A CONTENT ANALYSIS OF SELECTED MULTIVARIATE STATISTICAL TEXTBOOKS

by

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DEDICATION

This dissertation is dedicated to my wife, Karen, who has been my encouragement and support throughout this program. It is also dedicated to my sons, Jason and Michael, whose constant question, "When are you going to get your Ph.D.?" has been inspirational to me in completing it.

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CHAPTER I

INTRODUCTION

The Social Sciences and Multivariate Statistical Textbooks

Graduate social science statistical courses, such as fundamentals of statistics, variance and covariance analysis, multivariate analysis, and research and experimental design are common courses in colleges and universities. Some universities might entitle their courses as quantitative methods, or as probability and statistics. Others list their courses per the department from which they originate. For example, Michigan State University's Economics Department lists their statistics courses as Econometrics I, II and III (Michigan State University, p. A-59). In addition, other programs use the basic statistical names of the courses and attach them to the specific program they are being incorporated. Harvard University's Psychology Department teaches a course entitled, "Multivariate Analysis in Psychology" (Harvard University, 2003, Courses section). While Texas A&M's Department of Educational Psychology has a course just plainly entitled "Theory of Non-Parametrics Research" (Texas A&M, 2003, Courses section).

Most graduate schools require their students to take at least one statistics course to graduate from their programs. In many cases if the individual in these programs has a weak background in math or science, a prerequisite course in statistics might be required. For example, Wayne State University's (Detroit,

Michigan) College of Business Administration requires a course entitled, "Quantitative Analysis: Theory and Applications" (Wayne State University, p. 64) for those having no prior statistical experience. In any event, most graduate schools require some type of statistics course to make sure that their students are familiar with some of the basic fundamental aspects and techniques of data analysis. In today's world, those with advance degrees are considered leaders and decision-makers, and are expected to have a level of knowledge and expertise with data.

In the case of most social science Doctoral programs, it is mandatory to take a sequence of statistical courses. Programs such as education, psychology, engineering, and the sciences make statistical courses a part of their degree requirements. The courses enable those working on research for their dissertations to organize and analyze their data, observations and facts, in accordance with a systematic plan. These will provide answers to the specific questions that the doctoral students are trying to answer through testing hypotheses. After the completion of their doctoral degrees, many of these individuals will lead a life of research and discovery based on their statistical training.

Statistical textbooks can usually be broken down into mathematical and applied texts. Mathematical textbooks usually require knowledge of calculus, matrix and linear algebra, which few people except mathematics majors possess. These texts also rely heavily on mathematical and statistical notations.

In applied statistical textbooks, there are usually many examples

containing actual real-world problems, but with little mathematical knowledge required except basic high school algebra. No matrix algebra or higher level mathematics is employed. Social science textbooks do not have a mathematical one-sidedness, but rather pay attention to the verbal interpretation of the results and the feedback on the research problem. In these texts, the more technical material is confined to tables, drawings, and charts to aid in understanding. This enables all, not just the mathematically inclined, to follow the main points of the discussion. The main emphasis is on how to use and to understand the various statistical techniques, and how one should interpret the output results.

Social science graduate students use most social science statistical textbooks. Researchers and practitioners from the many disciplines can easily use the same text, which will contain many different examples from the social and behavioral sciences. The social science statistical textbooks can give a good working knowledge of statistical techniques for the students without them being bogged down with derivations and proofs. Certainly, most students want to know how to use statistical techniques correctly, rather than having a desire to know the basis and mechanics of these techniques. Most mathematical statistical textbooks are difficult to "digest", with their derivation and establishment of the techniques, for the average social science graduate student. For most of these students trying to accomplish these tasks, the actual interpretation of the results are lost, or worse yet, interpretation of the results leave students confused and frustrated. The point is that statistical textbooks should not intimidate students in the social sciences because of their

mathematics. Social science statistical textbooks offer graduate social science students the ability to use the various statistical procedures and techniques, and also the skill to interpret the results.

