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# EXPLORING THE NATURE OF MIXING METHODS IN ESP RESEARCH

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## Abstract

Mixed methods research has recently received attention in the social sciences and is a new approach in applied linguistics research. The present study investigates the current status of mixed methods research in the field of ESP. Qualitative analysis of 31 research articles revealed that a large number of ESP studies did not draw on a wide range of mixed methods research designs and ESP researchers adopted a pragmatic (i.e. practice-oriented) approach to integrating qualitative and quantitative strands. The results further revealed that although concurrent and sequential designs were utilized in ESP research, subcategories of mixed research designs and sampling designs were not frequent in the articles. The findings of this study may help us develop an enhanced understanding of how mixing can be systematically utilized in ESP research.

## 1. Introduction

The nature of inquiry in applied linguistics has undergone a number of challenges over the last few decades, and has been influenced by developments in research in the social and human sciences (see Dörnyei 2007). As with the social sciences, one major challenge for applied linguistics researchers has been the divide between qualitative and quantitative research which, in a number of contexts, has led to a division of researchers into two differently oriented camps (i.e. qualitative researchers and quantitative researchers). In this regard, as Newman & Benz (1998) pointed out, there have been serious debates and controversies on the nature of qualitative and quantitative approaches since the early 1980s “as though one or the other should eventually emerge as superior” (*ibid.*: xi). More recently, however, the dichotomy seems to have been rejected (Newman & Benz 1998; Ridenour & Newman 2008) and mixing the two approaches has become many social researchers’ concern (Tashakkori & Teddlie 1998, 2003, 2008).

Although mixed methods research is a new concept in the social and human sciences (Tashakkori & Teddlie 1998), many studies have directly addressed the issue since 2007, which marks the date of publication of the first issue of the *Journal of Mixed Methods Research* (January 2007). In the editorial of the first issue of the journal, Tashakkori & Creswell (2007a: 3) announced the advent of “the new era of mixed methods” by stating that the journal would start “a new era in conceptualiza-

tion and utilization of integrated approaches across the social and behavioral sciences" (*ibid.*).

Unlike studies in the social and behavioural sciences, it appears that applied linguistics research has not yet applied mixed methods as an independent approach. Despite the fact that a number of studies claim to have combined qualitative and quantitative approaches (e.g. Camiciottoli 2005; Lamb 2007; Rogerson-Revell 2008), we can hardly find systematic treatment of the practice of mixing methods in applied linguistics research: "We must note that most studies in which some sort of method mixing has taken place have not actually foregrounded the mixed methods approach and hardly any published paper have treated mixed methodology in a principled way" (Dörnyei 2007: 44). In fact, the nature of mixing methods, sampling designs, and validity/credibility or what Tashakkori & Teddlie (2008) call "quality of inferences" in mixed methods research has received scant attention even in the most recent works on mixed methods research (see Dörnyei 2007). It therefore seems that our understanding of mixed methods research in the field is yet to be developed and, to this purpose, serious and comprehensive research is a necessity.

The importance of mixed methods research in applied linguistics stems from the fact that it provides researchers with a range of possibilities in conducting research. That is, the use of mixed research enables researchers to explore an issue both qualitatively and quantitatively. More specifically, qualitative exploration of the processes and quantitative measurement of the outcomes (see Yin 2006) in a concurrent design would lead to a more comprehensive treatment of the phenomenon under study (Hashemi 2012). Furthermore, long-term investigation of a dynamic system using qualitative methods as well as exploration of the quantifiable cross-sections of the system in a sequential design would produce more credible results (see Hashemi 2012). Generally, the results from mixed methods research can be considered as a whole that is greater than the sum of its parts – i.e. qualitative and quantitative findings (Dörnyei 2007). That is something mono-method research cannot accomplish.

Research on mixing methods can be carried out in different areas such as second language acquisition, language assessment, teacher education, English for specific purposes, etc. Among various areas of research in applied linguistics, research on ESP seems to have shown a high potential for utilizing triangulation which can be defined as "use of multiple data-collection technologies, multiple theories, multiple researchers, multiple methodologies, or combinations of these four categories of research activities" (Denzin 1978 as cited in Berg 2001: 5) and in some cases is realized in practice through combining qualitative and quantitative methods (see Long 2005). Therefore ESP research seems to offer considerable potential for utilizing mixed methods research. The purpose of the present study is thus to explore the current status of mixed methods research in the field of ESP. The study investigates the nature of integration of qualitative and quantitative methods in ESP research by considering how mixing is used at different stages of the studies. More specifically, the study is an attempt to explore (a) the nature of research designs used when mixing is utilized in ESP research, (b) types of sampling designs used in mixed methods ESP research, and (c) the way general conclusions or "meta-infer-

ences” are developed in this type of research. The study focuses on these aspects of mixed methods research because these are the main elements in developing and utilizing mixed research designs (see Tashakkori & Teddlie 1998; Yin 2006). Purposes for mixing, rationales for mixing, and the nature of data integration are other important aspects of mixed research that have been addressed in several studies (see, for example, Greene *et al.* 1989; Hanson *et al.* 2005; Collins *et al.* 2007; Bryman 2008; Alise & Teddlie 2010). These aspects may well be worth examining in future research.

