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Review article

Resources on quantitative/statistical research for applied linguists

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The purpose of this review article is to survey and evaluate existing books on quantitative/statistical research in applied linguistics. The article begins by explaining the types of texts that will not be reviewed, then it briefly describes nine books that address how to do quantitative/statistical applied linguistics research. The review then compares (in prose and tables) the general characteristics of these nine books, and their coverage of conceptual and statistical topics. Examining all nine books together provides answers to three questions: What is the range of conceptual/statistical topics in applied linguistics? What are the most important conceptual/statistical topics in applied linguistics? And, how has the coverage of topics changed over the years? This review article should help readers sort through current books on how to do quantitative/statistical research so that they can locate one or more texts that will best meet their needs.

I Introduction

Since joining the language teaching profession in the 1970s, one of the issues that I have consistently worried about is the poor quality of much of the quantitative/statistical research that I read in the journals of our field. The situation was so bad during the 1980s that two of my colleagues set about to put together a collection of exemplary quantitative/statistical studies from the various sources in applied linguistics, and they abandoned the project

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because they were unable to find enough good quality studies to even come close to filling a volume. Indeed, I myself am not entirely innocent of producing poor quality research: when I look at my own first published research report (Brown, 1980), I shudder at the sheer statistical naivety and ignorance it displays (for a discussion of why I shudder, see Brown, 2002, or in press).

As a result of worrying about the quality of research in our field, one of my professional goals has always been to help improve that quality by teaching my graduate students to the best of my abilities and by mentoring their research insofar as possible. In that vein, the purpose of this article is to review all available books on the topic of doing quantitative/statistical research in applied linguistics with a view to helping teachers and researchers in the field who want to learn more about quantitative/statistical research to do so.

Because research means different things to different people (Brown, 1992a; 2004a), I begin by explaining that I will not be reviewing books on the following sorts of research:

- linguistic analysis in the classical sense, e.g., Wray *et al.*, 1998;
- discourse/conversational analysis, e.g., Johnstone, 1999; ten Have, 1999; Titscher *et al.*, 2000; Wood, 2000; Wodak and Meyer, 2001;
- classroom/action research, e.g., Allwright and Bailey, 1991; Freeman, 1998; Wallace, 1998; Burns, 1999; or
- qualitative research, e.g., Johnstone, 2000; Richards, 2003.

Nor will I review books that are:

- introductory overviews of the different types of research done in applied linguistics, e.g., Johnson, 1992; Nunan, 1992; McDonough and McDonough, 1998;
- overviews of classroom research, e.g., Chaudron, 1988;
- overviews of second language acquisition research, e.g., Larsen-Freeman and Long, 1991; or
- discussions of how to do research in specific areas, e.g., Færch and Kasper, 1987, on introspection; Kasper and Dahl, 1991, for pragmatics; Gass *et al.*, 1999, on L2 learning data; or Rost, 2001, for listening; Grabe and Stoller, 2002, for reading.

Nor will I be reviewing:

- edited collections of articles about research, e.g., Seliger and Long, 1983; Tarone *et al.*, 1994; Bailey and Nunan, 1997; Griffiee and Nunan, 1997; Hornberger and Corson, 1997;
- books focusing on language testing, e.g., Bachman, 1990; Brown, 1996, 2004b;
- books on quantifying data, e.g., Scholfield, 1995; or
- books designed to help language professionals understand the quantitative studies they read, e.g., Brown, 1988; Porte, 2002.

Although I am excluding these 12 categories of books from my review, the very categories I have sorted them into may provide some insight into the different strains of research-related books that have been published over the years.

What I will be reviewing are nine books that focus entirely, or in large part, on explaining how to do applied linguistics quantitative/statistical research. Several of these books – published between 1978 and 2002 – are now fairly old and/or are out of print. However, I include all of them here for four reasons:

- The field of applied linguistics quantitative/statistical research has not changed fundamentally over those 24 years.
- Most of these books are still around on the shelves of language teaching professionals or in the libraries available to them.
- Examining all of these books together will provide an overview of the sorts of quantitative research concepts and statistics that have been dealt with in our field; and
- Examining all of these books will allow me to develop some perspective on how our field's approaches to quantitative/statistical research have evolved over the years.

