



## *Mixed Methods Research and its Use in Speech-Language Pathology and Audiology Research*



## *Les méthodes de recherche mixtes et leur usage dans la recherche en orthophonie et en audiologie*

### KEY WORDS

MIXED METHODS  
RESEARCH

MIXED METHODOLOGY

PREVALENCE

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### Abstract

Mixed methods (MM) research involves the use of quantitative and qualitative approaches to data collection and analysis within a single study or series of studies. Much has been written about MM research; yet, the extent to which MM research is used in the fields of speech-language pathology and audiology (SLPA) is unknown. The primary objective of this study was to determine the prevalence of MM research in the SLPA literature. A review of published research papers in four journals was conducted and studies that met initial criteria were further analyzed to determine the use of MM designs. MM research is infrequently published in the journals of SLPA reviewed in this study (i.e., less than 1.2% prevalence rate). Although reasons for the low prevalence are unclear, it is anticipated that the use of MM designs will increase in the coming years.

### Abrégé

Les méthodes de recherche mixtes (MRM) font appel à des approches quantitatives et qualitatives pour la collecte et l'analyse des données au sein d'une étude ou d'une série d'études. On a beaucoup écrit sur les MRM ; cependant, on ne sait pas dans quelle mesure les MRM sont utilisées dans les domaines de l'orthophonie et de l'audiologie. L'objectif de cette étude était de déterminer la prévalence des MRM dans la littérature consacrée à l'orthophonie et à l'audiologie. Un examen des rapports de recherches dans quatre revues a été effectué et les études qui répondaient aux critères initiaux furent analysées pour déterminer l'utilisation des MRM. Les MRM ne sont pas publiées souvent dans les revues d'orthophonie et d'audiologie examinées dans cette étude (c.-à-d., un taux de prévalence de moins de 1,2%). Si les raisons de cette faible prévalence restent obscures, on s'attend à ce que l'usage de MRM dans les études augmente au cours des prochaines années.

## A Review of Mixed Methods Research and its use in Speech-Language Pathology and Audiology

The formalization of the term mixed methods (MM) research first occurred in the behavioral, social, and health sciences (i.e., educational psychology, sociology, nursing) approximately 20 years ago, in response to complex research problems that could not be addressed sufficiently with quantitative (QUAN) or qualitative (QUAL) research methods alone (Creswell & Plano Clark, 2011; Morse & Nieuhaus, 2009). Although MM research is increasingly recognized as a unique research paradigm, little is known about the extent of its use in speech-language pathology and audiology (SLPA). MM research designs may be particularly relevant to SLPA because speech, language, hearing, and swallowing abilities are influenced by multiple, dynamic interactions between individuals and the physical, social, and attitudinal environments in which they live (World Health Organization; WHO, 2001). Thus, as in related disciplines, the research questions in SLPA are often complex, multi-faceted and well-suited to the use of MM research designs. The objectives of this article are to present a summary of MM research designs and report on the prevalence of MM research within SLPA literature.

### MM Research Defined

In the first issue of the *Journal of Mixed Methods Research* (JMRR) in 2007, MM research was defined as, "... research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry" (Tashakkori & Creswell, 2007a, p. 4). Creswell and Plano Clark (2011) expanded on this definition, citing core characteristics of MM research that include the following:

- collection and analysis of both qualitative (QUAL) and quantitative (QUAN) data;
- mixing of QUAL and QUAN data through:
  - merging or combining the data;
  - connecting the data and having one type build on the other; or
  - embedding one type within the other;
- prioritization of one or both forms of data; and,
- framing the procedures within philosophical or theoretical lenses (i.e., an overarching methodology).

The classification of MM research is not without controversy. Nevertheless, researchers have developed a paradigm that incorporates moderate versions of QUAL

and QUAN philosophical frameworks (Morgan, 2007; Tashakkori & Teddlie, 1998). This MM philosophy is rooted in finding the common ground between QUAL and QUAN research in relation to key conceptual characteristics such as, for example, the nature of logic or scientific inquiry (reasoning), and the nature of reality (ontology; see Table 1). The paradigm proposed in Table 1 forms the foundation for the distinct MM research design classifications used in the current prevalence study.

### MM Research Designs

The interaction between the QUAL and QUAN components of a study is of integral importance in categorizing MM designs. QUAL and QUAN 'components' refer to the portions of the study that involve data collection and analysis in accordance with traditional QUAL or QUAN designs. As a basis for categorizing MM designs in the current study, four dimensions outlined by Creswell and Plano Clark (2007, 2011) were considered: (1) emphasis of QUAL and QUAN components, (2) timing of QUAL and QUAN components, (3) mixing strategies, and (4) timing of mixing. These dimensions form the basis for the following basic design types: *convergent*, *explanatory*, *exploratory*, and *embedded* designs (Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011; see Table 2).

