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ABSTRACT

A study investigated the statistical techniques used by applied linguists and reported in three journals, "Language Learning," "Applied Linguistics," and "TESOL Quarterly," between 1980 and 1986. It was found that 47% of the published articles used statistical procedures. In these articles, 63% of the techniques used could be called basic, 28% intermediate, and 9% advanced. Descriptive statistics accounted for 32% of the total range of techniques while analysis of variance techniques accounted for a further 16%. There was a ratio of about three different techniques per quantitative study. The study also examined how the researchers present their results and what implications this has for readers of quantitative studies. Based on the survey, recommendations are made concerning what should be included in introductory statistics courses in order to meet the needs of students of applied linguistics. (Author/MSE)

STATISTICAL TECHNIQUES USED IN THREE APPLIED LINGUISTICS JOURNALS; LANGUAGE LEARNING, APPLIED LINGUISTICS AND TESOL QUARTERLY 1980-1986: IMPLICATIONS FOR READERS AND RESEARCHERS

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Running Head: Statistical Techniques

ABSTRACT

This paper presents the results of a survey of the statistical techniques which were employed by applied linguists and which were reported in three journals: Language Learning, Applied Linguistics and TESOL Quarterly between 1980 and 1986. It was found that 47% of the published articles used statistical procedures. In these articles 63% of techniques employed could be described as Basic, 28% as Intermediate and 9% as Advanced. Descriptive statistics accounted for 32% of the total range of techniques while Analysis of Variance techniques accounted for a further 16%. There was a ratio of about three different techniques per quantitative study. The paper also describes how authors present their results and what implications this has for readers of quantitative studies. Based on this survey, some recommendations are made about what should be included in introductory statistics and courses to meet the needs of students of applied linguistics.

STATISTICAL TECHNIQUES USED IN THREE APPLIED LINGUISTICS JOURNALS; LANGUAGE LEARNING, APPLIED LINGUISTICS AND TESOL QUARTERLY 1980-1986: IMPLICATIONS FOR READERS AND RESEARCHERS.

In 1985, Goodman and Goodman published a study which analysed the statistical techniques used in studies published in the American Educational Research Journal (AERJ) between 1979 and 1983. They concluded that education students with both a basic and intermediate-level knowledge of statistics would understand most of the techniques encountered in the AERJ. In contrast, applied linguists have traditionally used fewer statistical techniques in their work than their educational counterparts, but as Henning (1986) found in his study of quantitative methods in language acquisition research published over the last 15 years, there has been both an increase in the proportion of quantitative studies reported in applied linguistics journals and a trend towards the use of inferential as opposed to descriptive statistics. These trends are further reflected by the fact that in recent years several statistics texts written especially for students of applied linguistics and applied linguists have been published (e.g., Hatch & Farhady, 1982; Butler, 1985; Woods, Fletcher & Hughes, 1986; Seliger & Shohamy, in press; Brown, in press). In view of these developments, it was decided that there was a need to carry out a survey similar to that done by Goodman and Goodman (1985) of representative journals in applied linguistics, to (a) determine what techniques were being most

frequently reported and (b) to see whether the techniques found were covered in statistics texts written specifically for students of applied linguists and language researchers.

The study reported in this paper was based on articles published in Language Learning (LL), Applied Linguistics (AL) and the TESOL Quarterly (TQ) between 1980 and 1986. These journals were selected because they were representative of the field of applied linguistics across geographic boundaries and because they represent a significant proportion of the body of research and theoretical discussion available in the field. Language Learning, published by the University of Michigan in the United States, and Applied Linguistics, published by Oxford University Press in the United Kingdom, publish research from geographic regions including Canada/U.S.A. and U.K./Europe. Applied Linguistics is jointly sponsored by the American and British Association for Applied Linguists, but the journal also publishes a large body of work from Europe. TESOL Quarterly is an example of a more application specific applied linguistics journal which is widely read by students, researchers and practitioners.

The specific objectives of this survey were :

(i) to classify the articles in these journals by type: (a) non-statistical, (b) theoretical statistical and (c) statistical;

(ii) to categorize the specific statistical techniques employed into three groups: basic, intermediate and advanced;

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(iii) to identify and comment on how specific techniques are reported and applied to research questions and data sets;

(iv) to draw implications from this information about what students, researchers and practitioners need to know in order to be critical readers of empirical studies done in the domain of applied linguistics.