General books on quantitative/statistical research can easily be traced back to the nineteenth century in forms recognizable today (for excellent and readable overviews of the history of this sort of research, see Stigler, 1999; Salzburg, 2002). Books written on introductory statistics for education and psychology (and many other fields) appeared throughout the twentieth century and into the present century. Such introductory books alone must number in the hundreds, if not thousands, not to mention books that focus

on specific types of statistics (measurement, regression, analysis of variance, factor analysis, etc.). Fortunately for the purposes of this article, books in English on doing language quantitative/statistical research began to appear relatively recently (1978) and are only nine in number. Chronologically, the nine books reviewed here are: Anshen (1978); Hatch and Farhady (1982); Butler (1985); Woods, Fletcher, and Hughes (1986); Seliger and Shohamy (1989); Hatch and Lazaraton (1991); Rietveld and van Hout (1993); Brown (2001); as well as Brown and Rodgers (2002).

II Comparing the nine books

I begin reviewing the nine books by comparing them in terms of their general characteristics, conceptual topics, and statistical topics.

1 Comparing general characteristics

Table 1 shows a comparison of the nine books in terms of the general characteristics wherein they differ. Since all of the books have Tables of Contents and References, that is not shown in the table; nor does the table show the fact that none of the books reviewed here provides a useful comparison of the various computer statistical packages that are available to applied linguists. However, the table does show that eight out of the nine books have Indexes, Application exercises and Statistical tables. Note that the number of statistical tables supplied in the various books differs considerably from three to 10; note also that only five of the eight books that supply applications exercises also supply an answer key for those exercises. Rarer qualities include the following: only four of the books offer chapter summaries, three have suggestions for further reading, two each have glossaries of terminology, lists of statistical formulas, or lists of journals, and only one offers a glossary of symbols. Note also that two of the books are clearly aimed at linguists (though they could prove useful to applied linguists as well), while seven are directed at applied linguists. The last characteristic shown in Table 1 requires a little more explanation. The distinction between conceptual and short-cut formulas is that conceptual formulas are ones that clearly show in

Table 1 Summary of general characteristics

Book characteristics	Anshen, 1978	Hatch and Farhady, 1982	Butler, 1985	Woods et al., 1986	Seliger and Shohamy, 1989	Hatch and Lazaraton, 1991	Rietveld and van Hout, 1993	Brown, 2001	Brown and Rodgers, 2002
Chapter summaries	✓							✓	✓
Application exercises			✓	✓	✓	✓	✓	✓	✓
Answer key			✓	✓		✓	✓		✓
Statistical tables	3	5	10	10		10	3	3	3
Suggested further readings		✓			✓		✓	✓	
Glossary of terminology							✓		✓
Glossary of symbols									
List of statistical formulas						✓			
List of journals					✓	✓			
Index			✓	✓	✓	✓	✓	✓	✓
Linguistic (L) or applied linguistics (AL) focus?	L	AL	L	AL	AL	AL	AL	AL	AL
Mostly conceptual (C) or mostly short-cut (SC) formulas?	C	C	C	C	–	SC	C	C	C

themselves how the statistic works in terms of the steps involved in calculating it, whereas short-cut formulas, while easier to calculate, obfuscate those operations. Clearly, seven of the books use conceptual formulas, while one uses short-cut formulas and one has no formulas at all.

I should add that all of these books could probably be used for self-study though those with the most examples and most application exercises (with answer keys) would probably best serve that purpose. Butler (1985), Woods *et al.* (1986), Hatch and Lazaraton (1991) and Brown and Rodgers (2002) would probably work best for self-study with the last two providing both the most examples and the most exercises. All in all, if some collection of these characteristics is particularly important to a reader, Table 1 should help that reader pick one book over the others.