Mention must also be made of the role of mixed methods in addressing the gaps in ESP research. Exploring complex ESP issues in a dynamic way would require utilization of both qualitative and quantitative methods for the purpose of investigating both processes and outcomes (see Yin 2006). By using mixed research in ESP, researchers would be able to examine complicated issues from different angles, have a more complete picture of the phenomenon under study, and explore both processes and outcomes in a single program of inquiry.

## 2. Review of the literature

### 2.1. *Mixed methods research*

Bergman (2008: 1) defines mixed methods research as “the combination of at least one qualitative and at least one quantitative component in a single research project or program.” Mixed methods research is the result of the “evolution” from mono-method research (Tashakkori & Teddlie *ibid.*). According to Tashakkori & Teddlie (1998), there are two stages involved in the evolution: from the 1960s to the 1980s – a shift to mixed methods considering the epistemological and ontological weaknesses of qualitative and quantitative approaches; and from the 1990s onwards – integration of qualitative and quantitative approaches for establishing a mixed model of research. However, as Bergman (2008: 3) argues, “any development in mixed methods will not necessarily come from developments in mono-method research”, and this would actually highlight the self-sufficient nature of mixed methods research as an independent mode of inquiry. In addition, it appears that using both qualitative and quantitative research cannot be considered to be the same as conducting mixed methods research. Bryman (2008: 98) confirms this by noting that “conducting both quantitative and qualitative research doesn’t mean that they are being integrated or mixed.” Rather, in mixed designs, integration needs to occur at different stages of the study (i.e. forming research questions, sampling, data collection, data analysis, and drawing conclusions) to improve the integration quality in mixed research (Yin 2006).

In order to construct a more comprehensive definition of mixed methods, Johnson *et al.* (2007) brought together definitions from the leading researchers in the field. Based on the definitions collected by Johnson *et al.* (*ibid.*), a number of key features of mixed methods research can be highlighted: mixed methods research is different from multi-method research: in the latter methods or approaches are used in parallel, but in the former methods and approaches are integrated. Methods are

“planfully juxtaposed or combined” (*ibid.*: 119) in a mixed methods study; mixed research involves simultaneous or sequential data collection and analysis. Mixed methods research is a type of “evolving methodological inquiry” (*ibid.*: 120) particularly used in research in the human sciences; in mixed methods research, in addition to equal-status designs (see Hanson *et al.* 2005), there might exist a qualitative or quantitative core component with qualitative or quantitative supplementary components (Johnson *et al.* 2007).

It follows that in mixed methods research integration takes place at different layers and stages from the use of research questions to the nature of data collection and analysis, and interpretation of the results. In this respect, mixed methods research will actually make valuable contributions to the nature of inquiry in the human and social sciences.

## 2.2. Major concepts and issues in mixed methods research

The social sciences have seen an increasing use of mixed methodology in recent years. Part of the research in the social sciences has directly addressed the issue of mixed methods, focusing on opportunities and threats in utilizing mixed methods research. The following is a selective review of a number of influential studies that have addressed both theoretical and methodological aspects of mixing qualitative and quantitative methods.

Concerned with paradigmatic problems at the epistemological and ontological levels and also methodological considerations in mixing, Morgan (2007) identifies several methodological issues for integrating qualitative and quantitative approaches and proposes that a “pragmatic approach” needs to be used as a new paradigm for mixing methods in the social sciences, taking into account methodological issues rather than “metaphysical concerns” (*ibid.*: 48). Furthermore, Denscombe (2008) argues that the mixed methods approach emerged as a “third paradigm” in social research. Denscombe (*ibid.*: 270) makes an argument for the necessity of “a vision of research paradigm” that takes into account “variations and inconsistencies” in the mixed methods approach and introduces the concept of “communities of practice” as a basis for understanding the new paradigm. Denscombe (*ibid.*: 279) argued that this model “is well placed to deal with the fact that decisions about the use of a mixed methods approach will be shaped by a socialization process involving the influence of peers.” These contributions would in fact legitimize the possibility of mixing qualitative and quantitative methods by addressing the “pragmatic” nature of conducting research or the “dialectical” relationship between the two strands. It seems that moving back and forth between the methods and attempting to accept the two discourses in the process of research would be helpful in investigating the unexplored or partially explored systems and phenomena.