**Convergent designs.** If QUAL and QUAN components are collected concurrently and contribute equally in answering a single research question, a *convergent* design is most appropriate. Convergent designs are characterized by the merging of QUAL and QUAN results during analysis or interpretation to create an integrated conclusion (Creswell & Plano Clark, 2011). Merging of results typically involves comparing, contrasting, and synthesizing QUAL and QUAN components (Creswell & Plano Clark, 2011). A simple example of a *convergent* design would be a study in which researchers conduct a focus group with parents of children with autism spectrum disorder to describe their experiences with speech-language therapy (QUAL) and also ask parents to complete a rating scale of their experience (QUAN). The data would be collected, analyzed, and reported distinctly, but merged in the discussion.

Sometimes a *convergent* design may involve the transformation of QUAL data into QUAN data. Transformation of QUAL data involves the application of numerical values to non-numerical data, typically in the form of frequency counts or a priori numerical values being applied to codes or themes used in the analysis (Sandelowski, Voils & Knafl, 2009). For example, a researcher could collect QUAL data on different types

Table 1. Continuum of paradigms and paradigm positions related to foundational elements

Approach to Research	QUAN	MM	QUAL
<b>Nature of Reasoning</b>	Deductive	Abductive	Inductive
<b>Nature of Reality (Ontology)</b>	Single reality	Single & multiple realities possible	Multiple constructed realities
<b>Nature of Knowing (Epistemology)</b>	Objective	Intersubjective	Subjective
<b>Impact of Values on Interpretation (Axiology)</b>	Interpretation should be unbiased & measures should be taken to eliminate bias	Interpretation is both biased and unbiased	Interpretation is fundamentally biased
<b>Generalization</b>	Generalizability	Transferability	Context-dependent
<b>Causality</b>	Cause results in effect	Causality cannot be determined	Cause cannot be isolated from effect

Note: Information derived from Creswell & Plano Clark (2007), Morgan (2007) and Tashakkori & Teddlie (1998)

of diet texture recommendations made by clinicians for individuals with dysphagia, and then count the frequency with which each type of recommendation was made over a certain time period. Importantly, transformed data continue to be viewed as the QUAL component in MM research designs (Creswell & Plano Clark, 2011). The transformed QUAL data in the above example would be integrated with a QUAN component, such as patient scores on a dysphagia-specific quality of life scale administered after treatment, to create a complete MM study.

Finally, *convergent* designs may involve collecting answers to close-ended (QUAN) and open-ended (QUAL) questions on a survey (Creswell & Plano Clark, 2011). In this approach, the QUAL data are used to validate the QUAN findings (Creswell & Plano Clark, 2011). For example, Bedwinek, Kummer, Rice and Grames (2010) conducted a MM survey study pertaining to speech-language pathologists' knowledge of, and education in, craniofacial disorders. The survey included several questions that had a Likert scale response format (QUAN) as well as open-ended questions (QUAL), with the questions intended to provide complementary data to the Likert scale responses.

**Explanatory and exploratory designs.** If the purpose of the study lends itself to an unequal weighing of QUAL and QUAN components and a sequential approach to data collection,

an *explanatory* or *exploratory* design will be best suited for the study (Creswell & Plano Clark, 2011). Both *explanatory* and *exploratory* designs involve the use of some form of connecting data in which the results from the first phase inform and connect to the development of the second phase of data collection and analysis (Creswell & Plano Clark, 2011). *Explanatory* and *exploratory* designs typically involve a summary of both sets of results and a discussion of the extent to which the second phase expanded or confirmed the first phase (Creswell & Plano Clark, 2011).

An *explanatory* design is one in which the QUAN data are collected and analyzed before the QUAL data (Creswell & Plano Clark, 2007; Creswell & Plano Clark, 2011). Most often, the QUAL information is collected to explain the QUAN results. For example, in an *explanatory* study, researchers may ask persons with hearing loss to rate their conversational abilities before and after an aural rehabilitation program (QUAN) and then have the same participants take part in one-on-one clinician-led follow-up interviews to discuss reasons for specific ratings (QUAL).

