

Writing publishable mixed research articles: Guidelines for emerging scholars in the health sciences and beyond

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ABSTRACT

In recent years, it has become more common for health science researchers to conduct and to write research reports and articles that involve the combining or mixing of quantitative and qualitative approaches within the same study. The purpose of this article is to delineate the challenges of writing mixed research studies and present a potential solution. The solution includes providing guidelines for writing mixed research that will be presented utilizing the framework designed by Leech and Onwuegbuzie (2010). Furthermore, examples of each step from a published mixed research study (Onwuegbuzie et al., 2007) will be presented. It is hoped that understanding these challenges in writing mixed methods reports and using the suggested guidelines will increase health science researchers' ability to publish mixed methods research.

Keywords: mixed methods research, writing, guidelines for writing

In recent years, it has become more common for health science researchers to conduct and to write research reports and articles that involve the combining or mixing of quantitative and qualitative approaches within the same study 'to guide their exploration of the complex phenomena that influence human health' (Andrew & Halcomb, 2009, p. 217). This combining of approaches is known as mixed methods research or more inclusively as mixed research (Johnson & Onwuegbuzie, 2004). With this recent increase of mixed research being reported

and written, Tashakkori and Creswell (2007) developed guidelines for identifying whether a study is a mixed research study. Their guidelines are to: (a) assess whether the research questions stem from both the qualitative and quantitative paradigms; (b) consider if the research questions are either preplanned or participatory; (c) gauge if two types of sampling are used, either probability and/or purposive; (d) judge whether or not two types of data collection are utilized; (e) assess whether or not two types of data are present; (f) evaluate whether two types of analyses

have been conducted; and (g) judge whether there are two types of conclusions (i.e., a conclusion from the qualitative portion and a conclusion from the quantitative section). These guidelines are beneficial for identifying whether a study has utilized mixed research; yet, they fall short for many health science researchers. There has yet to be specific guidelines made available for health science researchers to assist in conducting and writing a mixed research study. Furthermore, writing a mixed research study presents its own set of challenges including (a) writing for a varied audience, (b) knowing what language to use, (c) having adequate knowledge of research content, (d) formatting the sections of the manuscript, and (e) finding publishing outlets for mixed research studies (Bryman, 2007; Johnstone, 2004; O’Cathain, 2009; Sandelowski, 2003).

Unfortunately, the area of writing mixed research has not been given much attention (Creswell & Tashakkori, 2007; Leech & Onwuegbuzie, 2010). For example, some mixed researchers representing health sciences might search for assistance in writing mixed research reports through their national associations (e.g., American Psychological Association, APA; American Public Health Association, APHA; National Institute of Environmental Health Sciences, NIEHS; National Institute of Health, NIH). Interestingly, some fields, such as the field of education (cf. American Education Research Association, 2006), have standards that include guidance in writing qualitative and quantitative research articles, but they do not include information on writing a mixed research study. More recently, the reporting standards from APA (cf. APA Publications and Communications Board Working Group on Journal Article Reporting Standards, 2008) delineate helpful and specific guidelines for each section of a manuscript; however, the language of the document is based on quantitative methods, and does not include any specific guidance for mixed researchers from the health sciences.

There are texts devoted to mixed research wherein one might hope to locate guidelines on writing mixed research. In fact, the recent text edited by Andrew and Halcomb (2009) includes a chapter on writing mixed research reports as well as chapters that cover other extremely helpful topics. Yet, the seminal *Handbook of Mixed Methods Research* (Tashakkori & Teddlie, 2003a), although extremely beneficial, does not include information on writing a mixed research study. Some mixed research texts (e.g., Creswell & Plano Clark, 2006; Greene, 2007; Onwuegbuzie & Johnson, 2008) include a section or two on writing mixed research articles, but these sections tend to be brief and do not include step-by-step guidelines for writing mixed research studies for publication. Therefore, what mixed researchers from the health sciences need is a framework for reporting the multiple elements of a mixed research study.

It is important to note that designing, conducting, and writing mixed research are processes that cannot be separated. When designing a mixed research study, the researcher needs to consider possible problems, ethical issues, limitations, and the like for conducting the study. Furthermore, during the design stage, portions of the manuscript can be written, or at least, conceptualized, while planning the study. Thus, the purpose of this article is to delineate the challenges of writing mixed research studies and present potential solutions. The solution includes providing guidelines for writing mixed research that will be presented utilizing the framework designed by Leech and Onwuegbuzie (2010). These authors created a mixed research writing framework based on the 13 steps in the mixed research process described by Collins, Onwuegbuzie, and Sutton (2006). As shown in Figure 1, these methodologists distinguished three major stages of the mixed research process (i.e., research formulation stage, research planning stage, and research implementation stage), which are then sub-divided into 13 distinct steps. Furthermore, examples of each step from