Along similar lines, Greene (2008: 7) explores the value of mixed methods inquiry in the social sciences with regard to four methodological domains: “philosophy, methodology, practical guidelines, and sociopolitical commitments”. In her investigation, she identifies key design dimensions of mixed methods research and also addresses the neglected design dimensions like characteristics of methods, the nature

of mixing, and the relationship between research method, research purpose and research design. Greene (2008: 21) concludes that:

mixed methods approach in social inquiry has the potential to be a distinctive methodology within the honored traditions of social science [ . . . ] because a mixed methods approach embraces multiple paradigmatic traditions and has or will have distinctive methodological components and distinctive markers of practice.

In addition to studies that have dealt with conceptual aspects of mixing methods, several studies have been conducted to address methodological issues in mixing methods.

Bazeley (2004) and Yin (2006) discuss the fundamental importance of considering methodological issues in mixing qualitative and quantitative components at different stages of a mixed methods study. These include forming research questions, constructing mixed-method designs, determining sampling frames, and data collection and analysis. As for formulating mixed methods research questions, researchers advocate the use of “overarching” mixed questions, sequentially developed qualitative and quantitative questions, and converging qualitative and quantitative questions (see Creswell & Plano Clark 2007; Onwuegbuzie & Leech 2006; Tashakkori & Creswell 2007b). The typology for research designs, classifying the designs into major categories of a concurrent and sequential nature, has emerged from studies such as Creswell *et al.* (2008), Greene *et al.* (1989), and Nastasi *et al.* (2007). Mixed methods sampling designs in terms of time and orientation of the designs have been addressed by Collins *et al.* (2007) and Onwuegbuzie & Collins (2007). Data collection and analysis issues, ranging from the dominance of qualitative or quantitative methods to modern data analytic techniques, have been raised in Caracelli & Greene (1993), Leeuw & Hox (2008), Lieberman (2005), Niglas *et al.* (2008), Wheeldon (2010), among others.

Exploring the new possibilities in mixing methods, Hall & Howard (2008) present an alternative mixed methods approach by integrating strengths of “typological and systemic” approaches in a coherent construct. Through using mixed methods in a “randomized controlled trial,” they discuss the practical application of their alternative approach by focusing on a number of core principles such as “synergy, equal value, the ideology of difference, and the relationship of the researcher(s) with the study design” (*ibid.*: 267).

Addressing the validity of mixed methods research, Dellinger & Leech (2007) examine different views on validity and introduce a unified validity framework for mixed methods research. In doing so, they also identify several new components and elements in defining their validity framework. They conceptualize validity as a “continuous process of negotiation of meaning” (*ibid.*: 320).

Generally, mixed methods research can be considered as a new and self-sufficient approach. This approach makes use of its own philosophy, advocates using unique mixed research questions, involves independent mixed data collection and analysis methods, and draws on consolidation of the data for developing meta-inferences and interpretations based on qualitative and quantitative inferences (see

Caracelli & Greene 2003; Niglas *et al.* 2008; Onwuegbuzie & Leech 2006; Tashakkori & Teddlie 2008).

### 3. The study

#### 3.1. Data gathering procedure

Based on the research purpose, the data sources for this study constitute a purposive sample (see Benson *et al.* 2009; Bryman 2008; Jung 2004; Lazaraton 2002, 2005; Teddlie & Yu 2007) of articles published in the peer-reviewed journal *English for Specific Purposes*. The data consist of a corpus of articles published in a period of 14 years between 1995 and 2008. First, the electronic versions (Adobe Reader version 7) of all of the articles published from 1995 to 2008 were scanned quickly by the researchers. The abstract and methodology sections of the articles were closely examined, focusing on whether the design in each study involved mixing at the stages of sampling, data collection and/or data analysis. Also, the search function of Adobe Reader was used to search for key words or phrases such as *mixed methods*, *multi-method*, *qualitative*, *quantitative*, *triangulation*, *integrating methods*, *combining methods*. The searches would ease the process of double-checking the content to find reports on combining or integrating methods (see Bryman 2008). Following Bryman (2008), the articles were examined and selected mainly based on their data collection and data analysis procedures.

In the first phase, more than 410 data files each including articles, editorials, book reviews, and table of contents, published between 1995 and 2008, were examined. Editorials, book reviews, and non-empirical texts were excluded from the sources and a closer examination of the methodology sections of the empirical papers created a total of 44 articles that seemed to have used both qualitative and quantitative components.

#### 3.2. Content analysis

All the 44 articles were closely content analysed. The content analysis was done qualitatively, seeking to present a “rich description” (Erickson 1986) of the content of the articles, particularly those parts that involved description of how mixing or combining took place in the process of data collection and analysis. In doing so, rigorous examination of the content was carried out through an iterative process (for some articles the methodology section was read, examined, and re-examined more than three times) until “redundancy” (Lincoln & Guba 1985) had been achieved. In analysing the content, particular attention was given to the design of the study, type of sampling, and processes of data collection and analysis. Also, reports on arguments of validity and concluding interpretations were considered and notes were made on whether the researcher(s) would make any argument that could be indicative of using meta-inferences to ensure “inference quality” (Tashakkori & Teddlie 2008) based on results from integrating methods.