An *exploratory* study is one in which QUAL data are collected and analyzed before the QUAN data (Creswell & Plano Clark, 2011). The QUAL information is used to explore phenomena by uncovering variables of interest that could inform a hypothesis to be tested or the development of a

Table 2. Introductory matrix to basic mixed method designs in Creswell &amp; Plano Clark Typology

	<b>Convergent Design</b>	<b>Explanatory Design</b>	<b>Exploratory Design</b>	<b>Embedded Design</b>
<b>Notation</b>	QUAL + QUAN Parallel- database	QUAN -> qual Follow-up explanations	QUAL -> quan Theory or Instrument development	QUAL (quan) QUAN (qual) Embedded- experiment
<b>Variations</b>	Data transformation Data validation	Participant selection		
<b>Emphasis</b>				
Equal	•			
Not Equal		•	•	•
<b>Timing</b>				
Concurrent	•			
Sequential		•	•	
Either concurrent or sequential				•
<b>Mixing Strategies</b>	Merging	Connecting	Connecting	Embedding
<b>Timing of Mixing</b>				
Design				•
Data collection		•	•	
Data analysis	•			
Interpretation	•			
<b>Research Question</b>				
One overarching research question	•	•	•	
More than one related but distinct questions				•

Note: Information is derived from Creswell & Plano Clark (2011)

measurement instrument (Creswell & Plano Clark, 2011). The second QUAN phase either involves isolating and assessing variables to determine the validity of the QUAL hypothesis or using a QUAN measure developed from the QUAL results (Creswell & Plano Clark, 2011). For example, a researcher may conduct a focus group of special education teachers to generate discussion of perceived barriers to implementing speech and language services in the schools (QUAL). Then, using the ideas generated in the focus group, a large-scale survey might be sent to all the teachers in a district asking them to rate the impact of predetermined barriers (QUAN).

**Embedded design.** The final type of MM research design proposed by Creswell and Plano Clark (2011) is the *embedded* design. The primary purpose of this design is to enhance a traditional QUAN or QUAL design. An *embedded* design is appropriate if the QUAL and QUAN components have unequal weighting and the researcher determines that timing of the components could be either concurrent or sequential (Creswell & Plano Clark, 2011). The timing of the embedded data collection and analysis should be determined by the research questions (i.e., if the primary data are going to inform the extent of what is necessary for the embedded data collection and analysis, then the *embedded* information should be collected later; Creswell & Plano Clark, 2011). Creswell and Plano Clark (2011) explain two configurations of the *embedded* design; either the QUAN is emphasized and the QUAL is supplemental, or the QUAL is emphasized and QUAN is the supplemental component. The supplemental data set is designed to answer a second research question that differs from the primary research question, although it may be related (Creswell & Plano Clark, 2011). The presence of two distinct yet related research questions distinguishes the *embedded* design from the *convergent* design in which there is only a single research question. As the primary and secondary data in an *embedded* study address distinct questions, results should not be merged but rather kept separate and reported as related but distinct findings (i.e., the two components could be reported in ‘sister articles’) (Creswell & Plano Clark, 2011). Danzak (2011a, 2011b) conducted an *embedded* study and published the QUAN and QUAL components in two papers. In Danzak (2011a), writing samples from English language learners’ were analyzed for linguistic complexity to determine if a difference existed across languages (English/Spanish) and genres (expository/narrative) (i.e., the QUAN component). The QUAL component, published separately (Danzak, 2011b), consisted of a separate analysis of English language learners’ journal entries to determine the impact of

literacy experiences on their identities as bilingual writers. The QUAN and QUAL components were used to answer different but related research questions.

### Prevalence of MM research across disciplines

Scholars interested in methodology have begun assessing the extent or prevalence of use of MM research designs as a way to gauge awareness of MM research and its adoption across disciplines. Alise and Teddlie (2010) estimated the prevalence of MM designs in psychology, sociology, nursing, and education. They reviewed published articles in 20 journals (five per discipline) over approximately one year (2005) and randomly selected 150 articles per discipline to review for the use of MM research designs. They found an average prevalence rate (calculated as the percentage of total articles that met specified criteria to be classified as MM research) of 11% across the four disciplines (5% in sociology, 7% in psychology, 9% in nursing, and 24% in education). Using similar methods (a literature review and MM classification framework), researchers have reported variable rates in other disciplines, from 5% in library science (Fidel, 2008), to 13.7% in school psychology (Powell, Mihalas, Onwuegbuzie, Suldo & Daley, 2008), and 14% in education (Truscott et al., 2010). In assessing trends over time, Ivankova and Kawamura (2010) searched five multidisciplinary databases and found a steady increase in the publication of empirical MM studies from 2000–2008. The findings from this body of research indicate that MM research designs are being used in different disciplines, although rates of use vary based on several factors including sampling procedures and operational definitions of MM research (Alise & Teddlie, 2010).

In SLPA, little is known about the adoption and use of MM research designs. Thus, to address this knowledge gap and assess if and how MM research is being used in SLPA, the following research question was of interest in the current study: What is the prevalence of MM research designs in the published SLPA literature in the North American context?

### Methods

The study was conducted in two phases. In the first phase of the study, published articles were identified and selected through a literature search. In the second phase of the study, selected articles were evaluated to determine if the authors used research designs that met objectively defined MM criteria.