2 *Comparing conceptual topics*

Table 2 compares the nine books in terms of the conceptual topics they cover. A total of 29 conceptual topics are listed here. Each of these topics is included in two or more of the books reviewed here. Adding the numerous topics dealt with in only one book (but not the others) would have made this table unwieldy to the point of being useless. Notice in Table 2 that four topics – Types of scales, Significance testing, Graphical display of data and Correlation – are included in eight out of the nine texts.¹ Also popular are topics like Hypotheses, One-tailed/two-tailed, Probability, Random sampling and Computer analysis, all of which are found in seven out of the nine books. And so forth, until we see that three topics are included in only three of the books: Qualitative vs. quantitative research, Importance of reviewing the literature and Parameters/statistics. The table makes it clear just how many of the topics are found in each of these quantitative/statistical research books, and which books include which topics.

Looking at Table 2 from the perspective of the numbers of conceptual topics found in each book, it is clear that Hatch and

¹The reason Reitveld and van Hout (1993) does not cover so many of the topics is that it is a more advanced text wherein knowledge of these basic topics is assumed.

Table 2 Summary of conceptual topics

Conceptual topics	Anshen, 1978	Hatch and Farhady, 1982	Butler, 1985	Woods et al., 1986	Seliger and Shohamy, 1989	Hatch and Lazaraton, 1991	Rietveld and van Hout, 1993	Brown, 2001	Brown and Rodgers, 2002	Number
Correlation	✓	✓	✓	✓	✓	✓		✓	✓	8
Graphical display of data	✓	✓	✓	✓	✓	✓		✓	✓	8
Types of scales	✓	✓	✓	✓	✓	✓	✓	✓	✓	8
Computer analysis	✓	✓	✓	✓	✓	✓		✓	✓	7
Hypotheses	✓	✓	✓	✓	✓	✓		✓	✓	7
One-tailed/two-tailed	✓	✓	✓	✓	✓	✓		✓	✓	7
Probability	✓	✓	✓	✓	✓	✓		✓	✓	7
Random sampling	✓	✓	✓	✓	✓	✓		✓	✓	7
Significance testing	✓	✓	✓	✓	✓	✓		✓	✓	7
Data collection/coding	✓	✓	✓	✓	✓	✓		✓	✓	6
Normal distribution		✓	✓	✓	✓	✓		✓	✓	6
Population		✓	✓	✓	✓	✓		✓	✓	6
Stratified sampling		✓	✓	✓	✓	✓		✓	✓	6
What is research?	✓	✓	✓	✓	✓	✓		✓	✓	6
Covariance		✓	✓	✓	✓	✓	✓	✓	✓	5
Internal/external validity		✓	✓	✓	✓	✓		✓	✓	5
Repeated measures		✓	✓	✓	✓	✓	✓	✓	✓	5
Reporting research		✓	✓	✓	✓	✓		✓	✓	5

Table 3 Summary of statistical topics

Type of statistic/statistic	Anshen, 1978	Hatch and Farhady, 1982	Butler, 1985	Woods et al., 1986	Seliger and Shohamy, 1989	Hatch and Lazaraton, 1991	Rietveld and van Hout, 1993	Brown, 2001	Brown and Rodgers, 2002	Number
<i>Descriptive</i>										
Frequencies	✓	✓	✓	✓	✓	✓		✓	✓	8
Mean	✓	✓	✓	✓	✓	✓		✓	✓	8
Median	✓	✓	✓	✓	✓	✓		✓	✓	8
Mode	✓	✓	✓	✓	✓	✓		✓	✓	8
Standard deviation	✓	✓	✓	✓	✓	✓		✓	✓	8
Range		✓	✓	✓	✓	✓		✓	✓	6
Variance	✓	✓	✓	✓	✓	✓	✓			6
Skewness		✓	✓	✓	✓	✓		✓		5
Standardized scores		✓	✓	✓	✓	✓	✓			5
Interquartile range/ quartile deviation		✓	✓	✓	✓	✓				3
<i>Correlational</i>										
Pearson <i>r</i>	✓	✓	✓	✓	✓	✓		✓	✓	8
Spearman rho	✓	✓	✓	✓	✓	✓	✓	✓	✓	7
Factor analysis/PCA		✓	✓	✓	✓	✓	✓	✓		6
Multiple regression		✓	✓	✓	✓	✓	✓			5
Simple regression		✓	✓	✓	✓	✓	✓			4
Correction for attenuation		✓				✓		✓		3
Phi coefficient			✓			✓			✓	3
Rotation				✓		✓	✓			3
Kendall <i>W</i>						✓	✓			2
Point-biserial		✓				✓				2
Regression/ANOVA relationship		✓				✓				2
<i>Group Comparisons</i>										
<i>t</i> -test	✓	✓	✓	✓	✓	✓		✓	✓	7
One-way ANOVA		✓	✓	✓	✓	✓	✓			6