This survey should be of interest to the readers of the journals surveyed, to applied linguists, to writers of journal articles and texts on statistics in applied linguistics and more particularly to lecturers in quantitative research.

THE SURVEY

The Classification of Articles

Each article, except Exchange and Review articles, in the three target journals from 1980 to 1986 was analysed. The articles were first divided into three general categories: non-statistical, theoretical statistical and statistical. Non-statistical articles included studies which presented and discussed theoretical issues, and those which analysed language using non-statistical analytical techniques such as phonological analyses, discourse analyses and syntactic analyses. No attempt was made to identify and quantify the specific types of analyses used. Any study which employed both analytical and statistical analysis techniques was grouped with the statistical articles. Theoretical statistical articles included those which discussed or described design, method, procedure, etc., but which did not analyze any original data. Statistical articles were those that

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reported the analysis of raw data using statistical techniques 'which may or may not involve formal hypothesis testing' (Henning, 1986, p.702). It is this last group of studies which the authors examined in detail.

Each quantitative study was read to identify the individual statistical techniques employed. The identification and classification used followed where practicable, the categories employed by Goodman and Goodman (1985) in order that the results of the two studies would be comparable. Each technique used was tallied only once regardless of the number of times it may have been used in a single article. This procedure was adopted because we were interested in identifying the specific techniques which a reader would need to know, rather than noting the absolute frequency of occurrance of each technique. Thus the study describes the range of techniques used across the field and their relative frequency. As in the Goodman and Goodman (1985) study, techniques mentioned in passing in the review section were not tallied. Some techniques were linked with other techniques in a chain of analyses. For example, a study may have reported descriptive statistics for a set of variables, followed by a correlation matrix of those variables from which were derived, via a factor analysis, factor scores which were then used for a step-wise multiple regression. In such a case, the techniques used in each step were identified and tallied. This tallying procedure had the effect of increasing the proportion of descriptive statistical techniques reported because most studies followed normal conventions and presented summary descriptive and

variance data for the variables measured. This artifact is a valid outcome of the study as we were interested in the range of techniques used.

The Classification of Statistical Techniques

The statistical techniques use in each article were subdivided into three groups: basic, intermediate and advanced. Although arguments could be put about the composition of these groups, it was decided to retain the Goodman and Goodman (1985) groupings for reasons already explained.

The Basic group included descriptive and summary methods, central tendency and frequency; Pearson Product Moment Correlation (r); Independent and Dependent T-tests (2 samples), Chi Square ( ), and One-Way Analysis of Variance (ANOVA). These techniques provide the conceptual foundations for most other techniques and are referenced in each of the available texts on introductory statistical techniques for language students (See Appendix A)

The Intermediate techniques were grouped by two criteria: their level of complexity and their ability to explain variance and multivariance using linear models. Thus multiple regression, multiple comparisons of means (à priori and post-hoc), factorial ANOVA and ANCOVA, and other correlational techniques including part/partial and point bi-serial comprised this group.

Advanced techniques include two main types of statistics: those whose mathematical complexity and design generally necessitate the aid of a computer for analyses, and those which are seldom found in introductory texts. Although factorial ANOVA

can become very complex and could therefore have been included in this group, it was decided to leave it in the Intermediate group as it is often introduced in basic statistics texts. Factor analysis is also sometimes included in these texts but to compute one by hand would be tedious and difficult. A further criteria for this group which should be added, is the level of difficulty of interpretation of the results. Factor analysis, Multi-Trait Multi-Method (MTMM), test analysis, repeated measures ANOVA, MANOVA/MANCOVA, and advanced correlation techniques (including cluster analysis, discrimanant analysis, and path analysis) are grouped here. Scaling is included in this group because it is seldom found in introductory texts even though at the unidimensional level the computational technqiues are not mathematically complex.