The first social science statistic course is an "introduction to basic statistics." It provides students with an introduction to the basic concepts and procedures in statistics. For example, The University of Pennsylvania's Biology Department has a course entitled "Statistics for Biologists" (University of Pennsylvania, 2003, Courses). These courses assume that the students have no previous experience with statistics. The books are usually for audiences of students whose main interests are not quantitative methods, but rather require statistics to assist in their research. The "introductory" course is usually taught in one semester. For most Master's Degree programs in the social sciences, an introductory course in statistics is generally the only statistical course they will be required to encounter. In doctoral programs, the introductory statistics course is viewed only as a "stepping stone" for the other sequential courses needed to fulfill their program requirements.

In general, traditional statistical methods are described in the introductory social science statistical textbooks. The texts cover basic concepts and procedures. These statistical methods are for a single independent and a single dependent variable. They are often referred to as univariate methods. Most texts will include probability, sampling distributions, numerical and graphical methods for summarizing data, and hypothesis testing. They will also contain linear regression and correlation, inferential statistics for one and two samples,

power, one and two-way analysis of variance (ANOVA), and a few nonparametric statistics.

A multivariate statistics course usually follows the basic or introductory statistical courses. A multivariate course has more than one independent and/or more than one dependent variables. Univariate methods are classified as special cases of multivariate methods. With multivariate statistics, both multiple dependent and multiple independent variables are simultaneously analyzed.

Multivariate statistics is an accepted tool in the social sciences. The social and behavioral sciences are only about one hundred years old. This one hundred years span of empirical research resulted in a lot to social research having been done in univariate statistics. The development of multivariate methods in conjunction with the modern computer has resulted in multivariate methods becoming the accepted tool of the social and behavioral sciences. Prior to the computer all the calculations for multivariate statistics were done by hand, using slide rulers and calculators. These calculations could take months to perform. In this day and age, the same calculations can be done in a matter of seconds after all the data has been inputted into the computer. This has created popularity in the use of multivariate statistics. Along with the computer came data analysis packages for multivariate programs. Some of the popular programs are SPSS, SAS, and Minitab. This has created a number of textbooks on the software packages.

William Cooley and Paul Lohnes wrote the first multivariate statistics textbook in the social sciences in 1962, entitled *Multivariate Procedures for the*

Behavioral Sciences. The book came out in a second edition in 1971 (Huberty and Barton). In the 1980's multivariate textbooks were coming out at a rate of about two per year (Huberty and Barton, 1991). Since the 1980's and continuing today, many specialized multivariate textbooks dealing with only one topic, such as regression analysis, or structural equation modeling are being published.

The main multivariate statistical procedures covered by most textbooks are canonical correlation, discriminant analysis, factor analysis, multiple regression and multiple analysis of variance, and structural equation modeling. Listed below is a short explanation of each procedure.

CANONICAL CORRELATION: Canonical correlation, simply put, is a measure of overall correlation between two sets of variables. We are comparing several dependent variables with several independent variables. It is concerned with the amount of linear relationship between two linear sets of data. It is an extension of multiple regression, which involves a single dependent variable, and several independent variables (Hair et al. 1998).

DISCRIMINANT ANALYSIS: Discriminant analysis is used to predict group membership. Linear functions or discriminant functions are used to describe the differences between two or more groups. Discriminant analysis will help to understand group differences, and also predict the likelihood that the individual will belong to a certain group, or class (Tabachnick and Fidell, 2001).

FACTOR ANALYSIS: Factor analysis is helpful in identifying underlying factors to a problem. It can be helpful in developing and assessing theories. Factor analysis tries to identify a few factors that are among a larger

number of correlated variables. Many view factor analysis as a data reduction technique (Tabachnick and Fidell, 2001).

MULTIPLE REGRESSION: Multiple regression is used when the research problem involves one dependent variable and more than one independent variable. The object is to predict the changes in the dependent variable based on the changes in the independent variables. Least squares is the technique which is usually performed when using multiple regression (Hair et al, 1998).