Lazaraton (1991) and Hatch and Farhady (1982) have the greatest coverage of these conceptual topics with 26 and 25, respectively. Butler (1985), Brown (2001) and Brown and Rodgers (2002) each include 20, while Woods *et al.* (1986), Seliger and Shohamy (1989) and Anshen (1978) include 18, 15 and 11, respectively, and Rietveld and van Hout (1993) contains the fewest of these shared topics with only four.²

It is important to note that such a table may be somewhat misleading in that it does not represent the differences in the relative depth of treatment in the various books. For example, according to Table 2, the topic of What is research? is covered in six of the nine books, but they do so to varying degrees: Brown (2001) has two pages on the topic, while Hatch and Lazaraton (1991) offer five pages, Woods *et al.* (1986) provide seven pages, Hatch and Farhady have 11 pages, Brown and Rodgers (2002) offer 16 pages, and Seliger and Shohamy (1989) have 17 pages on this topic.

3 *Comparing statistical topics*

Table 3 compares the nine books in terms of the statistical topics they cover. A total of 45 statistical topics are listed in the table. Note again that these are all topics that are included in least two books. Many additional topics could have been added to this list, but they are only found in one book.

Some topics like Frequencies, Means, Medians, Modes, Standard deviations, Pearson r , Spearman rho, t -tests, as well as One-way and Multi-way chi-squared analysis are included in at least seven out of the nine texts. Fourteen of the topics are found in four, five or six books, and the rest are found in only two or three of the books. Table 3 indicates just how many statistical topics there are in each of these books, and which books include which topics. Clearly, Hatch and Lazaraton (1991) has the most statistical topics with a total of 44. Hatch and Farhady (1982), Woods *et al.* (1986), Butler (1985) and Rietveld and van Hout (1993) follow next with 29, 28, 25 and 20 topics, respectively. In

²Again, the fact that this book overlaps so little with the other books is probably due to its more advanced topics.

addition, Brown (2001), Seliger and Shohamy (1989), Anshen (1978) and Brown and Rodgers (2002) have the fewest statistical topics with 16, 15, 12 and 10, respectively.

Again, note that such a table may be somewhat misleading in that it cannot represent the differences in the relative depth of treatment from book to book. For instance, while six books are listed in Table 3 as discussing factor analysis/PCA, Seliger and Shohamy (1989), Brown (2001) and Woods *et al.* (1986) each devote 4–5 pages to that topic, Hatch and Farhady (1982) and Hatch and Lazaraton (1991) dedicate nine to 10 pages to it, and Rietveld and van Hout (1993) offer a whopping 44 page explanation.

III An overview of each of the books

In this section, I briefly review each of the books in chronological order with a view to pointing readers to each book's most salient features.

1 Anshen, 1978

Anshen (1978) is chronologically the first of the books reviewed here. As indicated in Tables 2 and 3, Anshen's *Statistics for linguists* deals with a small number of conceptual topics with 11 and statistical topics with 12. The book is divided into nine chapters providing chapter-length treatments of the following topics: why statistics are important for linguistics, creating numbers, averages, the significance of significance, correlations, picking the sample, the linguist and the machine, variable rules, and do it yourself. Notice that Anshen is the only book reviewed here to include variable rules and that, as indicated in the previous sentence, this book offers chapter-length coverage of that topic. The book contains very few examples drawn from the literature and those it does contain only appear as a direct part of the statistical explanations. While the explanations of the various topics are brief, they are simple and clear as far as they go. In short, readers who are in search of a linguistic focus with a few simple straightforward conceptual and statistical topics or who are interested in exploring the use of variable rules should be happy with this book.