**Phase one – Literature search.** Four discipline-specific journals published by the national organizations governing

SLPA in Canada and the United States were chosen, including the *Canadian Journal of Speech Language Pathology and Audiology* (CJSLPA), *American Journal of Speech-Language Pathology* (AJSLP), *Journal of Speech, Language and Hearing Research* (JSLHR), and *Language, Speech, Hearing Services in Schools* (LSHSS). These journals were chosen to ensure that all published papers would be relevant to SLPA and because the total number of published papers across the four journals provided a sufficient sample for review, based on previous prevalence studies in other disciplines (Alise & Teddlie, 2010; Powell et al., 2008). All articles published in these four journals over six years from 2007 – 2012, inclusive, were selected for review. The year 2007 was used as a starting point as it coincides with the release of the first issue of the *Journal of Mixed Methods Research*, an important point in the emergence of MM research as an accepted and well-defined paradigm.

The CINAHL plus database provided electronic records and full text access of AJSLP, JSLHR, and LSHSS from 2007–2012. The CINAHL database provided electronic record access to CJSLPA from 2007–2011 and full text access to CJSLPA from 2008–2011. As such, investigators manually searched the full texts of issues of CJSLPA published in 2007 and 2012 for MM studies. In consultation with two research librarians, the first author developed a complex search string for this first phase of the study. The search was restricted to research and review articles published from January 1, 2007 to February 1, 2013. Articles such as editorials, letters to the editor, tutorials, and field notes were excluded. Next, a search protocol, developed by a senior research librarian was applied. This search protocol was designed to employ a variety of terms to identify studies in the electronic record that included both QUAL and QUAN components or used any terms or combinations of terms characteristic of MM studies. Derivations of terms that would directly denote MM studies were searched (e.g., *mixed method*, *multimethod*, *multiple research methods*, *mixed research*, *'qualitative and quantitative'*). The search included methodological terms that could be used to classify the study as having an organized approach to collection and analysis of QUAN and QUAL components (e.g., *nested*, *blending*, *concurrent*, *transformative*, *iterative*, *triangulation*). The search protocol further facilitated identification of studies that contained a derivation of *quantitative* research in conjunction with a variety of terms that could indicate a QUAL component existed within the study (*phenomenology*, *hermeneutic*, *content analysis*, *lived experience*, *narrative*, *interview*, *focus group*, *action research*, etc.). The investigators also searched for articles where derivations of key words like

*qualitative* and *quantitative* or *triangulation* and *design* occurred in close proximity to one another (e.g., with five or fewer words between them). Finally, the search protocol involved exploration of the full text of articles for author self-identification of MM research designs through the use of derivations of the phrases *mixed methodology*, *multimethod*, *qualitative and quantitative*, and *quantitative and qualitative*.

**Phase two – MM criteria analysis.** Objective criteria were developed based on the definition of MM used by the *JMMR* and guidelines provided by Creswell & Plano Clark (2007; Tashakkori & Creswell, 2007a) to further analyze the studies selected in phase one. The hierarchy included four criteria (Figure 1) that had to be met for an article to be designated as including MM.

The first criterion was the collection and analysis of both QUAL and QUAN raw data. QUAL data consisted of words, text and/or, images, which were analyzed through a process that involved reporting depth and breadth of ideas presented (Creswell & Plano Clark, 2007; Sandelowski, Voils & Knafl, 2009; Thomas, 2003). QUAN data comprised numbers and measurements, which were analyzed using descriptive and/or inferential statistical techniques (Creswell & Plano Clark, 2007; Thomas, 2003).

For the purposes of this study, quantitized or transformed QUAL data, where numerical values are derived from a text data source such as a language sample transcript, were classified as QUAN data instead of QUAL data, which is typical of transformed QUAL data. In the field of speech-language pathology, assessments of speech and language will often involve analysis of transcripts to determine the way in which a person is using speech and language conventions (Shiple & McAfee, 2009). A language sample typically consists of over 50 utterances that are analyzed to evaluate the form or nature of language being used (e.g., average number of words in each utterance or complexity of sentence or syntactic structure), the use of language (e.g., the communicative intent of the utterances), the rate of speech, and skills related to storytelling or narrative tasks, among others (Shiple & McAfee, 2009). The numbers from a language sample are not based on the content of the transcript; rather they are based on quantifiable occurrences of linguistic properties. To consider data from a language sample analysis as QUAN data is somewhat unique to speech-language pathology and is in contrast to transformation of thematic analysis into numerical form via transformation. In a true data transformation, the focus is on ideas participants share in their narratives (i.e., content), whereas in linguistic