MULTIPLE ANALYSIS OF VARIANCE (MANOVA): MANOVA is designed to test differences among groups on several dependent variables simultaneously. It is an extension of univariate ANOVA. MANOVA emphasizes the statistical differences among groups and the mean differences (Hair et al, 1998).

Currently, there is very little in the literature that pertains to evaluating multivariate statistical textbooks. There is also very little on basic statistical textbooks. Most citations are on basic book reviews. Many of the reviews tend to be subjective in their nature. These opinions are usually based on the authors' teaching experiences and general intuitive reasoning. One reviewer might have nothing but praise for a specific text, while another might not think too highly of it. All reviewers have their biases that may consciously or sub-consciously be carried into their reviews. It is very hard, in defense of these reviewers, to be fair and honest. Probably no one could write subjective reviews without their own experiences and prejudices coming into play. Reviewers, who

are most likely professors in the field, have to teach to a varied student population with their own built-in prejudices. Their perceptions and opinions can be of great benefit but empirically based reviews should also be used.

The Biometric Society, The American Educational Research Association, The Psychometric Society, and The American Statistical Association all have journals which publish reviews on statistical textbooks. Many of these reviews are subjective. This is quite surprising considering the statistical nature of these associations and their journals. There appears to be no apparent guidelines or theory-based rationale for evaluating statistical textbooks.

Textbooks touch the lives of both professors and students everyday while they are in school. In graduate school, it is expected that the students are reading, reviewing, and studying the texts. Many times the text might only be used as a reference to supplement classroom lectures. If this is the case, it is even more important that the proper text be used to help and enhance the students' learning. It is therefore very critical that more than just a subjective approach be used for statistical textbook reviews. This will result in a better-informed professional world, and more importantly, directly benefit the intended recipients, the students. It is the student who is the true consumer, who ultimately will benefit the most from a good text.

Content Analysis

Weber (1990) states, "Content analysis is a research method that uses a

set of procedures to make valid inferences from text" (p. 9). It has also been used to study problems related to individuals, society, and culture. Content analysis has been used for analyses of newspapers, government documents, propaganda literature, advertising, and television analysis. Through analysis of such things as magazines, cartoons, movies, and comic strips, content analysis has revealed attitudes and beliefs of people. It has also shown how religion, violence, hatred, sex, and crimes have revealed themselves throughout our history (Wade 1991). It can also serve as a standard for text analysis studies. Nearly all of the social sciences depend on reading of documents in one form or another. Social scientists and researchers use content analysis as a technique to help them explain and understand textual materials.

Berelson in 1952 stated that content analysis was "a research technique for the objective, systematic and quantitative description of the manifest content of communication" (cited in Stone, Dunphy, Smith, and Ogilvie, 1966). Manifest content means the surface meaning of the text, or "what you see is what you get." Most all of the later definitions of content analysis are based on Berelson's definition. According to Carney (1972), this definition is an "unsatisfactory definition because it does not reflect what was being done by content analysts even prior to 1952". Analysts were making inferences on non-quantitative evidence. In World War II, for instance, "it was inferred from internal evidence that the Nazi and Fascist propaganda agencies were operating independently" (p. 24). This definition was nevertheless a starting point or initial building block or base, from which modern definitions of content analysis have sprung. Since

that definition, others' definitions have stressed inference as the major purpose of content analysis. They have dropped the word "manifest", due to the fact that many content analysis researchers look for and assess latent meaning of the text being analyzed. Latent meaning is the meaning embedded in the text, or "reading between the lines" of the text. Stone et al. (1966) stated "a text represents the author" (p. 6). "Making inferences from communication content is considered the primary function of content analysis" (Stone et al. p. 17).