The differences between the classification table in this study and the one developed by Goodman and Goodman (1985) result from differences in the specific techniques found in the journals selected for the two studies. These differences are worth noting. The basic group categories used for both studies were the same. However, the intermediate group in the Goodman and Goodman study included "planned orthogonal comparisons" only, Trend analysis and Part/Partial correlation. Applied linguists reported a wider range of <u>à priori</u> multiple comparisons of means, both orthogonal and non-orthogonal so we have grouped them under one heading, '<u>à priori</u> multiple comparisons of means'. As very few Part/Partial correlations were identified in this survey, these have been classified under the collapsed heading "advanced correlational

techniques' which includes discriminant analysis, path analysis and cluster analysis. Goodman and Goodman had categorised these three techniques under separate headings. Furthermore, one-way and factorial ANCOVA have been collapsed into one category as few examples of factorial ANCOVA were identified. Multiple regression, on the other hand, has been separated into linear/multiple and step-wise multiple regression because the researchers utilised the two procedures for extracting different information from their data. Other correlational procedures in the intermediate category included point bi-serial correlations, and non-parametric techniques (including rank order) which were grouped together because there were too few of each in the sample to warrant separate categories.

In contrast to the Goodman and Goodman study, no canonical correlations or meta analyses were identified in this survey so these techniques were omitted from the advanced classification. One-way and Factorial MANOVA/MANCOVA were collapsed since only three were found. Multi-trait multi-method (MTMM) was listed separately because it was specifically used to test theoretical constructs of linguistic phenomena. Test analysis and scaling, both implicational and multidimensional, were added because they were identified in the sample though they were not noted by Goodman and Goodman. Repeated measures ANOVA was categorized separately because it is mathematically and conceptually different from other ANOVA techniques and because it imposes different design and interpretation difficulties on the data.

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Goodman and Goodman (1985) added a miscellaneous group of categories including 'Validity' 'Reliability', 'Other correlational' and 'Other non-parametric' techniques in their table. Most quantitative studies were concerned with reliability and validity but the specific statistics employed to test these concepts were extremely varied. It was decided to concentrate on the statistical techniques themselves, rather than their theoretical concepts and to include these 'other' techniques within our main classification system.

RESULTS

Types of Articles

472 articles were examined for the years 1980 - 1986 inclusive. Of these, 222 (47%) were quantitative studies, 8 (1.69%) were theoretical statistics articles and 242 (51.3%) were non-statistical. Of the quantitative studies, 50 (22.5%) employed descriptive techniques only which meant that the remaining 172 quantitative studies reported an average of 3.5 different techniques per study.

The Statistical Techniques and their Application

Table 1 provides a summary of the survey results by journal. The basic group accounted for 63% of all reported techniques in the literature. The largest single group of techniques were the descriptive statistics (32%). The 50 studies which employed descriptive techniques only, included surveys, language acquisition and language use studies. However, if those studies

which employed onlydescriptive statistics are excluded, then 59.7% of the total remaining reported techniques fall into the basic group, 30.4% fall into the intermediate and 9.9% fall into the advanced.

INSERT TABLE 1 ABOUT HERE

The next most frequently reported technique was the PPM correlation (11%). The most common uses of this technique were as estimates of inter-rater reliability and in correlation matrices. However, once these two categories of statistics are excluded, no other single technique had a high frequency of occurance compared with any of the other categories.

INSERT TABLE 2 ABOUT HERE

We also wanted to find out what particular ANOVA-based techniques were reported in the studies in order to comment meaningfully on the adequacy of information available to readers in introductory statistical texts for applied linguists. Table 2 presents a breakdown of the relative proportions of the categorised ANOVA-based techniques found in the study. This breakdown gives some indication of the variety of designs and applications employed by the researchers. From the table it can be seen that one-way ANOVA accounted for less than 30% of the total ANOVA group. Factorial designs accounted for the highest proportion (38%) of the ANOVA-based techniques. In fact, all of

the repeated measures techniques occurred within factorial studies, most of which analysed four or more factors with several levels within each factor. The proportion (24%) of studies reporting repeated measures on at least one factor underlines the need for course designers and text authors in this field to address this particular technique as it is obviously important in applied linguistic research.

It was noted with interest that fixed effects designs were reported most often. There were very few reports of completely or partial random designs. This reflects the procedural difficulties for researchers in a field where the subjects are usually humans. The sample populations were generally drawn from fixed groups, even though many writers failed to take this into account in their conclusions. When drawing their conclusions in fact, many writers exceeded the constraints imposed by the sampling method or the design and tended to overgeneralise.

Applied linguists have enthusiastically embraced this group of techniques, but they frequently demonstrate a lack of understanding of the design and application options available. Therefore specialised texts need to be written for applied linguistics beyond the introductory level. This serves to identify the need for advanced statistics courses for graduate students who will not only read many research articles but who will most probably be required to use them. At least writers on statistics for students and language researchers should reference specialised texts (e.g. Bruning & Kintz, 1987) in their introductory statistical texts.