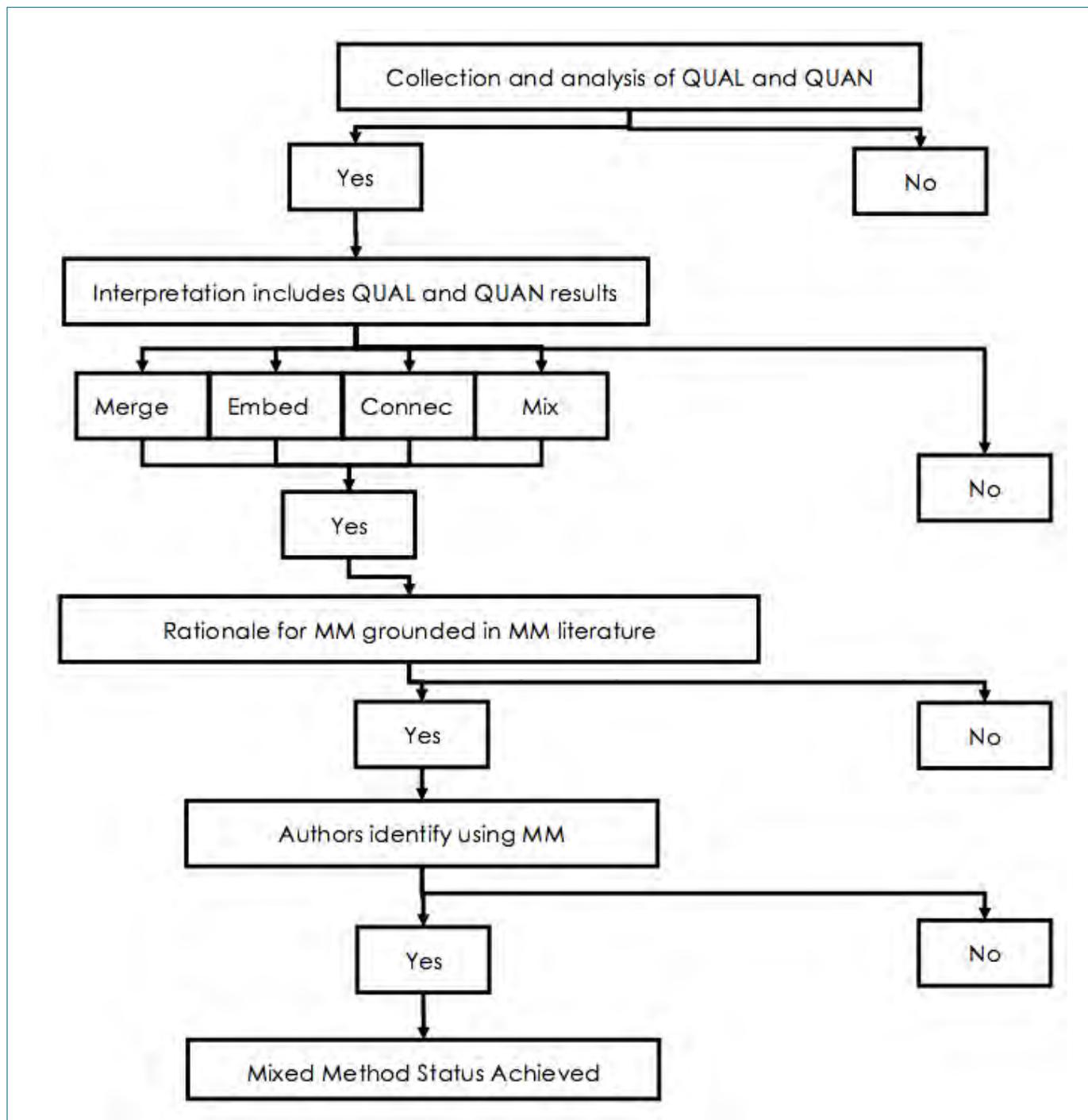


Figure 1: A priori hierarchy to determine MM status of article (Phase 2)

analysis the emphasis is on the use of linguistic features (i.e., form; Sandelowski, Voils & Knaf, 2009). We also considered phonetic transcription analysis as QUAN analysis, even though the data yield written symbols or a transcript (Shiple & McAfee, 2009). Similar to language sample analysis, phonetic transcription analysis results in numbers that are not derived from the ideas presented in

the transcript but rather a person’s use of speech sounds (Shiple & McAfee, 2009).