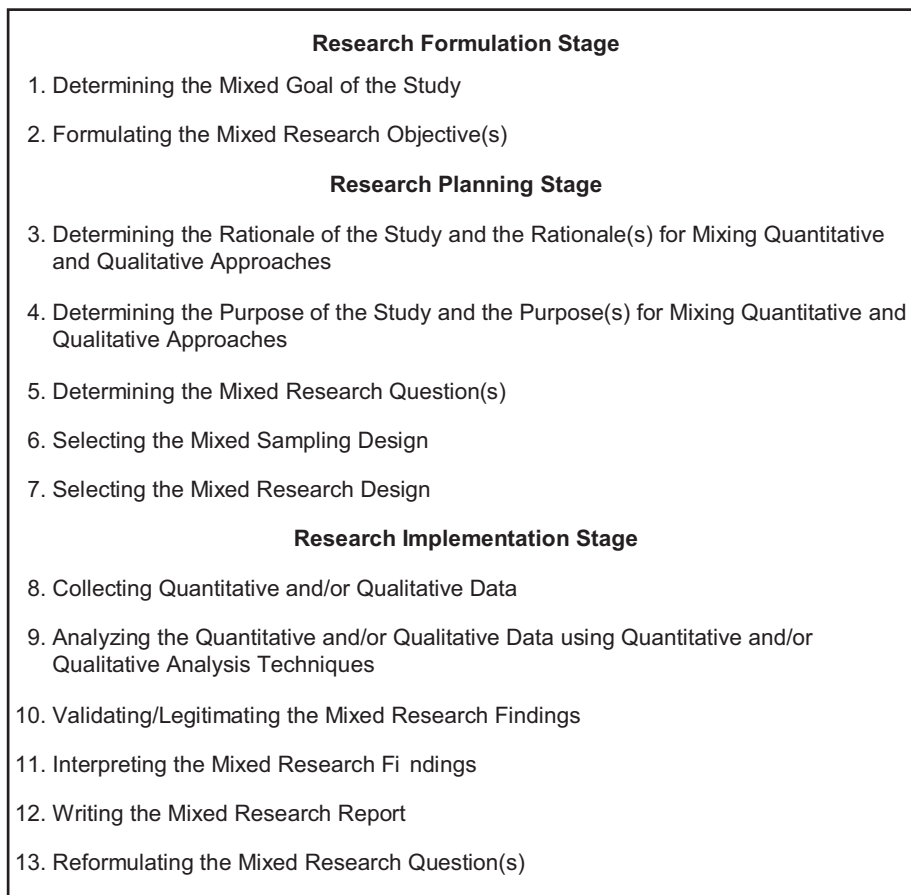


FIGURE 1: ASPECTS OF COLLINS ET AL.'S (2006) 13-STEP MODEL

a published mixed research study (Onwuegbuzie et al., 2007) are presented. Understanding these challenges in writing mixed research and following the suggested guidelines likely will increase health science researchers' abilities to publish mixed research reports.

CHALLENGES OF WRITING MIXED RESEARCH STUDIES

Writing research reports, regardless of the study design, can be daunting for many health science researchers. When writing a mixed research report, the difficulties and challenges can increase for the researcher. These challenges stem from multiple areas, including (a) writing for a varied audience, (b) knowing what language to use, (c) having adequate knowledge of research content,

(d) formatting the sections of the manuscript, and (e) finding publishing outlets for mixed research studies. Each of these challenges will be discussed in turn.

Challenge #1: Writing for a varied audience

The first major challenge for writing a mixed research report is the issue of communicating findings to a varied audience. As Sandelowski (2003) so aptly suggests, 'A major – and arguably the most important – criterion in evaluating the merits of a study lies in the ability of writers to persuade readers of its merits in their research reports' (p. 321). Yet, readers of mixed research reports vary in their knowledge, understanding, and backgrounds: some readers may

be qualitatively oriented, whereas others may be quantitatively oriented, and still others may be oriented towards mixed research. The problem lies in the fact that readers with a qualitative orientation and readers with a quantitative orientation have different ideas about what components of a (mixed) research article is interesting and relevant (Golden-Biddle & Locke, 1993). Moreover, readers of mixed research come from varying backgrounds, as noted by O’Cathain (2009), including health care professionals, policy makers, and consumers. Thus, it can be a conundrum for mixed researchers from health sciences to know how to present their research reports in ways that are clear and accessible to diverse audiences.

Challenge #2: Knowing what language to use

The second challenge for the mixed researcher is knowing what language and style to use. Quantitative research has strict guidelines regarding the language of report writing. For example, in the APA (2010) *Publication Manual*, quantitative terms such as *variable* and *test scores* are commonly used. Furthermore, statistical symbols are discussed at length (i.e., approximately four pages are devoted to this topic).

On the other side, constructivists who promote qualitative inquiry encourage the use of specific language when describing qualitative studies; yet, they are more vague as to what language should be utilized. For example, in the third edition of *The Sage Handbook of Qualitative Research*, the concept of language is described as being subjective, ‘Language is how social organization and power are defined and contested and the place where one’s sense of self – one’s subjectivity – is constructed’ (Richardson & St. Pierre, 2005, p. 961). Notwithstanding, interestingly, qualitative health science researchers have a dictionary of terms to assist in their understanding of ‘terms and phrases that partially shape the origins, nature, purpose, logic, meaning, conduct, methods, and significance of the practices broadly

referred to as qualitative inquiry or qualitative research’ (Schwandt, 2007, p. 27).

Unfortunately, to date, there are not commonly agreed terms for mixed researchers. In fact, consensus has not even been reached as to the basic mixed research design terms, with multiple design typologies used by various authors (Creswell & Plano Clark, 2006; Greene, Caracelli, & Graham, 1989; Johnson & Onwuegbuzie, 2004; Maxwell & Loomis, 2003; Onwuegbuzie & Johnson, 2008; Tashakkori & Teddlie, 1998, 2003b). This plethora of choices can be daunting for even the seasoned mixed researcher.

Challenge #3: Having adequate knowledge of research content

Having adequate knowledge of research content is another potential hurdle for the mixed researcher. According to Collins et al. (2006), conducting mixed research requires:

expertise in designing and implementing both the qualitative and quantitative phases (Teddlie & Tashakkori, 2003). In particular, a researcher with more of a qualitative orientation likely would find it more difficult to design the quantitative component of a mixed-methods study than would a researcher with a more quantitative orientation, and vice versa. (p. 68)

Therefore, researchers with a more qualitative orientation might have difficulty with having sufficient knowledge regarding the quantitative component of the study to write about it adequately, and vice versa. It is here that ensuring that the composition of research teams includes researchers with various methodological backgrounds can be of importance (Andrew & Halcomb, 2009).