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The multiple comparisons of means tests that were reported in sufficient detail to make a judgement, showed that researchers normally select an appropriate test subsequent to ANOVA. However, some authors exhibited an lack of clarity and/or rigour in their reports. For example, it was difficult to identify the specific post-hoc test used if it was not specified in the study. Some authors reported using 't-tests' after stating the null hypothesis (i.e., no specific à priori relationships had been hypothesized) and because of this lack of specificity it was virtually impossible to decide which test for the comparisons of means had been applied. This could be due to the application of particular statistical analyses by computer programs which may not identify either the specific multiple comparison of means tests, or the assumptions underlying them. As a result, it was impossible to identify and reliably quantify the specific multiple comparisons of means tests evident in quantitative research in the sample.

Regression analysis was applied in a variety of ways including the use of factored variables as predictors. The stepwise approach to multiple regression was reported more frequently than simple linear or simple multiple regression approaches (see Table 1.). In fact the simple linear approach was only identified twice in the sample. The wide variety of correlations identified as part of the study included the 'basic' Rho and the more 'advanced' point bi-serial. What is to be noted however, is that writers identified the specific correlation techniques they had used. This implies that either the statistical packages provided

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the relevant information or that researchers are more aware of the assumptions underlying specific correlational techniques.

The Advanced group represents 9% of the total range of techniques reported. Goodman and Goodman (1985) reported nearly twice the proportion of such techniques (17%), with Path analysis, factor analysis and factorial MANOVA/MANCOVA scoring the highest percentage - 3.2% each. In this study however, repeated measure ANOVA (17 studies), Factor Analysis (10 studies) and scaling (10 studies) were the most widely reported advanced techniques. Factor analyses were mainly used as data reduction techniques. They were rarely used in exploratory or confirmatory studies and varimax was the preferred rotational technique. These techniques were employed in large studies which investigated a number of social, psychological and linguistic variables. Often these variables were factored to reduce the number of scores. These factor scores were then employed either in multiple regression or other correlation matrices.

MTMM (4 studies) and test analyses (7 studies) were less frequently reported. For scaling techniques, implicational scaling studies (9 cases) were reported more often than multidimensional scaling studies (1 case).

DISCUSSION

The Comparative Perspective

The Goodman and Goodman study (1985) covered a five-year period (1979-1983) whereas this study covered seven years. The five-year period was admitted to be too short a period to make

any valid observations about trends in statistical usage of various statistical techniques. However, this study covers a period when microcomputers and statistical programs have become an established tool in statistical analysis. Therefore the results presented in this survey would seem to be better indicators of recent trends in statistical techniques employed by applied linguists in research.

There are some notable differences between the results of the two surveys. Some of these differences are a result of the differences in coding. Goodman and Goodman coded the techniques as either minor or major. Minor techniques (which were not presented in the final data) included those mentioned as having been conducted preliminary to the major analysis and those "presented as an accompaniment to the major analyses to more fully described the findings (e.g. means and standard deviations reported in conjunction with ANOVA.. .)" (p.7). This may explain the lower figure for descriptive statistics (10%) in that study compared with 34% in this study. In this study, if the descriptive statistics were included by the author as an important component of the results and figured prominently in the discussion then they were coded as major regardless of whether further analysis followed. Since 50 studies employed descriptive statistics only it is quite clear that had this group been coded differently, different proportions for the major groups would have resulted. It is argued here however, that without presentations of descriptive statistics by the author and a corresponding understanding of these analyses by readers, then

no intelligible interpretation of further tests can be made. This could lead to serious problems of interpretation where authors present only those data which relate directly to the questions or hypotheses being tested and they omit the descriptive statistics altogether.