In fact, the analysis began with “a broad consideration of theoretical issues” (Davis 1995) related to the research questions, using classifications and categories

from previous research. At the same time, descriptive notes about different stages of combining were kept for the sake of presenting relevant examples.

Similar to Alise & Teddlie (2010: 111), analysis procedures used in the present study were based on both “manifest content (concrete terms used in the code sheet) and latent content (underlying nature of the methods determined by the coder’s interpretation of the information contained in the article.” Thus the analysis involved completing code sheets as well as making descriptive notes of the contents of the articles.

For analysing the design of the articles, the researchers used the methodological framework presented by Creswell, Plano Clark & Garrett (2008). Based on extensive literature reviews and analysis of the methods sections, Creswell *et al.* (2008: 67-68) classified the designs as either “concurrent” (designs that would make use of qualitative and quantitative research concurrently) or “sequential” (designs that can be conducted sequentially). Each of the two major designs was then classified into more specific designs. According to Creswell *et al.* (*ibid.*: 67-70) these include: (a) [*Concurrent*] *Triangulation Design* (QUAN and QUAL data are collected and analysed concurrently and inferences are drawn based on QUAN QUAL results); (b) *Concurrent Embedded Design* (QUAL data are collected between pre-tests and post-tests in an experiment, and inferences are made based on QUAN QUAL data); (c) [*Sequential*] *Explanatory Design* (first QUAN data are collected and analysed; then QUAL data are collected and analysed; finally, inferences are based on QUAN QUAL data); (d) [*Sequential*] *Exploratory Design* (first QUAL data are collected and analysed; then QUAN data are collected and analysed; finally, inferences are drawn based on QUAL QUAN data); (e) *Sequential Embedded Design* (this “typically involves collecting qualitative data before an intervention begins or after it is complete” (*ibid.*: 69); inferences are then developed based on QUAL QUAN data).

As for analysis of sampling, Collins, Onwuegbuzie & Jiao’s (2007) two-dimensional model of mixed methods sampling designs was used. According to Collins *et al.* (2007: 276), “this model provides a typology in which mixed methods sampling designs can be categorized according to (a) the time orientation of the components and (b) the relationship of the qualitative and quantitative samples.” Collins *et al.* (2007) categorized sampling designs with regard to the relationship of qualitative and quantitative samples as *identical*: “exactly the same sample members participate in both the qualitative and quantitative phases of the study” (*ibid.*: 276); *parallel*: “samples for the qualitative and quantitative components of the investigation are different but are drawn from the same underlying population” (*ibid.*: 277); *nested*: “the sample members selected for one component of the inquiry represent a subset of those participants chosen for the other phase of the study” (*ibid.*); *multi-level*: “involves the use of two or more sets of samples that are obtained from different levels of the investigation (i.e. different populations)” (*ibid.*).

Furthermore, to take into account how “inference quality” was realized in the discussion and conclusion sections of the articles, the researchers examined these sections based on Tashakkori & Teddlie’s (2008: 112) “integrative model of inference quality in mixed methods research.” Their model (*ibid.*: 112-116) involves two broad categories: *design quality*, including “design suitability”, “design adequacy”, “within

design consistency”, “analytic adequacy” (*ibid.*); and *integrative rigour*, including “interpretive consistency”, “theoretical consistency”, “interpretive agreement”, “interpretive distinctiveness”, “integrative efficacy” (*ibid.*). Although Tashakkori & Teddlie (2008) attempted to present some definitions for these elements, they did not present an operational definition for each. Therefore, in the present study, the analysis is based on only one of the above components (i.e. integrative efficacy) to examine “the degree to which inferences made in each strand of mixed methods study are effectively integrated into a theoretically consistent meta-inference” (*ibid.*: 115).

The reasons why the above-mentioned frameworks were utilized for content analysis are: (a) there are hardly any other recently developed comprehensive frameworks, (b) in designing these frameworks the elements and components of the research designs and sampling schemes that had already been developed were taken into account, (c) the frameworks above are based on empirical research and extensive literature, (d) the components of the frameworks used for content analysis are defined clearly (as they emerged from research on mixed methods studies) and thus could be easily operationalized for the purpose of the present study.