Challenge #4: Formatting the sections of the manuscript

Knowing how to format the sections of the manuscript can be another challenge for the mixed researcher. Unlike quantitative health

science researchers, who can look to the standards of different associations (e.g., AERA, 2006; APA Publications and Communications Board Working Group on Journal Article Reporting Standards, 2008), to date, mixed researchers have had limited guidelines as to how to structure the various sections of the mixed research report (Johnstone, 2004; O’Cathain, 2009). For example, should the qualitative and quantitative components of the study be presented separately or together in one section?

Challenge #5: Finding publishing outlets for mixed research studies

Finally, finding publishing outlets for mixed research studies can be challenging. Recently, numerous journals have begun routinely to publish mixed studies (e.g., *Field Methods*, *Educational Evaluation and Policy Analysis*, *Quality and Quantity*, *Evaluation*, *Evaluation Practice*, *Research in Nursing and Health*, *The Qualitative Report*). Fortunately, a few journal editors have published or are preparing to publish special issues on mixed research (Brannen & Edwards, 2005; Gorard & Smith, 2006; Leech, Onwuegbuzie, Hansson, & Robinson, 2010; O’Cathain & Collins, 2009; Onwuegbuzie & Daniel, 2006), so hopefully, more journal editors will consider publishing special issues on mixed research in the future. Furthermore, the *Journal of Mixed Methods Research* recently became the first journal to publish only mixed studies and theoretical manuscripts about mixed research (Tashakkori & Creswell, 2007). This journal has been followed, even more recently, by the *International Journal of Multiple Research Approaches* (Grbach, 2009). Yet, readers of journals that are specific to mixed methods research are not usually the same as readers of journals of health research (i.e., clinicians and policy makers).

Based on these and possibly other challenges, health science researchers might shy away from utilizing mixed research techniques when conducting research or report the findings of mixed research as separate reports (Collins et al., 2006).

Unfortunately, this list of challenges is by far not an exhaustive list. In fact, there might be many additional reasons why health science researchers would not choose to utilize or to write reports on mixed research procedures.

A POSSIBLE SOLUTION TO THE CHALLENGES FOR THE MIXED RESEARCHER

One possible solution to the challenges that are present for the mixed researcher is to utilize a general framework for writing mixed research. Having a framework to guide the process of writing mixed research reports should help to increase the rigor of mixed research studies, as well as the probability of getting these mixed research studies published.

Fortunately, Leech and Onwuegbuzie (2010) have developed a framework for that can be utilized for writing mixed research. As noted previously, this framework is built on Collins et al.’s (2006) 13-step mixed research process (see Figure 1), which distinguishes three major stages of the mixed research process (i.e., research formulation stage, research planning stage, and research implementation stage). To assist the mixed researcher in the challenges of writing mixed research, the 13 steps in the Leech and Onwuegbuzie’s framework are presented with examples from Onwuegbuzie et al.’s (2007) study. Onwuegbuzie et al. (2007) conducted a mixed research study using a multistage mixed analysis to assess the content-related and construct-related validity of a teaching evaluation form (TEF). The researchers examined the perceptions of effective college teachers by undergraduate and graduate students. Where appropriate, quotes from this study will be presented to assist the reader’s understanding of how to write about each of the steps. This mixed research study was selected as an exemplar for two major reasons. First, the authors framed their article around Collins et al.’s (2006) 13 steps of the mixed research process, providing explicit statements that can be directly tied to each of these 13 steps. Second, this article not only was published in one of the premier journals in the

field of education with a high impact factor (2007 Journal Impact Factor = 1.93) – namely, the *American Educational Research Journal (AERJ)* – but was the most downloaded article in *AERJ* in 2007, 2008, 2009, and 2010, and, at the time of writing, still holds this distinction. Therefore, this article is being used by many researchers and can be utilized by health researchers as a model to enhance their own research studies. Further, this article is relevant to the field of health research because TEFs are an important means of assessing the quality of instruction of health research courses.

Table 1 maps the sections of a research manuscript onto the 13 steps of the mixed research process as outlined by Collins et al. (2006). This table can be utilized by the mixed researcher to help guide their thinking when writing a mixed research report. This mapping, which is based on Onwuegbuzie et al.’s (2007) study, provides only one of many possible representations; that is, the mixed researcher could configure the write-up pertaining to each of the 13 steps in another way or even present the material in a different manner.

TABLE 1: SECTIONS OF ONWUEGBUZIE ET AL.’S (2007) MIXED RESEARCH ARTICLE MAPPED ONTO THE STEPS OF THE MIXED RESEARCH PROCESS

Section of manuscript	Possible step(s) to include in section
Introduction	Step 1
	Step 2
	Step 5
Methods	Step 3
	Step 4
	Step 6
	Step 7
	Step 8
Results	Step 9
Discussion	Step 10
	Step 11
	Step 13

Stage 1: The research formulation stage

The first stage of writing about the research process is the research formulation stage, which incorporates the first five steps of the research process, comprising identification of (a) the mixed goal of the study, (b) the mixed research objective(s), (c) the rationale of the study and the rationale(s) for mixing quantitative and qualitative approaches, (d) the purpose of the study and purpose(s) of mixing quantitative and qualitative approaches, and (e) the mixed research question(s). How to write about each of these first five steps will be delineated, as well as a discussion regarding the importance of the literature review.