2 *Hatch and Farhady, 1982*

Hatch and Farhady (1982), the second book chronologically, clearly broke new ground in that it was the first book aimed directly at applied linguistics researchers as indicated by its title *Research design and statistics for applied linguistics*, and moreover, it provides very broad coverage. As indicated in Tables 2 and 3, this book has good coverage with 25 conceptual topics and 29 statistical ones. This book is divided into 18 relatively short chapters that provide chapter-length treatments of the following topics: what is research, what is a variable, constructing research designs, research report format, sorting and displaying data, describing data, standardized scores, probability and hypothesis testing, distribution of means, comparing two means, one-way analysis of variance, factorial analysis of variance, chi-square, implicational scaling, correlational analysis, simple regression, reliability and validity, and factor analysis. Hatch and Farhady offer the only information on implicational scaling and they do so at chapter length. This book provides numerous examples drawn from the literature as part of the explanations of concepts and statistics, and as part of applications and computer examples. However, the computer examples are drawn from an out-of-date mainframe-computer era replete with 'job control cards' and 'data control cards'. The explanations of concepts and statistical procedures are clear and straightforward. Readers interested in an applied linguistics focus, good coverage of conceptual and statistical topics, as well as clear explanations should find this book appealing.

3 *Butler, 1985*

The Butler (1985) book is entitled *Statistics in linguistics*. As shown in Tables 2 and 3, this book contains a moderate number of conceptual topics with 20, and a relatively large number of statistical topics with a total of 25. It is divided into 12 chapters that provide chapter-length treatments of the following topics: fundamental statistical concepts, frequency distributions, measures of central tendency and variability, normal distribution, sample statistics and population parameters, project design and hypothesis

testing, parametric tests of significance, some useful non-parametric tests, chi-squared, the *F* distribution, correlation, as well as statistics and computers/calculators. Unfortunately, only a few examples are provided from the literature. Readers in search of a linguistic focus with reasonably good coverage of concepts and statistics, as well as straightforward explanations of those topics should be pleased with this text.

4 Woods et al., 1986

The Woods *et al.* (1986) book is entitled *Statistics in language studies*. This book includes a moderate number of conceptual topics with 18 and a relatively large number of statistical topics with a total of 28. This book contains 15 chapters offering chapter-length treatments of the following topics: why do linguists need statistics, tables and graphs, summary measures, statistical inference, probability, modelling statistical populations, estimating from samples, testing hypotheses about population values, testing the fit of models to data, measuring the degree of interdependence between two variables, testing for differences between two populations, analysis of variance, linear regression, searching for groups and clusters, and principal components/factor analyses. Woods *et al.* (1986) is the only book reviewed here that discusses cluster analysis, which it does at chapter length. The book draws some examples from the literature. Readers interested in an applied linguistics focus, good coverage of concepts and statistics and clear explanations of those topics should be content with this volume.

5 Seliger and Shohamy, 1989

Seliger and Shohamy (1989) is entitled *Second language research methods*. This book focuses largely on the issues involved in applied linguistics research design including both qualitative and quantitative types of research. Seliger and Shohamy (1989) offer a relatively small number of conceptual and statistical topics with 15 of each. The book's 10 chapters offer chapter-length treatments of the following topics: what is research, a paradigm for second language research, the preparatory stages, contextualization of

research, components of research, qualitative and descriptive research design, experimental research design, data collection procedures, analysing data, and putting it all together. Seliger and Shohamy (1989) is the only book to discuss discriminant function analysis, and it offers an unusually detailed (17 pages) on the topic of What is research? The book draws a fair number of examples from the literature. Readers interested in an applied linguistics focus and good coverage of the conceptual nuts and bolts of doing research including both qualitative and quantitative research (without much information about actually doing statistics) should be happy with this volume.