PUT FIGURE 1 ABOUT HERE

Figure 1 shows shows the mean proportion of quantative studies for each journal and the total mean proportion (——) for all journals for each year of the survey period. The graphs show that there has been an overall increase in the mean proportion of quantative studies from 41% in 1980 to 56% in 1986. For the seven years of this study there is a strong positive correlation, but non-significant ($p>.07$) between year of study and mean proportion of statistical articles published. At what level this trend will plateau out cannot be predicted from this data. Individual journals show some fluctuation in the proportion of quantitative studies across time but this is to be expected. Occasional special subject area editions caused some of the fluctuations in the trend. For example, an issue on Epistomology was published by LL in 1983. AL generally publishes articles on a particular theme in each edition which partially explains the fluctuations in that graph. However, the trend towards a higher proportion of quantitative studies is clear. It is obvious therefore that students, readers and practitioners are increasingly required to have greater knowledge of and more

advanced interpretive skills in statistics. This trend in turn makes current introductory texts and introductory courses based on these texts in statistical techniques for applied linguistics less and less adequate. These results demonstrate the need for statistical text books and more advanced courses on intermediate and advanced statistical applications especially for graduate students of applied linguists.

Differences in Journal Focus

Language Learning and Applied Linguistics present contrasting profiles reflecting the different traditions across the Atlantic and the different emphases in the field of applied linguistics. LL reflects the American tradition of empirical studies where statistical analyses are extensively applied and where there is a fascination with social/psychological measurement. AL reports more non-statistical analytical techniques. These differences are reflected in amount of quantitative studies published, not in the complexity of statistical analyses reported. TESOL Quarterly, while reporting a comparable proportion of quantitative studies, emphasises the practical application of applied linguistic theories to language teaching, learning, and testing.

None of the journals appear to have imposed a single editorial policy over methods of presentation of results for particular techniques. Equally, a variety of terminology is used to refer to statistical procedures both within and across the journals. LL editors however have shown some concern about this problem and have recently imposed a two-tiered editing procedure for studies which employ statistical techniques: first, for the

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presentation of data analyses and second, through the normal referee editorial process. However, freedom of choice of terminology, techniques and method of presentation places a heavy onus on a researcher to justify choices of techniques and report procedures and results clearly. For the readers alas, particularly students, this puts great cognitive demands on their background knowledge, their understanding of text content and structure and their interpretive and critical abilities.

Introductory statistical texts and readers needs.

If, as we have assumed, these journals are representative of the trends in the way applied linguists statistically analyse data and present results, then some implications can be drawn about what readers need to know in order to critically read articles which report statistical methods.

Readers need a complete understanding of descriptive techniques - how they are applied to research questions, how they are used to prepare raw data for further analysis, and how they are presented in reports. The wide variety of graphic tabular and textual presentation of results encountered in this study right across the field of applied linguistics means that introductory texts should draw their examples from a cross-section of the field. In many texts there is a concentration on tabular formats for presenting results whereas authors in applied linguistics frequently presented results 'in text' in the form of a mathematical 'statement'. Presented in this manner, results are difficult to read and interpret for readers from generally

non-mathematical/scientific backgrounds who have not had adequate preparation and practice.

Apart from descriptive statistics and the PPM, the results of this study suggest that no other technique or single statistical test than any other is more likely to be encountered in this literature, although parametric rather than non-parametric techniques are more frequently reported. An examination of several introductory texts in statistical techniques for language researchers (see Appendix 1) shows that some frequently reported techniques are omitted altogether.

PPM should be presented with illustrations of inter-rater reliability and matrix formation for multiple regression and factor analyses. The specific advantages of step-wise multiple regression cannot be omitted from any useful text. More detailed attention should be given to the available variety and appropriate applications of the many multiple comparisons of means tests. Multivariate techniques, including factor analyses, factorial ANOVA and repeated measure ANOVA should be at least briefly introduced in introductory texts.

The emphasis in many existing texts is on computation, rather than explanation when a particular statistic is appropriate or what results mean in relation to an hypothesis. Explanations of design are frequently sacrificed to the minutae of computation. This is particularly regrettable now that there are a variety of powerful microcomputer programs which do the computation swiftly, but which offer a bewildering array of design and analyses options. Some recently published statistical text books attempt

to address this need., Hatch and Farhady (1982) provide practice exercises based on the SPSS computer program at the end of each chapter. Butler (1985) outlines some micro-computer programs which might be useful for applied linguistic researchers. Since introductory texts can cover neither all possible statistical techniques, nor all the possible alternatives, references to other sources of information need to be supplied either in an index or at the end of the releveant chapter.

Course designers, lecturers, researchers and readers in applied linguistics not only need access to texts which will show them how to compute the various statistical tests, but also texts which illustrate applications, rationales and various methods of presentation of the most commonly applied techniques employed in their field. Readers of journal articles which report these techniques, especially graduate students, are certainly expected to know and understand as much that is implied as is stated.

