.

Summary

Many studies could be enhanced by using mixed methodologies including theory development, reliability studies, and validity studies. Reichardt and Rallis (1994) discussed two interesting studies that might have benefited from mixed methodologies. In the first, Whittingham's (1986) research included a listing of the best ski resort cities in the United States. Cities such as Detroit, Buffalo, and Chicago were among the top 10, whereas Denver, Winter Park, and other Colorado resorts were not mentioned. Had researchers also completed a field study their embarrassing error might have been avoided. Following the Whittingham report another researcher, Kliewer (1986), conducted interviews with some of the top 10 listed resort managers. He learned that the Detroit slopes were built on a landfill and relied on artificial snow. Another manager reported that the slope was mainly a hill designed to prepare skiers for higher slopes. Kliewer later interviewed Whittingham and learned that he had relied on usage data alone and had not taken into account the quality of the sites. Thus, his report had resulted in a listing of 10 high-density population areas! This illustration highlights one of the possible research errors when only one methodology is employed.

Another, more famous research error resulting from use of a single methodology is found in Margaret Meade's famous study, *Coming of Age in Samoa: A Psychological Study of Primitive Youth* (1928). Meade relied on field observations and interviews to investigate sexual activity in a society with which she was unfamiliar. She wrote that promiscuous behavior was the norm among preadolescents and adolescents in Samoa. What Meade did not realize was that the young females whom she interviewed were embarrassed by her questions and that they saw her intense focus on sexual behavior as strange. They believed the researcher was obsessively preoccupied with sexual behavior and decided to tell her whatever they believed she wanted to hear. Findings of this widely acclaimed study were later discovered to be a hoax. Again, the error might have been avoided had multiple methodologies been employed in addressing this research issue.

Fortunately, the concept of enhancing research efforts through triangulation may be coming to the forefront. As noted, some researchers (e.g., Creswell, 1994; Tashakkori & Teddlie, 1998; Wimmer & Dominick, 2000) are seeing the value of using multiple approaches to the same research issue. Tashakkori and Teddlie even spoke of the paradigm war as a phenomenon of the past, claiming that "the triangulation of methods [Denzin and Lincoln's (1994)

methodological triangulation] was the intellectual wedge that eventually broke the methodological hegemony of the mono-method purists" (p. 41). Stated succinctly, it ended the paradigm war.

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