The review of the literature is one of the most important aspects of writing about the research formulation process, except in mixed research studies that are nested in designs where the research literature is not conducted at an early stage in the research process (e.g., grounded theory designs). Leech and Onwuegbuzie (2010) suggest that the role of the literature review should be made explicit and recommend that the framework of Onwuegbuzie, Collins, Leech, Dellinger, and Jiao (2010) be utilized to organize the literature review. These methodologists suggest undertaking a mixed research synthesis (Sandelowski, Voils, & Barroso, 2006), which is defined as ‘an interpretation of a selection of published and/or unpublished documents available from various sources on a specific topic that optimally involves summarization, analysis, evaluation, and synthesis of the documents’ (Onwuegbuzie et al., 2010, p. 173). Health science researchers should treat the information from articles as data that provide both qualitative and quantitative information and, therefore, can be analyzed using qualitative and quantitative approaches, including creating meta-inferences (i.e., inferences from qualitative and quantitative data integrated into a whole). For example, health science researchers can use quantitative data to enhance the qualitative results, and qualitative data to increase understanding of the quantitative results, or both. Studies involving

meta-analyses (Glass, 1976), meta-syntheses (Sandelowski & Barroso, 2006), and meta-summaries (Sandelowski & Barroso, 2003) – that involve analysis of a set of quantitative or qualitative studies on a given topic – occupy a central place in mixed research syntheses, whenever they are available. Also, beginning reviewers, instructors, advisors, and mentors can use Combs, Bustamante, and Onwuegbuzie's (2010) mixed methods-based interactive literature review process (ILRP) framework to teach students how to conduct effective mixed research syntheses. The components of the ILRP framework are included in Figure 2.

Goal of mixing

Leech and Onwuegbuzie (2010) suggest that when writing about a mixed research study, it is important for health science researchers to clearly delineate the study aims. There are multiple common goals for mixed research, namely to: predict; add to the knowledge base; have a personal, social, institutional, and/or organizational impact; measure change; understand complex phenomena; test new ideas; generate new ideas; inform constituencies; and examine the past (Newman, Ridenour, Newman, & DeMarco, 2003). Health science researchers should identify the study aim

and state it in a few sentences. Onwuegbuzie et al. (2007) present the goal of their study as 'Using Newman et al. (2003) typology, the goal of this mixed-methods research study was to have a personal, institutional, and/or organizational impact of future TEFs' (p. 122).

Mixed research objective(s)

Along with the goal of the study, health science researchers should make explicit the objective(s) in their manuscripts (Leech & Onwuegbuzie, 2010). There are several common research objectives identified in mixed research, including (a) exploration, (b) description, (c) explanation, (d) prediction, and (e) influence (Andrew & Halcomb, 2006; Collins et al., 2006). Exploration includes using inductive methods to understand better an idea, issue, and the like, which then leads to hunches, hypotheses, inferences, or generalizations. The second type of research objective, description, includes identifying and describing the antecedents, correlates, and/or the nature of the phenomena. Explanation is achieved by developing or expanding a theory in order to understand better the phenomena. The fourth type of research objective, prediction, helps the researcher forecast future events through the use of prior knowledge. Finally, the last research objective, influence, is the manipulation of a variable or construct for the purpose of producing an outcome.

Onwuegbuzie et al. (2007) stated the objective of their study as follows: 'The objectives of this mixed-methods inquiry were threefold: (a) exploration, (b) description, and (c) explanation' (pp. 122–123). Aspects of this written objective statement that are important to consider are the use of the word 'objective' in the sentence and the use of the typology of objectives.

Rationale of the study and the rationale(s) for mixing quantitative and qualitative approaches

When writing mixed research – as is the case for all quantitative, qualitative, and mixed research

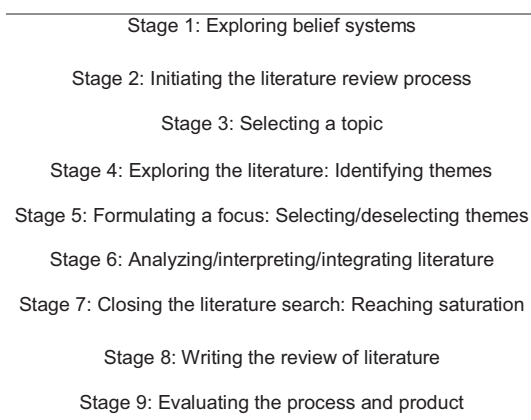


FIGURE 2: COMPONENTS OF COMBS ET AL.'S (2010) MIXED METHODS-BASED INTERACTIVE LITERATURE REVIEW PROCESS (ILRP) FRAMEWORK

studies – authors should state explicitly why the study is needed. The rationale is the most important element of a research report because it delineates to the reader what the gap is in the extant literature. As noted by Onwuegbuzie and Daniel (2005), the most prevalent rationale presented is that few or no researchers have conducted a study in the underlying area; therefore, the study represents a beginning or early attempt to fill the void. The second most common rationale presented is that although some/many researchers have undertaken the research, few or no researchers have examined the topic using the underlying population, instrument(s), setting, site, and/or the like. The third most common rationale presented is that although some/many researchers have undertaken the study, the results have been contradictory. Whatever the researcher's rationale for conducting the study, it should be presented clearly and it should be presented relative to the investigation's underlying participant(s) or groups(s), particularly in terms of the historical, cultural, linguistic, social, and/or psychological composition of the sample members (AERA, 2006). The following extract represents Onwuegbuzie et al.'s (2007) rationale of the study:

Although the few studies on students' perceptions of effective college instructors have yielded useful information, the researchers did not specify whether the perceptions that emerged were reflected by the TEFs used by the respective institutions. Bearing in mind the important role that TEFs play in colleges, universities, and other institutions of further and higher learning, it is vital that much more validity evidence be collected. (p. 122)

In addition to specifying the rationale of the mixed research study, health science researchers should clarify why a mixed research study is needed by describing the rationale for using both quantitative and qualitative methods. This rationale is achieved by explaining why a mixed research study is better than is a mono-method study to examine the research question. There

are four common rationales for mixing: participant enrichment, instrument fidelity, treatment integrity, and significance enhancement (Collins et al., 2006). According to Collins et al. (2006), participant enrichment refers to the combining of qualitative and quantitative approaches for the rationale of optimizing the sample (e.g., increasing the number of participants, improving the suitability of the participants for the study). Instrument fidelity refers to a combination of quantitative and qualitative procedures used by researchers to maximize the appropriateness and/or utility of the quantitative and/or qualitative instruments used in the study. Treatment integrity involves the combining of quantitative and qualitative techniques for the rationale of assessing the fidelity of treatments, programs, or interventions. And, finally, significance enhancement refers to the use of qualitative and quantitative approaches to maximize the interpretation of the results.