The second criterion for the classification of a study as MM research was the demonstration of mixing of QUAL and QUAN results (Creswell & Plano Clark, 2011; Tashakkori & Creswell, 2007a). To meet this criterion, the authors had

to explicitly demonstrate that QUAL and QUAN results were merged, connected, embedded, or mixed (Creswell & Plano Clark, 2011). Merging of data was demonstrated through integration of the QUAL and QUAN data sets either during design, data collection, analysis, or in the discussion (Creswell & Plano Clark, 2011). Merged data involved equal emphasis of QUAL and QUAN as results were compared, contrasted, or synthesized (Creswell & Plano Clark, 2011). Data were considered connected in instances where a sequential design was used and one data set was collected, analyzed, and interpreted before a second set of data was collected, analyzed, and interpreted. A study that included a summary of QUAL and QUAN phases and involved description of the extent to which one data set informed the other was considered to connect the data (Creswell & Plano Clark, 2011). Embedded data was demonstrated through the use of one data set to address supplemental questions in an overall study (Creswell & Plano Clark, 2011). In an *embedded* design, components could be reported independently (Creswell & Plano Clark, 2011).

The third criterion was evidence of explicit MM design grounded in MM philosophy (Creswell & Plano Clark, 2011). The introduction, methods, and discussion sections of each article were reviewed for a stated rationale for the use of MM that included citations from MM literature (Creswell & Plano Clark, 2007). To meet this criterion, the article had to contain at least one citation and one reference that were specific to MM research.

The fourth criterion required that the study investigators identified the study as involving a MM research design (Creswell and Plano Clark, 2007; 2011). To meet this criterion, authors could explicitly state the study involved mixed methods in the title, abstract, purpose statement, methods, or analysis sections of the paper by using any derivation of the terms *mixed methods*, *qualitative and quantitative*, *integrate methods*, *combined methods*, *methodological triangulation*, or *multi-methods* to describe the study. Whereas Creswell and Plano Clark (2007; 2011) used the last two criteria as basic parameters for determination of MM status, in the current review, articles were examined for the collection, analysis, and integration of QUAL and QUAN components before investigators assessed the inclusion of specific conventions.

**Phase two analyses.** The two authors and a research assistant completed the analysis for the study. First, the primary author reviewed one article from each of the selected journals and developed a checklist for analysis. Next, both authors reviewed four articles, one from each journal, and refined criteria and operational definitions. After

reaching consensus related to the four articles, the primary author reviewed all the articles retrieved in phase one and analyzed them to determine MM status. Fifty-two articles (20% of the articles reviewed) were randomly selected and coded by the second author or the research assistant. Two measures of agreement were determined. First, overall agreement of MM status of an article was calculated by counting the number of agreed upon articles divided by the total number of articles. Second, criterion agreement was determined for each article by dividing number of agreed upon criteria by the total number of criteria (i.e., 4). For example, if the two coders agreed on three of four criteria for one article, inter-rater agreement for that article would be 75%.

## Results

**Phase one – Literature search.** From 2007–2013, 1623 articles were published across the four journals; 1125 were research or review articles. Of those, 257 articles were selected using the MM search protocol: 153 articles were from JSLHR, 49 articles were from AJSLP, 46 articles were from LSHSS, and 9 articles were from CJSLPA (see Table 3).

**Phase two – MM criteria analysis.** Of the 257 articles that met criteria for inclusion after phase one, 249 were appropriate for phase two analysis (Table 4). Eight articles were excluded because they were systematic reviews (e.g., Cirrin & Gillam, 2008) or presented theoretical synthesis of information and recommendations (e.g., Tager-Flusberg et al., 2009). Only 5 of the 249 articles analyzed in phase two met all four criteria to be classified as MM studies (Table 4); one was published in AJSLP (Langevin, Packman & Onslow, 2009), and four were found in LSHSS (Bedwinek, Kummer, Rice & Grames, 2010; Danzak, 2011a; Danzak, 2011b; Overby, Carrell, & Bernthal, 2007). Two of the four articles in LSHSS were related to one study that used an *embedded* design; specifically, in one article the author reported on the QUAN data (Danzak, 2011a) and in another article she reported on the QUAL data (Danzak, 2011b).

The overall prevalence of MM research designs across all SLPA journals over the six year search time frame, based on articles meeting all four criteria in the hierarchy, was less than 0.5%, with slight variability across journals (i.e., from 0.0% in JSLHR and CJSLPA to 2.2% in LSHSS; see Table 4). Eighteen articles met between one and three of the criteria. Seven articles met the first two criteria related to using and mixing QUAL and QUAN components (Ball & Lewis, 2011; Brandel & Frome Loeb, 2011; Clegg, Anson, Stackhouse, Donlan, 2012; Irani & Richmond, 2012; Jackson, Wegner, & Turnbull, 2010; Stockman, Boulton, Robinson, 2008; Washington, Thomas-Stonell, McLeod & Warr-Leeper,

Table 3. Summary of Phase One Results (Literature Search)