6 *Hatch and Lazaraton, 1991*

The Hatch and Lazaraton (1991) book is entitled *The research manual: design and statistics in applied linguistics*. Looking at Table 2 from the perspective of the numbers of conceptual topics in each book, it is clear that Hatch and Lazaraton (1991) is the leader with 26 conceptual topics and 44 statistical topics. Of the books reviewed here, this one is the longest and undoubtedly provides the best overall coverage of conceptual and statistical topics. This book is divided into 18 chapters on the following topics: defining the research question, describing variables, constructing research designs, writing research proposals and reports, coding and displaying frequency data, describing interval and ordinal values, locating scores and finding scales in a distribution, probability and hypothesis testing, comparing two groups (between groups), comparing two groups (repeated measures), comparisons among three or more groups, repeated measures comparisons of three or more groups, comparisons of means in factorial designs, relationships in nominal data, correlation, regression, other statistical tests used in applied linguistics, and assumptions of statistical tests. Hatch and Lazaraton (1991) is the only book to explain Cramer's V, Kendall tau, Tetrachoric correlation, path analysis, as well as the Kruskal–Wallis, Nemenyi's, Fisher's exact and McNemar's tests. This book also is the only book to provide (in appendix) a tree showing the relationships among all of the most prominent

types of analyses. This would prove particularly useful to anyone who has a research question or two and is trying to figure out what sorts of analyses to use (another resource that might prove useful for this purpose is Brown, 1992b). To its credit, this book offers an abundance of examples from the literature as part of both the explanations and application exercises. Readers interested in an applied linguistics focus, excellent coverage of both conceptual and statistical topics, and clear explanations with lots of examples drawn from the literature should be ecstatic about this volume, especially if they are also interested in self-study.

7 *Rietveld and van Hout, 1993*

The Rietveld and van Hout (1993) book entitled *Statistical techniques for the study of language and language behaviour* is more advanced than the other books reviewed here. It assumes that readers already have the sorts of knowledge provided by the other eight texts. This book includes the smallest number of shared conceptual topics (4)³ and a moderately high number of statistical topics (20). Rietveld and van Hout provides fairly extensive intermediate-level treatments of a number of other topics. The chapter headings are as follows: statistics and the study of language behaviour, analysis of variance, multiple regression, more ANOVA and MR (assumptions and alternatives), reliability and agreement among raters, introductory matrix algebra, factor analysis, analysis of frequencies, and logistic regression. Rietveld and van Hout (1993) is the only book to provide any explanation of matrix algebra, which it does at chapter-length. This book also offers the best explanation of factor analysis/PCA of any of the books reviewed here and is the only book to include linearizing transformations, bootstrapping, logistic regression and a number of other advanced topics. In the process, this book draws some examples from the literature. All in all, readers who have already read one of the other books reviewed here and are interested in moving to the next level may find this book worthwhile.

³Again, the fact that this book overlaps so little with the other books is probably due to its more advanced topics.

8 Brown, 2001

Brown (2001) has a somewhat more specialized focus in that it focuses on survey research as indicated by its title *Using surveys in language programs*. Brown (2001) contains a moderate number of conceptual topics with 20 and a relatively small number of statistical topics with a total of 16. This book offers complete chapters on the following six topics: planning a survey project, designing a survey instrument, gathering and compiling survey data, analysing survey data quantitatively, analysing survey data qualitatively and reporting on a survey project. This is the only book to discuss multi-trait–multimethod analysis. In addition, this book offers a fairly large number of examples: one overall example that appears in all the chapters and other different examples that appear in and illustrate the specific concepts in the various chapters. However, all of the explanations of statistics appear in one very long, and perhaps too-dense, chapter. Readers interested in doing quantitative and/or qualitative survey research in applied linguistics should be happy with this book⁴ although they might find it necessary to supplement the information about statistical concepts with another book.