Onwuegbuzie et al. (2007) presented the rationale and purpose together, using the Collins et al. (2006) RAP model. Therefore, the example of writing the rationale for a mixed research study is discussed after the purpose explanation.

Purpose of mixing

Leech and Onwuegbuzie (2010) believe that purpose statements in a mixed research report should include a short, but comprehensive description of the scope of the study and the problem that the study is designed to answer. For Onwuegbuzie et al. (2007):

the purpose of this study was to conduct a validity study of a TEF by examining students' perceptions of characteristics of effective college teachers. Using mixed-methods techniques, the researchers assessed the content-related validity and construct-related validity pertaining to a TEF. With respect to content-related validity, the item validity and sampling validity pertaining to the selected TEF were examined. With regard to construct-related validity, substantive

validity was examined via an assessment of the theoretical analysis of the knowledge, skills, and processes hypothesized to underlie respondents' scores; structural validity was assessed by comparing items on the TEF to effective attributes identified both in the extant literature and by the current sample; outcome validity was evaluated via an appraisal of some of the intended and unintended consequences of using the TEF; and generalizability was evaluated via an examination of the invariance of students' perceptions of characteristics of effective college teachers (e.g., males vs. females, graduate students vs. undergraduate students). Simply put, we examined areas of validity evidence of a TEF that have received scant attention. (p. 122)

In a mixed research study, the purpose statement also should delineate why the mixed approach is being used instead of a mono-method design. For example, under the rationale of significance enhancement, Onwuegbuzie et al. (2007) reported that the purpose of mixing was 'to enhance researchers' interpretations of results' (p. 130).

Onwuegbuzie et al. (2007) clearly outline the rationale and purpose of their study. Using the RAP model (Collins et al., 2006), three aspects of the model (i.e., participant enrichment, instrument fidelity, and significance enhancement) are presented along with a description for why these aspects of the model are appropriate for the study. Onwuegbuzie et al. (2007) describe the types of rationales and then explain how the study fits the RAP. For example, Onwuegbuzie et al. (2007) state '*Participant enrichment* represents the mixing of quantitative and qualitative approaches for the rationale of optimizing the sample (e.g., increasing the number of participants)' (italics in original, p. 128). Then, later in the same paragraph, the authors state, 'With respect to participant enrichment, the present researchers approached instructors/professors before the study began to solicit participation of their students and thus maximize the participation rate'

(p. 129). Each rationale and purpose is explicated in their study.

Mixed research question(s)

When writing a mixed research report, presenting the research question(s) is one of the most important steps. Research questions play a pivotal role in mixed research studies and thus are interactive, emergent, fluid, and evolving (Onwuegbuzie & Leech, 2006). Research questions should be developed and presented early in the manuscript. The research questions also should be reevaluated throughout the study, and if they are modified or changed, this information should be included in the manuscript. Onwuegbuzie and Leech explain that 'mixed methods research questions combine or mix both the quantitative and qualitative research questions. Moreover, a mixed research question necessitates that both quantitative data and qualitative data be collected and analyzed' (pp. 14–15). It is important that the researcher understand the importance of the research questions, as they are used to drive the other steps in the mixed research process.

The mixed research question is clearly presented in Onwuegbuzie et al.'s (2007) study. These researchers state, 'The following mixed-methods research question was addressed: What is the content-related validity (i.e., item validity, sampling validity) and construct-related validity (i.e., substantive validity, structural validity, outcome validity, generalizability) pertaining to the TEF?' (p. 122). This is a great example of a mixed research question because it suggests the use of both quantitative and qualitative data and analysis and the question is clearly identified with the words 'the following mixed-methods research question ...' (p. 122). Because the words 'mixed methods' are included in the research question, the reader is alerted to fact that the study was a mixed methods research study.

Stage 2: Research planning stage

The research planning stage is the second stage in writing a mixed research manuscript. In this

stage, health science researchers write about how the sampling design was chosen and describe various aspects of the mixed research design.

Mixed sampling design

It is important to delineate clearly in the writing of a mixed research report the sampling design utilized in a mixed research study. Information regarding the sampling design includes the type of sampling, the sample size (for both the qualitative and quantitative components), and sample size considerations including a priori power (cf. Cohen, 1988) and information rich cases (Miles & Huberman, 1994; Onwuegbuzie & Leech, 2007a).

We suggest the use of Onwuegbuzie and Collins’ (2007) model for choosing and writing about samples for mixed research studies. The components of the model can be found in

Figure 3. Furthermore, it is important to delineate what type of generalization(s) will be made, whether it will be a statistical generalization (i.e., making generalizations or inferences on data obtained from a representative statistical sample/subsample to the population/sample from which the participants were drawn), an analytic generalization (i.e., ‘applied to wider theory on the basis of how selected cases “fit” with general constructs’; Curtis, Gesler, Smith, & Washburn, 2000, p. 1002), or a case-to-case transfer (i.e., making generalizations from one case to another similar case; Firestone, 1993).

Onwuegbuzie et al. (2007) clearly present the mixed sampling design as ‘The sample was selected purposively utilizing a criterion sampling scheme ...’ (p. 123). This paragraph continues by describing the specific demographics of the sample.