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Table 1: Analysis of statistical techniques reported in the 222 statistical articles in Language Learning (LL), Applied Linguistics (AL) and TESOL Quarterly (TQ) summarised for the years, 1980-1986.

Statistical Technique	LL N	LL %	AL N	AL %	TQ N	TQ %	TOTAL N	TOTAL %
Descriptive Stats.	97	(30)	32	(51)	83	(30)	212	(32)
PPM	36	(11)	5	(8)	34	(12)	75	(11)
Chi Square	11	(3)	4	(6)	5	(5)	30	(5)
Independent T-test	20	(6)	3	(5)	7	(6)	40	(6)
Dependent T-test	7	(2)	2	(3)	13	(5)	22	(3)
One-Way ANOVA	19	(6)	2	(3)	12	(4)	33	(5)
TOTAL BASIC	190	(59)	48	(76)	174	(64)	412	(63)
Factorial ANOVA	19	(6)	1	(1.6)	17	(6)	37	(6)
Multiple Regression	7	(2)			5	(2)	12	(2)
Step-wise Mult. Reg.	12	(4)			8	(3)	20	(3)
A priori Mult.Comp.Means	8	(3)	1	(1.6)	1	(.3)	10	(2)
Post-hoc Mult.Comp.Means	15	(5)	3	(4.8)	17	(6)	35	(5)
One-Way/Factorial ANCOVA	9	(3)	1	(1.6)	5	(2)	15	(2)
Other Correlations	19	(6)	5	(7.9)	31	(11)	55	(8)
TOTAL INTERMEDIATE	89	(28)	11	(17.5)	84	(31)	184	(28)
Factor Analyses	8	(3)			2	(1)	10	(1.5)
One-Way MANOVA/MANCOVA	3	(1)			1	(.3)	4	(0.6)
Adv. Corr. Techniques	7	(2)			1	(.3)	8	(1.2)
MTMM	3	(1)			1	(.3)	4	(0.6)
Test Analyses	4	(1)			3	(1)	7	(1.1)
Repeated Measure ANOVA	12	(4)	1	(2)	4	(1)	17	(2.6)
Scaling	4	(1)	3	(5)	3	(1)	10	(1.5)
TOTAL ADVANCED	41	(13)	4	(7)	15	(5)	60	(9)
Total Techniques	320		63		273		656	
Total No. Stat. Articles	103		32		87		222	
No. theoretical statistical articles	6		2				8	
Total No. Articles	153		121		198		472	
Mean Techniques/Article	3.1		2.0		3.1		3.0	

Note: Minor arithmetic discrepancies in this table are due to rounding.

Table 2. Analysis of ANOVA techniques reported in quantitative studies in Language Learning (LL), Applied Linguistics (AL) and TESOL Quarterly (TQ) 1980 - 1986.

ANOVA Techniques	LL		AL		TQ		TOTALS	
	N	%	N	%	N	%	N	%
One-way ANOVA	14	(26)	2	(50)	16	(28)	32	(28)
Factorial ANOVA	18	(33)	1	(25)	19	(33)	38	(33)
One-way/Fact.ANCOVA	9	(16)			9	(16)	18	(16)
Repeated Meas. ANOVA/ ANCOVA	11	(20)	1	(25)	12	(21)	24	(21)
One-way MANOVA/MANCOVA	2	(4)			2	(3)	4	(3)
TOTALS	54		4		58		116	

Note: Minor arithmetic discrepancies in this table are due to rounding.

APPENDIX A

Statistical techniques found in introductory texts on quantitative analyses for applied linguistics and language research.*

Statistical Technique	Hatch & Farhady (1982)	Butler (1985)	Woods et.al. (1986)
Descriptive Statistics	X	X	X
PPM	X	X	X
Chi Square	X	X	X
Ind. T-test	X	X	X
Dep. T-test	X	X	X
One-Way ANOVA	X	X	X
Factorial ANOVA	X		X
Simple Linear Regression	X		X
Multiple Regression			X
Step-wise Mult. Reg.			
A Priori Mult. Comp. Means	X		
Post-hoc Mult. Comp. Means.	X		
One-Way/Factorial ANCOVA			
Part/Partial Corr.			X
Factor Analysis	X		X
One-Way MANOVA/MANCOVA			
Cluster Analysis			X
Discriminant Analysis			X
Path Analysis			
MTMM			
Repeated Measures ANOVA	X		X
Implicational Scaling	X		

* These texts touch on some other techniques but in insufficient detail to be coded in this table. Other techniques may be covered in these texts but they fall outside the scope of this table.