Journal	Bibliographic Records	Full Text Available	Total research/ review articles Jan 2007 – Feb 2013	# Articles retrieved by MM database search Jan 2007 – Feb 2013
AJSLP	1996 – present	2001 – present	167	49
CJSLPA	2007 – present	03/01/2008 – 12/31/2011	95	9
JSLHR	1996 – present	01/01/1997 – present	681	153
LSHSS	1995 – present	01/01/1995 – present	182	46
<b>Total</b>			<b>1125</b>	<b>257</b>

Table 4. Summary of Phase Two Results (MM Criteria Analysis)

Journal	Total Research/ Review	# Articles Retrieved by Phase One	# Articles appropriate for Phase Two Analysis	# MM studies as determined by Phase 2 Analysis	Prevalence of MM as determined by MM criteria analysis (%)
AJSLP	167	49	47	1	0.6
CJSLPA	95	9	9	0	0
JSLHR	681	153	150	0	0
LSHSS	182	46	43	4	2.20
<b>Total</b>	<b>1125</b>	<b>257</b>	<b>249</b>	<b>5</b>	<b>0.44</b>

2012). Ritzman and Sanger (2007) did not reference MM literature but their study met the three other criteria. In two articles, authors used QUAL and QUAN components but failed to meet the other three criteria (Carey, O'Brian, Onslow, Packman, & Menzies, 2012; Jonk & Ennes, 2009). In contrast, authors of two articles self-identified as using MM research but did not use or integrate QUAL and QUAN data as per the classification criteria used in this study (Bahr, Silliman, Berninger, & Dow, 2012; Johnston et al., 2008). In addition to self-identification, Johnston and colleagues (2008) also provided a rationale grounded in MM literature. Marshall (2010) also self-identified as using

an MM design, but there was no explicit integration of QUAL and QUAN data and no reference to the MM literature.

Table 5 summarizes articles that met at least one of the MM criteria. Table 6 presents adjusted prevalence rates across journals to include all articles that included a description of research that, at minimum, met the first two criteria related to collection, analysis, and integration of QUAL and QUAN components (13 articles yielded a 1.16% prevalence rate).

**Measures of agreement.** Investigators had 100% overall agreement of MM status of an article based on independent analysis of 52 articles. The investigators had 96% criterion

Table 5. Summary of articles that met at least one MM criteria

Article	Journal	Collects and Analyzes QUAL and QUAN	Mixing of QUAL and QUAN	Provides rationale grounded in MM literature	Self Identifies as MM
Bahr, Silliman, Berninger, & Dow (2012)*	JSLHR				•
Ball & Lewis (2011)	CJSLPA	•	•		
Bedwinek, Kummer, Rice & Grames (2011)	LSHSS	•	•	•	•
Brandel & Frome Loeb (2011)	LSHSS	•	•		
Carey, O'Brian, Onslow, Packman & Menzies (2012)	LSHSS	•			
Clegg, Ansorge, Stackhouse & Donlan (2012)	LSHSS	•	•		
Danzak (2011a)*	LSHSS	•	•	•	•
Danzak (2011b)*	LSHSS	•	•	•	•
Irani & Richmond (2012)	CJSLPA	•	•		
Jackson, Wegner, Turnbull (2010)	LSHSS	•	•		
Johnston et al. (2008)	CJSLPA			•	•
Jonk & Ennes (2009)	CJSLPA	•			

Langevin, Packman & Onslow (2009)*	AJSLP	●	●	●	●
Marshall (2010)	LSHSS	●			●
Overby, Carrell, & Bernthal (2007)	LSHSS	●	●	●	●
Ritzman & Sanger (2007)	LSHSS	●	●		●
Stockman, Boulton, Robinson (2008)	AJSLP	●	●		
Washington, Thomas-Stonell, McLeod, & Warr-Leeper (2012)	CJSLPA	●	●		

Note:

- Articles that were considered MM studies are highlighted in dark grey
- Articles that met basic MM criteria (uses and integrates QUAL and QUAN components) without using MM writing conventions (i.e., use of MM literature or self identification) are highlighted in light grey

(\* ) – indicates studies that used a speech-language transcript analysis as the QUAN component of the study

Table 6. Adjusted prevalence rate to include studies that included collection, analysis, and integration of QUAL and QUAN data but not a grounded rationale or author-identification as MM

Journal	Total Research/ Review	# MM studies	# studies that met basic criteria but not writing conventions	Adjusted # of MM studies	Adjusted Prevalence of MM (%)
AJSLP	167	1	1	2	1.20
CJSLPA	95	0	3	3	3.16
JSLHR	681	0	0	0	0.00
LSHSS	182	4	4	8	4.40
<b>Total</b>	<b>1125</b>	<b>5</b>	<b>8</b>	<b>13</b>	<b>1.16</b>

agreement. The investigators disagreed on one or two criteria in six of the 52 articles used in the reliability analysis and reached 100% agreement following discussion.