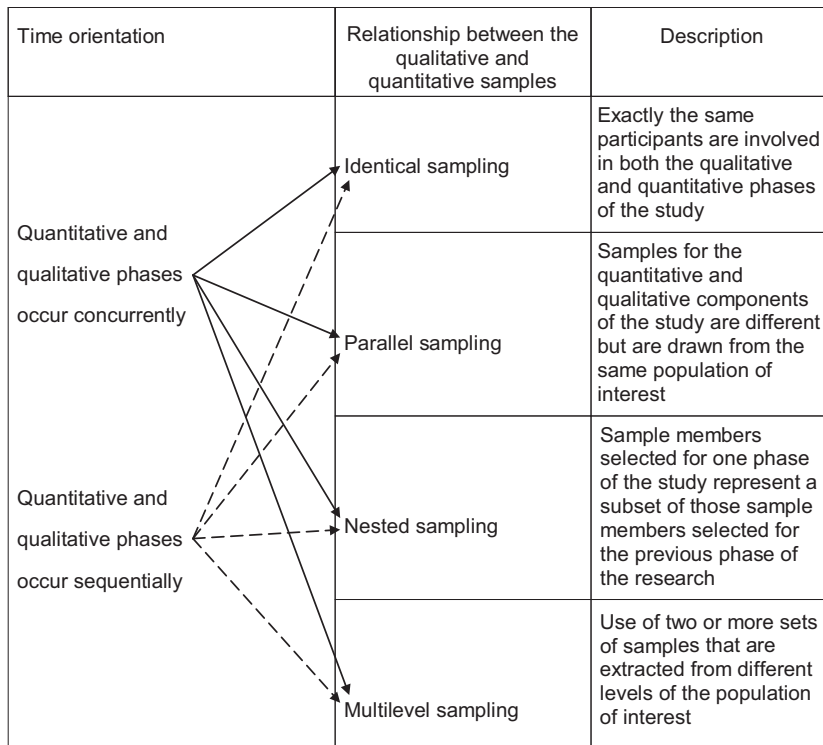


FIGURE 3: ONWUEGBUZIE AND COLLINS’ (2007) MODEL FOR CHOOSING AND WRITING ABOUT SAMPLES FOR MIXED RESEARCH STUDIES

Mixed research design

There are many mixed research designs from which to choose and to describe in a mixed research report. To assist health science researchers in choosing a design, several researchers have created typologies, or ways of thinking about different designs (Greene et al., 1989; Hanson, Creswell, Plano Clark, Petska, & Creswell, 2005; Johnson & Onwuegbuzie, 2004; Leech & Onwuegbuzie, 2009; Tashakkori & Teddlie, 1998, 2003b; Teddlie & Tashakkori, 2006). In an attempt to simplify the classification of mixed research designs, Leech and Onwuegbuzie (2009) developed a typology that explicates the following three dimensions: (a) level of mixing, (b) time orientation, and (c) emphasis of approaches. Teddlie and Tashakkori (2006) also present a useful typology, that of the Methods-Strands Matrix. The matrix is created by crossing the number of methods used (i.e., mono-method vs. mixed methods) by the number of research strands (i.e., single vs. multiple).

Whatever design framework is chosen for any given study, it is important for the research report to describe clearly the framework, the rationale for its use, and any modifications in the design. The specific designs used in the qualitative (e.g., case study, ethnography, grounded theory) and quantitative (e.g., descriptive, correlational, experimental design) phases of the study also should be delineated.

An example of how to write the mixed research design is:

Using Leech and Onwuegbuzie's 2009 typology, the mixed-methods research design used in this investigation could be classified as a fully mixed sequential dominant status design. This design involves mixing qualitative and quantitative approaches within one or more of, or across, the stages of the research process. In this study, the qualitative and quantitative approaches were mixed within the data analysis and data interpretation stages, with the qualitative and quantitative phases occurring sequentially and the qualitative phase given more weight. (p. 125)

Onwuegbuzie et al. (2007) include this information in a dedicated paragraph with the heading 'Research design'. Having the mixed research design set apart from the other text helps the reader clearly identify it and indicates the importance of the design.

Stage 3: Research implementation stage

The research implementation stage includes four distinct stages to incorporate in a mixed research manuscript, that of data collection, data analysis, data validation, and data interpretation. These stages are interactive and cyclical, so they can be presented in various orders within a mixed research report.

Data collection

Johnson and Turner's (2003) typology for data collection can be utilized when conducting and writing a mixed research manuscript. This typology includes the following six strategies, a mixture of: (a) open- and closed-ended items on one or more questionnaires; (b) depth and breadth interviewing; (c) '*a priori*' and 'emergent/flowing' focus group strategies; (d) standardized open- and closed-ended pre-designed tests; (e) standardized/confirmatory and less structured/exploratory observations, alternating between participatory and non-participatory researcher roles; and (f) non-numeric and numeric documents, consisting of archived data based on open- and closed-ended items. Teddlie and Tashakkori (2009) recently presented an even more comprehensive typology of 36 mixed methods data collection combinations, comprising 30 between-strategies mixed methods data collection combinations (e.g., quantitative observations with qualitative-based focus group) and 6 within-strategies mixed methods data collection combinations (e.g., quantitative interview and qualitative interview). Furthermore, authors should include information regarding data collection instruments, including who developed the instruments, the format of the instrument, when and how the instrument was administered,

the amount of time involved in the data collection, and information regarding the quality of the data collected (e.g., score reliability, score validity, inter-rater reliability).

Onwuegbuzie et al. (2007) clearly explicate in their writing the data collection process utilized in their study. These researchers state, ‘Using Johnson and Turner’s (2003) typology, the mixed-methods data collection strategy reflected by the TEF was a mixture of open- and closed-ended items (i.e., Type 2 data collection style)’ (pp. 125–126). Here, it is helpful to note that not only was the data collection method clearly identified, the chosen mixed research data collection strategy was supported by an established resource.