At this stage, careful analysis of the content revealed that 13 of the 44 articles had not actually combined qualitative and quantitative methods, that is, no patterns of mixing qualitative and quantitative methods (i.e. equal status, qual-dominant, quan-dominant – see Hanson *et al.* 2005; Alise & Teddlie 2010) were found in the design of the articles. Rather, one approach influenced the study as a core methodology and the components of the other approach (i.e. numbers, statistics, words, verbal description) were only used as a part of the main method. Thus the final analysis showed that 31 articles attempted to integrate or combine qualitative and quantitative methods at different stages of data collection and/or data analysis. It should be further noted that, as mentioned earlier, by integration of methods we mean “the combination of at least one qualitative and at least one quantitative component in a single research project or program” (Bergman 2008: 1).

To ensure inter-coder reliability, another coder examined one third of the articles. As a statistical measure of inter-rater agreement for categorical data, Cohen’s Kappa was calculated for research designs and sampling designs. The Kappa coefficients for the two sets of ratings were .69 and .61 respectively, which can be considered as satisfactory (see Altman 1991). In cases of disagreement between the two coders, both re-analysed the designs and reached a consensus in a session of joint analysis.

## 4. Findings

### 4.1. *Mixed methods research designs*

Content analysis of the relevant sections showed that 61.3% of the studies used a concurrent design and 38.7% of them used a sequential design (see Table 1). As shown in Table 1, among the studies with concurrent designs no study utilized a concurrent embedded design. All studies in this category used triangulation (61.3%). This is probably because triangulation is a highly recommended method in ESP re-

search (see Jasso-Aguilar 2005; Long 2005). Triangulation in this sense is not just using different sources and/or different methods. What makes triangulation different in mixed methods research is that, when integrating methods, triangulating by methods and by sources (Long 2005) would require at least one qualitative and one quantitative component.

Design				
Concurrent		Sequential		
I	II	III	IV	V
Triangulation	Concurrent Embedded	Explanatory	Exploratory	Sequential Embedded
61.3	0	32.3	3.2	3.2
%	%	%	%	%

Table 1. Mixed methods designs used in ESP articles

Long (2005) suggested that it would be helpful for ESP researchers to use these two main types of triangulation. However, he did not draw any distinction between triangulation within a particular method – qualitative or quantitative – and triangulation across methods – qualitative plus quantitative – (see Denzin 1978; Jick 1979). All the studies examined here used a triangulation of the latter type (the numbers in square brackets correspond to those used for numbering the data sources):

[1] p. 46: Findings – A Quantitative Perspective

Table 1 below indicates a quantitative overview of data for textual revisions in the seven sets from the FIRST available draft in English to the FINAL published paper.

p. 49: Findings – A Qualitative Perspective

Illustrative comments on the different categories of textual revisions are made from the viewpoint of the supposed or evident rationales for changes from the base FIRST draft in English when compared to the FINAL published version.

[4] p. 199: The program was based on data collected from detailed interviews with graduate supervisors, and a survey of graduate students, as well as an analysis of extended pieces of graduate writing.

[13] p. 207: The study employs both qualitative and quantitative approaches, comprising frequency counts and text analysis of a corpus of published articles and a series of interviews with academics from the relevant discourse communities.

[22] p. 183: Speech rate, redundancies, interpersonal and disciplinary features and references to local culture were compared using both quantitative and qualitative methods.

As is shown in the extracts above, triangulation in mixed methods research is different from triangulation in its broad sense, in that the former must involve at least one qualitative and one quantitative component (see the underlined parts in

the examples). However, in the latter type, triangulation may involve use of multiple strategies within one component.

More interestingly, probably because mixed methods designs are not yet widely used in ESP research, in a good number of articles mixing did not take place consistently at different stages and levels. In some studies, the researchers only used mixing at the analysis stage. In such cases, a third type of triangulation emerged in the process of data analysis. As this type shares similar features with the definition of triangulation presented by Webb *et al.* (1966: 3: use of multiple measurement methods for the purpose of reducing uncertainty about the object of measurement), we may call this type *triangulation by methods of analysis* or simply *triangulation by analyses*. Several researchers asserted that they used both qualitative and quantitative methods of analysis so that one would complement the other. This type of triangulation was very common when a particular corpus was to be investigated both qualitatively and quantitatively:

- [5] p. 241: Two types of analysis were performed: first, a quantitative analysis examined features such as linearity, symmetry, data integration, advance organizers and sentence types; second a qualitative analysis examined the content of the sections of the letters.
- [6] p. 374: Data analysis for the survey involved both quantitative and qualitative procedures [...].
- [17] p. 181: At the macro-textual level the analysis focused on rhetorical structure, mainly drawing on the notion of move. At the micro textual level the analysis concentrated on the pragmatic use of mood, modality, reference system and metadiscourse.
- [28] p. 52: We have carried out a quantitative and qualitative analysis of actual corpus-based data [...].