9 Brown and Rodgers, 2002

The Brown and Rodgers (2002) book is entitled *Doing second language research*. This book includes a moderate number of conceptual topics with 20 and the fewest statistical topics of all the books with only 10. The topics discussed at chapter-length in its eight chapters are as follows: the nature of research, then the qualitative topics of case study research, introspective research and classroom research, as well as the quantitative topics of descriptive statistics research, correlational research and quasi-experimental research, along with a summary chapter that brings all the types of research together under the umbrella of course evaluation. This book draws extensively on examples from the literature and has the most exercises of all the books reviewed here; in fact, it is structured around the exercises. Readers interested in both qualitative

⁴Note that Dömyei (2003) also covers issues of survey questionnaire design and data handling, but is not reviewed here because it stops short of discussing statistical data analysis.

and quantitative forms of analysis framed in a variety of different research traditions with numerous exercises and many examples drawn from the literature should be pleased with this book, especially if they are also interested in self-study.

IV What can we learn from examining all of these books together?

There are at least three questions that can be answered using the information contained in this review article: What is the range of conceptual/statistical topics in applied linguistics? What are the most important conceptual/statistical topics in applied linguistics? And, how has the coverage of topics changed over the years?

1 What is the range of conceptual/statistical topics in applied linguistics?

If the books reviewed here are any indication, the range of topics in quantitative/statistical analyses in the field of applied linguistics is wide indeed. A total of 29 conceptual topics and 45 statistical topics were included in at least two books, for a total of 74 topics; at least one and a half times that number of topics appeared in only one of the books. My guess is that over 100 topics could easily be included in a single comprehensive book, which indicates three things:

- Quantitative/statistical research has become complex and relatively sophisticated (at least compared to when I started out in the 1970s);
- Given the length of the book that involves the most topics (Hatch and Lazaraton, 1991), a truly comprehensive book on quantitative/statistical research for applied linguists would be enormously long; and
- Readers may find it necessary to use more than one of these books to obtain fully comprehensive coverage.

2 What are the most important conceptual/statistical topics in applied linguistics?

Another way to look at the information provided in this review article is to consider which of the conceptual and statistical topics

are the most important. For instance, the first 20 conceptual topics listed in Table 2 are included in more than half (five or more) of the nine books. That is a fair vote of confidence from these authors that these are the 20 most important conceptual topics. That in turn implies that these 20 topics are perhaps the essential conceptual topics for quantitative/statistical researchers in applied linguistics, or at very least are the conceptual topics that should be learned first.

In terms of statistical topics, a majority of the authors appear to agree that all of the descriptive statistics (except the interquartile range/quartile deviation) are important to include. For the correlational category of statistics, Pearson r , Spearman rho, factor analysis/PCA, and multiple regression appear to head the list for a majority of the authors, while t -test, one-way ANOVA and factorial ANOVA do so in the group comparisons category. In addition, one-way and multi-way chi-squared analyses head the list in the non-parametric category, and reliability does so in the other statistical procedures category. I should add that I think that the 20 topics that authors have chosen most often to address in these books are probably among the most important ones. However, the topics that individual researchers may need for their own research can differ quite widely. The information provided in Tables 1 to 3 should help readers find one book or some combination of books that will best meet their individual needs.

3 How has the coverage of topics changed over the years?

With the exception of Seliger and Shohamy (1989), the books published between 1978 and 1991 use similar, fairly traditional approaches in a general trend toward providing ever-increasing amounts of coverage in terms of both conceptual and statistical concepts. Even Seliger and Shohamy (1989), though it does not provide much guidance on the statistical topics, can be said to provide increased depth on conceptual topics and an increase in breadth in the information provided on other types of research as well. Of these books, Hatch and Lazaraton (1991) may be the watershed book in the sense that its coverage was so broad and ambitious that other authors, myself included, chose not to

compete head-to-head with it, but rather to use different and more specific approaches to the issues involved, including more advanced statistical topics (Rietveld and van Hout, 1993), quantitative and qualitative survey research (Brown, 2001) and a very hands-on exercise-driven approach to both quantitative and qualitative research types (Brown and Rodgers, 2002). I do not know for certain what will come next in this ever-developing area of applied linguistics quantitative/statistical research methodology, but I have some ideas, and I am sure other authors do as well. In the meantime, I hope this review article will help readers to sort through the existing nine books on doing quantitative/statistical research and to find one or more that will be maximally useful to them.

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