Mixed data analysis

Onwuegbuzie and Teddlie (2003) identified seven stages of the mixed data analysis process that should be incorporated into the analysis section

of mixed research report. These are delineated in Table 2. Each of these stages should be explicated clearly. It is important to include all the steps and decisions made during the data analysis process. Additionally, authors should present the statistical analyses (i.e., descriptive and inferential statistics), which are linked to the research problem, purpose, and question(s). Assumptions (e.g., linearity, normality, independence, equality of variance) should be discussed as well as the extent to which assumptions were assessed and met. According to Constas (1992), the qualitative analysis should include information regarding: (a) where the responsibility for the creation of categories resided; (b) what the grounds were on which one could justify the existence of a given set of categories; (c) what the source of the name was that was used to identify a given category; and (d) at what point during the research process the categories were specified. Further, where possible, the author(s) should provide the

TABLE 2: ONWUEGBUZIE AND TEDDLIE’S (2003) SEVEN STAGES OF THE MIXED DATA ANALYSIS PROCESS

Stage	Definition	Example of use
Data reduction	Reducing the dimensionality of the qualitative data and quantitative data	Thematic analysis of qualitative data; exploratory factor analysis of quantitative data
Data display	Describing pictorially the qualitative data and quantitative data	Matrices and photographs (i.e., qualitative data); tables and graphs (i.e., quantitative data)
Data transformation	Converting quantitative data into narrative data that can be analyzed qualitatively (i.e., <i>qualitized</i> ; Tashakkori & Teddlie, 1998) and/or converting qualitative data into numerical codes that can be analyzed statistically (i.e., <i>quantitized</i> ; Tashakkori & Teddlie, 1998)	Counting the occurrence of (qualitative) themes; forming narrative profiles from quantitative data (e.g., two or more subscale scores)
Data correlation	Correlating quantitative data with quantitized data or correlating quantitative data with quantitized data	Correlating the frequency of themes (i.e., quantitized data) with the age of the participants (i.e., quantitative data)
Data consolidation	Combining both qualitative and quantitative data to create new or consolidated variables or data sets	(Quantitative) exploratory factor analysis of (qualitative) themes to yield meta-themes (i.e., themes at a higher level of abstraction)
Data comparison	Comparing data from the qualitative and quantitative data sources	Comparing findings from interview data to findings from a Likert-format scale
Data integration	Integrating both qualitative and quantitative data into either a coherent whole	Meta-inferences stemming from both quantitative findings and qualitative findings

name of the technique used to analyze the qualitative data (e.g., method of constant comparison; cf. Leech & Onwuegbuzie, 2007, 2008). Finally, it is important to describe any statistical (e.g., Excel, SAS, SPSS) and qualitative (e.g., NVivo9, QDA Miner, Ethnograph, HyperResearch, Atlas-ti) software that was used to analyze the data.

Onwuegbuzie et al. (2007) begin their section on data analysis with:

A sequential mixed-methods analysis (SMMA; Onwuegbuzie & Teddlie, 2003; Tashakkori & Teddlie, 1998) was undertaken to analyze students' responses. This analysis, incorporating both inductive and deductive reasoning, employed qualitative and quantitative data-analytic techniques in a sequential manner, commencing with qualitative analyses, followed by quantitative analyses that built upon the qualitative analyses. Using Greene et al.'s (1989) framework, the purpose of the mixed-methods analysis was development, whereby the results from one data-analytic method informed the use of the other method. (p. 125)

With respect to Onwuegbuzie and Teddlie's (2003) seven-stage model, Onwuegbuzie et al. (2007) revealed that:

In implementing the four-stage mixed-methods data analysis framework, the researchers incorporated five of the seven stages of Onwuegbuzie and Teddlie's (2003) model, namely, data reduction, data display, data transformation, data correlation, and data integration. (p. 128)

The entire analysis section in Onwuegbuzie et al. (2007) contains 1880 words, not including the results section.

Data legitimization

For the data legitimization stage, both the qualitative and quantitative data and findings should be assessed and presented in a clear and concise manner. In the quantitative phase, threats to external and internal validity should be presented (cf. Cook & Campbell, 1979; Onwuegbuzie, 2003). Onwuegbuzie (2003)

developed the Quantitative Legitimation Model, which delineates 50 sources of invalidity at three stages of the quantitative research process (i.e., research design/data collection, data analysis, data interpretation). For the qualitative phase, any threats to trustworthiness, credibility, dependability, authenticity, verification, plausibility, applicability, confirmability, and/or transferability of data (Maxwell, 2005; Miles & Huberman, 1994) should be assessed. The Qualitative Legitimation Model (Onwuegbuzie & Leech, 2007b) can be used to help assess 29 components of qualitative legitimization at three interactive and recursive stages of the qualitative research process (i.e., research design/data collection, data analysis, data interpretation).

For the overall mixed research model, authors can utilize Onwuegbuzie and Johnson's (2006) typology that includes nine legitimization types, which are: sample integration legitimization, insider–outsider legitimization, weakness minimization legitimization, sequential legitimization, conversion legitimization, paradigmatic mixing legitimization, commensurability legitimization, multiple validities legitimization, and political legitimization. Definitions of each of these legitimization types are included in Table 3.

One of the most important aspects to include when writing about a mixed research study is the step of legitimization. The example from Onwuegbuzie et al. (2007) is very beneficial as it clearly outlines the steps taken, refers to an established source, includes this information in its own section with the heading 'Mixed-Methods Validity' (p. 143), and defines all terminology for readers who are unfamiliar with the terms utilized. For example, when discussing sample integration legitimization, the authors state:

sample integration legitimization was optimized by using large and identical samples for both the qualitative and quantitative approaches. This enabled the researchers justifiably to combine the inferences that emerged from both approaches into meta-inferences (i.e., coherent set inference; Tashakkori & Teddlie, 2003, 2006). (pp. 143–144)