As for sequential designs, 38.7% of the articles used qualitative and quantitative research sequentially. In this category, most of the articles (32.3%) used an explanatory sequential design. This design utilizes a quantitative component in the first phase. Then following up the quantitative component, qualitative methods will be used to provide further examination of the case or sample. This would allow the researchers to further examine outliers, extreme cases, and/or the units and sub-samples that show inconsistent behaviour. Focusing on time sequences, the research reports in these articles often make it clear that the study was carried out at different stages. In the following extracts, use of time sequences or making mention of the stages and phases imply that the research was conducted sequentially:

- [3] p. 41: The main method for analyzing the field of present English business communication was a questionnaire survey, which was conducted in the spring and summer of 1992. The quantitative results of the survey were complemented by qualitative data received from research interviews carried out in the spring of 1993.
- [8] p. 34: Staff questionnaires were distributed via campus mail on February 1 1997. Distribution of the international student questionnaires was conducted from February 1 through April 30 1997 [...] Follow-up interviews were attempted with students who responded [...] The final procedure for data collection was through onsite observations.

The other two sub-categories of sequential designs (i.e. exploratory and sequential embedded) were used in a few studies (3.2% each). In fact, one study used a sequential exploratory design. The first phase of this study was qualitative, and the second phase utilized a quantitative methodology:

[20] p. 327: Thus, this paper will first report on the descriptive study (Section 2) and then the experimental study (Section 3).

p. 327: The descriptive study

To understand the discourse of lectures that enhances participation, it was necessary to develop a corpus of lectures. Thus, all the members of the department under study were given questionnaires to become familiar with their attitudes, practices, and willingness to allow their lectures for EFL students taking the degree course in English Studies to be recorded and transcribed.

p. 327: The experimental study

After having recorded, transcribed, analyzed and compared the three interactive lectures (Int A, Int B and Int C) with the three non-interactive lectures (N1, N2, N3), the next step was to determine if the findings could help to transform non-interactive into interactive lecture discourse. To carry out this second objective, the three lecturers using the non-interactive mode agreed to attempt a more interactive style with another group in the second semester of the same academic year.

In the above article (data source [20]), the two phases were carried out sequentially and were reported in two different sections. Following the qualitative descriptive phase of the study, the quantitative experimental methodology complemented the findings and provided more accurate accounts of the phenomenon under study. Also, within the descriptive approach, triangulation by sources was used. Generally, it seems that in exploratory designs new problems may emerge from the qualitative phase. That is, in such designs, quantitative research questions may emerge from the qualitative phase (see Tashakkori & Creswell 2007b). These problems could be investigated more systematically in the quantitative phase.

Finally, one study in this category used a sequential embedded design. Embedded designs allow researchers to quantitatively study cross-sections of the qualitative process in more depth. In data source [21] a qualitative needs analysis was used to collect data from teachers and students for developing a reading improvement program. The intervention was an experimental study conducted to trial the sample materials. After the intervention, qualitative comments were collected from students and teachers to improve the quality of the materials. In this type of design, there seemed to be a close interaction between the qualitative and quantitative components:

[21] p. 442: The experiment left positive impressions among the students, teachers and administration. Students found the project teachers 'very competent', and demonstrated a positive change in their attitudes towards English and reading [...] In a postprogramme interview, a female student said 'the new programme helped me'.

#### 4.2. Mixed methods sampling designs

The analysis of the sampling designs revealed that use of concurrent and sequential sampling designs directly corresponded to the type of mixed methods designs in the research articles. Table 2 shows that in 61.2% of the sources a concurrent sampling design was utilized, whereas 38.7% of the sampling designs were of a sequential nature.

Sampling							
Concurrent				Sequential			
Identical	Parallel	Nested	Multi-level	Identical	Parallel	Nested	Multi-level
45.1	0	0	16.1	16.1	3.2	9.7	9.7
%	%	%	%	%	%	%	%

**Table 2.** Mixed methods sampling designs used in ESP articles

In the concurrent sampling category, however, the studies did not utilize a variety of sampling procedures. Here identical sampling was more often used by the researchers (45.1%). This means that 45.1% of the articles used the same sample from the same population frame for both qualitative and quantitative components of the study. Moreover, most of the studies that involved corpus analysis used identical sampling, utilizing both qualitative and quantitative methods of analysis with the same corpus.

Although the sampling procedures were described in most of the studies, recognizing the sampling design was a complicated task:

[14] p. 463: Another main motive was simple curiosity concerning the suitability of an electronic speech corpus for exploring the data in both quantitative and qualitative ways, converging the angles on a single item.

It can be inferred that the above study (data source [14]) made use of an identical sampling design purposefully. This is probably a validity concern as the researcher intends to view the same frame from different angles. Here qualitative and quantitative components are used to ensure complementary validity for the study.

As can be seen in Table 2, two concurrent sampling designs, i.e. parallel and nested, were absent in the studies. Thus it appears that ESP researchers are quite comfortable with already-existing designs and they have not felt the need to resort to other available but less commonly-used designs.