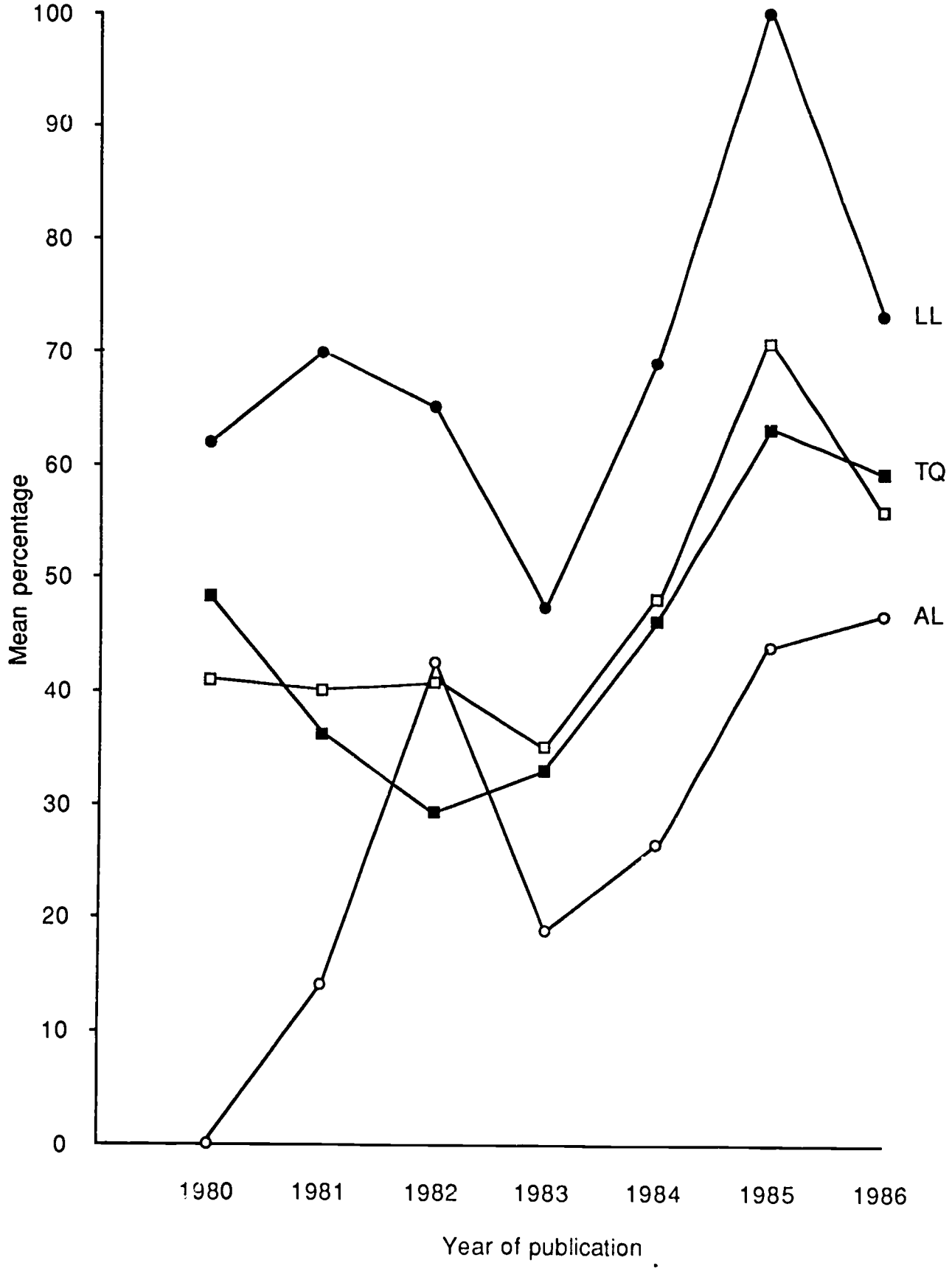

Figure 1. Mean proportion of quantitative studies by journal by year.