### Discussion

Overall, prevalence rate estimates for MM studies in the North American SLPA literature are substantially lower than prevalence rates reported in other disciplines in which the average was 11% (Alise & Teddlie, 2010) and the lowest reported rate was 5% in both library science (Fidel, 2008) and sociology (Alise & Teddlie, 2010). If the prevalence estimates in this study are a valid reflection of the use of MM designs, then researchers in SLPA may not be aware of, or they may lack knowledge about MM designs at the philosophical and/or practical levels. Indeed, the results provide some support for this contention. Seven studies that were reviewed met designated criteria of using and integrating QUAL and QUAN components but were not identified as MM studies by the authors. In three other articles, authors identified the study as incorporating a MM design, and/or they provided a MM rationale grounded in MM literature, but then did not collect, analyze, and integrate QUAL and QUAN data. Alternatively, the low prevalence rate may reflect researcher choice rather than lack of knowledge about MM research designs. Researchers may choose not to use MM designs because they ask questions that are best addressed using either QUAN or QUAL designs, but not both (Fidel, 2008). However, the current study did not involve evaluation of the appropriateness of research designs nor aspects of validity and reliability of the reviewed research articles.

Practical considerations such as page limits, may have constrained the publication of MM research studies, which tend to be longer than mono-method research manuscripts (Lopez-Fernandez & Molina-Azorin, 2010; Onwuegbuzie, 2013). However, MM research is published in single manuscripts in other disciplines, as per reported prevalence rates, and seven MM articles were found in the current study. Thus, page limits are likely not the primary reason for low prevalence rates in the four journals searched in this study.

The classification scheme used in the current study may have influenced the prevalence rate. A less rigid scheme, with fewer criteria, may have resulted in higher prevalence estimates. The current classification scheme was implemented to reduce the likelihood of over-estimation of prevalence of MM research, and it could be argued that the use of this classification resulted in an under-estimation of MM research in SLPA. However, even when a less stringent classification approach was applied in phase two, with only

two criteria necessary for a study to be designated as MM, the prevalence rate was still only 1.16%.

However, the findings should be interpreted cautiously for several reasons. First, the literature search was somewhat limited in breadth. The initial search for MM research articles was limited to four of the most prominent SLPA journals published in North America. Although the search included six years and more than one thousand articles, and is consistent with the breadth of other prevalence studies (Alise & Teddlie, 2010; Fidel, 2008; Ivankova & Kawamura, 2010), sampling bias may have contributed to the low prevalence rates. For example, non-discipline specific journals were not considered, nor were audiology-specific and internationally published journals. Thus, results cannot be generalized comprehensively across the disciplines of SLPA.

Despite the limitations, the study findings are important to research and clinical practice in SLPA. First, the use of MM reduces the impact of biases inherent in either a QUAN or QUAL approach alone. As such, results are more likely to converge in closer proximity to the real phenomena under study (Salsali, 2009). Second, by utilizing both the subjective and objective points of view, MM embraces subjective reality within the context of the search for generalizable findings (Tashakkori & Teddlie, 1998). Thus, the use of a different and second approach to confirm the findings of the initial study, may contribute to increased reliability of findings and confidence in results (Denzin, 1988; Salsali, 2009). MM provides a framework for research in clinical fields to mix and integrate QUAL and QUAN information to reach more thoroughly informed conclusions (Creswell & Plano Clark, 2007), which can help to support evidence-based practice.

As recently as 2011, Scheffner-Hammer wrote that, compared to quantitative methods, "as a field we have largely overlooked the value of the qualitative research methods, which can be employed to answer a different but complementary set of research questions" (p. 161). The results of this study show that MM research designs also may be overlooked in the field of SLPA. However, more research is needed to support these conclusions.

### Future Directions

Future research should include examination of a larger, more diverse sample of journals to increase the external validity of the findings from this foundational work. In addition, prevalence could be estimated over time and by journal, including prevalence rates of QUAN and QUAL research alone as well as MM research in SLPA. A potential

next step in this line of research could include conducting a MM research study in which QUAN prevalence data are collected in conjunction with QUAL data from interviews with researchers and SLPA students as to their awareness of MM designs and barriers and facilitators of their use in research.

For individuals who want to learn more about MM research, there are many excellent sources of information, including textbooks and articles that provide details on the design, implementation and dissemination of MM research (see Leech, Onwuegbuzie & Combs, 2011). As speech-language pathologists and audiologists, it is important to be aware of methodological developments within and between research communities to address complex research questions that characterize the field of SLPA.

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### Acknowledgements

The authors would like to thank Dr. Sharon Warren, for her initial feedback on this article and her continued support, Dagmara Chojecki and Linda Seale (research librarians), for their assistance and expertise in constructing the literature review, and Tassani Hoskyn, research assistant.

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