Another type of sampling design in the concurrent category is multi-level sampling. This type of sampling was observed in 16.1% of the articles. The reason might lie in the fact that ESP researchers tend to use triangulation frequently in their designs. In concurrent multi-level sampling, researchers use two or more samples for

qualitative and quantitative components of the study. The following examples can illustrate this tendency:

- [2] p. 250: The data for this research project were collected through interviews with the professors who require term papers for their courses, a questionnaire administered to the students who took these courses, structured interviews with a sample of these students, and analysis of a sample of the term papers they wrote in Arabic and English.
- [6] p. 372: The sampling procedure involved three levels of selection: academic departments, individual graduate students, and paired advisors and advisees.
- [22] p. 186: As a comparative case study, it was important to provide a detailed account of the two lecture events. Taking inspiration from ethnographic research methodology, various types of data were collected from a range of different sources.

As the other major design, sequential sampling constituted 38.7% of the total. In this category sequential identical design was more frequently (16.1%) used than other designs.

- [10] p. 311: Forty subjects (Ss) from various social and learning backgrounds out of approximately 400 students doing biology were randomly sampled.
- [25] p. 307: The corpus used in this contrastive analysis is composed of 32 research articles (RAs) listed in the Appendix A.
- p. 312: The material is analysed in three stages. In the first stage, all the complete texts are read and analysed; the purpose of the first stage is to identify instances of previews and reviews within the texts. The second stage involves examining the referential characteristics of the elements identified as previews and reviews according to the criteria described below and the processing of quantitative data for the individual texts. The third stage of analysis includes a parallel comparison of the quantitative results.
- [30] p. 368: The author conducted a multi-level discourse analysis on a corpus of 30 medical/dental school application letters, using both a hand-tagged move analysis and a computerized analysis of lexical features of texts.

Only 3.2% of the articles (i.e. one study) made use of sequential parallel designs. The parallel sample in this study (data source [20]) is realized differently from that defined in Collins *et al.* (2007) according to whom a parallel sampling design involves two similar samples from the same population. In this case, however, the samples are similar but not from the same population. In actual fact, the researcher intended to analyse similar pieces of discourse (three lectures) presenting different degrees of interactivity. For this purpose, the initial sample is somehow modified and lecturers are advised to incorporate interactivity to a greater extent in their lectures.

Nested sampling in sequential designs comprised 9.7% of the designs. In this type of sampling, after quantitative treatment of the sample, a sub-sample is examined qualitatively. This produces a more rigorous and comprehensive analysis of a particular part of the whole, generating complementary information:

- [3] p. 41: The quantitative results of the survey were complemented by qualitative data received from research interviews carried out in the spring of 1993.
- p. 49: Ten out of 395 respondents were interviewed in March-June 1993.

There emerged one interesting case in this category. In one of the articles (data source [16]), the sampling design was not defined a priori. Rather, when the researcher felt the need to examine a more limited sample qualitatively, she used a nested sample. This actually reflects the pragmatic (i.e. practice-oriented) nature of mixed methods research:

[16] p. 50: I immediately realized that the application of Wordsmith Tools to Corpus A would not help me with these two variables. A thorough qualitative analysis was needed, which required a careful reading of a more limited corpus. For this purpose, Corpus C, with a total of 40, 986 words, was created.

Similarly, 9.7% of the studies utilized sequential multi-level sampling. As can be understood from the following extract, a multi-level design involves two or more different samples:

[11] p. 359: Two independent but complementary questionnaires were conducted; one which targeted 300 Poly U graduates and the other, 60 KTTI graduates. While the two questionnaires differed in design, focus and length, they contained questions relating to six identical topic areas.

#### 4.3. Inferences based on mixing

Tashakkori & Teddlie (2008: 101) introduced the term “inference quality” to present a framework “for evaluating the quality of conclusions that are made on the basis of findings” from both quantitative and qualitative phases of the study. They actually asserted that the uniqueness of the mixed methods approach would mainly depend on the uniqueness of the “overall conclusion, explanation, or understanding developed through an integration of the inferences obtained from the qualitative and quantitative strands”, which they refer to as “meta-inferences” (*ibid.*). In the present study, the discussion and conclusion sections of the articles were examined to find traces of meta-inferences that would actually enhance the “integrative efficacy” of the research, leading to improvement of “inference quality” in the studies.

The analysis of the conclusion and discussion sections of the articles showed that separate sections on data integration and consolidation were not presented in the studies (for an excellent example of data consolidation see Jang *et al.* 2008), and in a number of cases meta-inferences were not developed based on qualitative and quantitative inferences. However, it is worth mentioning that although data consolidation and integration of qualitative and quantitative findings did not appear as an independent section in the articles, some authors did present overall conclusions that could be considered as general inferences:

[13] p. 224: The distribution of these features shows that not all disciplines sanction the same degree of authorial presence. Writers’ decisions are closely related to the social and epistemological practices of their disciplines [...].