TABLE 3: ONWUEGBUZIE AND JOHNSON’S (2006) TYPOLOGY OF LEGITIMATION TYPES

Legitimation types	Definition
Sample integration legitimation	Extent to which the relationship between the quantitative and qualitative sampling designs yields quality meta-inferences
Insider-outsider legitimation	Extent to which the researcher accurately presents and appropriately utilizes both the insider’s (emic) and observer’s (etic) view
Weakness minimization legitimation	Extent to which the weakness from one approach is compensated by the strengths from the other approach
Sequential legitimation	Extent to which meta-inferences could be affected by the order of the quantitative and qualitative phases
Conversion legitimation	Extent to which the quantizing or qualitzing yields quality meta-inferences
Paradigmatic mixing legitimation	Extent to which the researcher’s epistemological, ontological, axiological, methodological, and rhetorical beliefs underlying the quantitative and qualitative approaches are successfully combined
Commensurability legitimation	Extent to which the resultant meta-inferences reflect a mixed worldview that stem from the cognitive process of Gestalt switching and integration
Multiple validities legitimation	Extent to which addressing legitimation of the quantitative and qualitative components of the study results from the use of quantitative, qualitative, and mixed validity types, yielding high quality meta-inferences
Political legitimation	Extent to which the consumers of mixed research value the meta-inferences stemming from both the quantitative and qualitative components of a study

Adapted from Onwuegbuzie and Johnson (2006). Reprinted with kind permission of the Mid-South Educational Research Association and the editors of *Research in the Schools*.

Data interpretation

The significance of all findings should be clearly presented in the mixed research manuscript (Onwuegbuzie & Leech, 2004). Teddlie and Tashakkori (2009, pp. 301–302) outline what they term an interpretive framework for inference quality. This framework comprises the following 10 aspects of quality:

1. Design suitability (i.e., ‘Are the methods of study appropriate for answering the research questions?’; ‘Does the design match the research questions?’; ‘Does the mixed methods design match the stated purpose for conducting an integrated study?’; ‘Do the strands of the mixed methods study address the same research questions [or closely related aspects of the research question]?’)
2. Design fidelity (i.e., ‘Are the qualitative, quantitative, and mixed methods procedures or design components ... capturing the meanings, effects, or relationships?’)
3. Within-design consistency (i.e., ‘Do the components of the design fit together in a

seamless manner?’; ‘Do the strands of the mixed methods study follow each other [or are they linked] in a logical and seamless manner?’)

4. Analytic adequacy (i.e., ‘Are the data analysis procedures/strategies appropriate and adequate to provide possible answers to research questions?’; ‘Are the mixed methods strategies implemented effectively?’)
5. Interpretive consistency (i.e., ‘Do the inferences closely follow the relevant findings in terms of type, scope, and intensity?’; ‘Are multiple inferences made on the basis of the same findings consistent with each other?’)
6. Theoretical consistency (i.e., ‘Are the inferences consistent with theory and state of knowledge in the field?’)
7. Interpretive agreement (i.e., ‘Are other scholars likely to reach the same conclusions on the basis of the same results?’; ‘Do the inferences match participants’ constructions?’)
8. Interpretive distinctiveness (i.e., ‘Is each inference distinctively more credible/plausible

than other possible conclusions that might be made on the basis of the same results?')

9. Integrative efficacy (i.e., 'Do the meta-inferences adequately incorporate the inferences that are made in each strand of the study?'; 'If there are credible inconsistencies between inferences made within/across strands, are the theoretical explanations for these inconsistencies explored, and possible explanations offered?')
10. Interpretive correspondence (i.e., 'Do the inferences correspond to the stated purpose/questions of the study?'; 'Do the inferences made in each strand address the purposes of the study in that strand?'; 'Do the meta-inferences meet the stated need for using a mixed methods design?')

Onwuegbuzie et al. (2007) present the interpretation of the data in multiple pages. Overall, the authors created an acronym (i.e., RESPECTED) for the nine themes that emerged from the data. RESPECTED represented the following themes to describe the effective teaching practices investigated in their mixed method study: responsive, enthusiast, student centered, professional, expert, connector, transmitter, ethical, and director. Each of these themes is discussed in relation to the data. An example of the statements made to interpret the data included:

Comparing the results of the current study to the American Association of School Administrators' conceptualization revealed that a similarly high proportion of the present sample of college students noted one or more characteristics representing the personal characteristic domain (80.5%) as did those who rated a trait representing management and instructional techniques (88.8%). (p. 145)

Report writing

All steps of the mixed research process should be clearly presented for a report to be well written (Onwuegbuzie & Johnson, 2008). It is especially

important for the context in which the study took place to be delineated for the reader so that it is clear how the quantitative and qualitative findings relate and the extent in which meta-inferences can be made. As in all published work, reports of mixed research should be accurate and complete, free of plagiarism, and include all ethical considerations of the study.

CONCLUSION

The purpose of this article was to present the challenges of writing mixed research studies and discuss a potential solution. The solution included providing guidelines for writing up mixed research studies, which were presented utilizing the framework presented by Leech and Onwuegbuzie (2010). This mixed research writing framework was based on the 13 steps in the mixed research process described by Collins et al. (2006). We do not see writing as a linear process that occurs *after* a study has been completed. Rather, we view writing research studies in general and mixed research studies in particular as involving analysis and interpretations, thereby making the writing phase a recursive process. Thus, in mixed research studies, the writing phase both informs and is informed by the other stages in the mixed research process. For instance, in writing up the results of a mixed research study, an author might realize that they need to conduct further analyses.

The example by Onwuegbuzie et al. (2007) was provided to present the reader with an example of how each of the steps would appear in a published article. Understanding the challenges in writing mixed research is hopefully the first step for health science researchers to increase their ability to publish mixed research studies. The second step is to consider the suggested guidelines to inform writing mixed research papers. It is hoped that having guidelines for writing a mixed research report will assist health science researchers in conducting, writing, and publishing rigorous mixed research studies, thereby increasing the likelihood that their studies will be published in the peer-reviewed literature.

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