[16] p. 62: The results showed that, though this is not the most frequent pronoun, it still has an important presence in spoken academic English.

- [17] p. 203: Our conclusion is that uniformity of expression in the business community is limited to the conventions imposed by the genre used.
- [31] p. 356: The findings of this 'broad sweep' analysis are rather paradoxical. On one level the meetings appear 'normal' and 'orderly'. They also appear effective in the sense that items on the agendas are covered and to time.

The above examples may indicate that general conclusions or inferences were used by several researchers who attempted to combine qualitative and quantitative methods in their studies. It does not appear that these researchers presented general inferences because they planned to base their conclusions on consolidation of qualitative and quantitative data or because they intended to develop general explanations from integrated results. Rather, these general inferences were offered by some of the researchers to enrich their discussions and conclusions or present informative summaries of the findings. It should be also noted that these general inferences are different from meta-inferences in that they are not necessarily developed based on data integration and are not a result of integrating inferences from the qualitative and quantitative strands (see Tashakkori & Teddlie 2008).

## 5. Concluding remarks

The aim of the present study was to examine the current status of mixed methods research in the field of ESP. The study was conducted with special attention to the research designs, sampling designs, and inference quality in the articles that comprised the data sources. As for generalizability of the findings, the results need to be interpreted with caution because the sample was limited to studies published in the journal *English for Specific Purposes*.

The analysis of the designs of the studies with a primary focus on data analysis and data collection procedures revealed that most of the designs used in ESP research corresponded to those that had previously emerged in the social and human sciences (Creswell *et al.* 2008). Interestingly, among the designs introduced by research in the social and human sciences one was not present in ESP research, i.e. concurrent embedded design. On the contrary, the most frequently used design was triangulation in the concurrent category (61.3%). Furthermore, this small-scale study showed that novel mixed methods designs were scarce in ESP research. Also, as most of the studies did not make any mention of the names of the designs, it appears that mixed methods designs have not been introduced appropriately into ESP research. In fact, ESP researchers adopted a practice-oriented approach toward mixing qualitative and quantitative methods. Moreover, depending on the research purpose, the researchers defined qualitative and quantitative designs separately. These independent components with separate designs were then used to complement each other.

As for sampling, the designs directly corresponded to the research designs. Again no mention of a particular sampling design (i.e. identical, parallel, nested, multi-level; see Collins *et al.* 2007) was made by the researchers. However, the

findings revealed that some of these designs (except for concurrent parallel and concurrent nested designs) were used in several studies that attempted to integrate qualitative and quantitative methods. Similarly, none of the studies directly acknowledged that it had used a mixed methods sampling design for a particular purpose.

Another issue worthy of attention is that most of the studies that used at least one qualitative component and one quantitative component did not go through a data consolidation process to integrate qualitative and quantitative data. More importantly, the studies did not present a clear discussion on mixing the findings from these two strands. Although some studies offered general conclusions and summaries based on the findings from both strands, none of the articles presented meta-inferences by addressing the concept of “inference quality” in mixed methods research.

The results revealed that ESP research has great potential for making use of mixed methods. More particularly, in a number of studies examined in this paper the researchers used mixed methods to analyse the data at both macro- and micro-levels. In this regard, quantitative analysis of a corpus, for example, would provide the researcher with a general sense of the text through use of descriptive statistics; and qualitative corpus analysis, on the other hand, would help the researcher to scrutinize different textual features and discover the emerging patterns or text qualities. Using both qualitative and quantitative methods in corpus analysis would provide the researcher with a more complete picture of the characteristics of the text. Therefore, mixed methods could be a useful tool for discourse and genre analysis in ESP. Also, mixed methods research would make effective contributions to ESP curriculum design and evaluation by exploring both the processes and the outcomes. Making informed use of concurrent or sequential designs with nested or multi-level samples would enrich the data for needs assessment and analysis. It is also helpful to utilize both qualitative and quantitative methods for ESP material evaluation, ESP course design, and ESP curriculum evaluation. To this purpose, the processes and outcomes can be evaluated effectively using qualitative and quantitative methods in concurrent and sequential designs.

To sum up, a deeper and more comprehensive understanding of mixing qualitative and quantitative components at different stages of the study needs to be developed (e.g. forming the research questions, data collection, data analysis, data consolidation, developing meta-inferences). To this purpose, it would be helpful for ESP researchers to examine and experiment various types of mixed methods designs currently used in the social and human sciences. Furthermore, it would be possible for ESP researchers to experiment novel designs based on their specific research purpose(s) and the requirements of the research context. Finally, it should be noted that developing informed opinions about mixed methods research in ESP and also making creative use of different mixed methods designs would lead to the improvement of the quality of research in the field of ESP.

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