Krippendorff (1980) defined content analysis as "a research technique for making replicable and valid inferences from data to their context" (p. 21). Holsti's (1969) definition stated, "Content analysis is any technique for making inferences by objectively and systematically identifying specified characteristics of messages " (p. 21). Stone et al. (1966) stated a similar definition, "content analysis is any research technique for making inferences by systematically and objectively identifying specified characteristics within text." (p. 5). Finally, we have this definition by Riffe et al. (1998),

> Quantitative content analysis is the systematic and replicable examination of symbols of communication, which have been assigned numeric values according to valid measurement rules, and the analysis of relationships involving those values using statistical methods, in order to describe the communication, draw inferences about it meaning, or infer from the communication to its context (p. 20).

All of these definitions are useful because they emphasize systematic and objectiveness of content analysis. It is the scientific method that enabled the researchers to draw their conclusions from the studied text. "Content analysis is the application of scientific methods to documentary evidence" (Holsti, 1969, p.

5). Popping (2000) stated, it is "a research technique for making replicable and valid inferences from text" (p.7). By taking representative samples of the text being studied, coding the text according to category rules that have been set, and quantitatively analyzing the data collected, the researcher is able to describe typical patterns or characteristics of the data. Quantitative methods enable content analysis to be more precise without using subjective or impressionistic judgment. This enables researchers to identify the important variables or relationships among the variables, all of which must be replicable and valid. This is a scientific endeavor or enterprise using methodical procedures whose purpose is to "provide knowledge, new insights, and representation of "facts" (Weber, 1990, p. 5). Content analysis is a general analytical technique used for a wide range of purposes. "It is intended for anyone who wishes to put questions to communication to get data that will enable him to reach certain conclusions" (Carney, 1972, p. 26).

Content analysis represents measurements and inferences common to all scientific researchers. The researcher is trying to understand a particular event, instance, problem, or comparison, and is using texts as a means to accomplish this. Inferences are made from carefully inspecting the selected text. The researcher has to carefully select and inspect a sampling of his text. Theory determines the categories and indices of the text being studied. Inferences then are drawn from the results of the measurements of these categories and indices. It is these measurements that are used to test hypotheses and draw conclusions. Measurements can also describe variations, and single out

instances of the text that the researcher is interested in. The conclusions can then be checked by referring back to the text.

Content analysis studies have a rich diversity of focus. For example, a content analysis was performed by Walker in 1975, on the similarities and differences in song lyrics for American black and white popular songs from 1962 to 1973 (cited by Weber, 1990). A content analysis was performed on fictional television programs to determine their violence profiles by Gerbner et al. in 1979 (cited by Krippendorff, 1980). Another study by Stone, Dunphy, and Bernstein (1966) used content analysis to study product image in advertising. Images of the United States and Great Britain as portrayed by the communist press were studied using content analysis techniques (Stone et al., 1966). Using magazine articles cited in *The Readers Guide to Periodical Literature*, Stone and Lowry (1990) characterized the shifting public image of international terrorism during the 1980 through 1988 period. Thirty presidential inaugural addresses have been analyzed in terms of "symbols of national identity, of historical reference, of reference of fundamental concepts of government, and of fact of expectation" (McDiarmid, 1937). A study of documents by Hitler and Roosevelt compared their propaganda styles (White, 1949). Another researcher studied the stereotype of the American teacher in American novels (Foff, 1958). In addition, researchers have looked at science news both in tabloid and prestigious newspapers. It was reported that the prestige papers were more comprehensive and rigorous in their science reporting, while the tabloids did a respectable reporting job (Evan et al., 1990). These studies differed in focus and purpose,

but all employed the techniques of content analysis.

Purpose of the Study

The purpose of this study was to use content analysis as a means of analyzing multivariate statistics textbooks. Content analysis has had a long and successful history of analyzing all types of communications, including textbooks. Content analysis can help teachers in selecting textbooks for their classes. It can also help teachers choose particular chapters to be included in their course. In addition, it can help reviewers find out what objectives are represented in a particular test (Tamir & Lunetta, 1978). The reviewer subjectively reviews most textbooks, with preconceived biases and notions. The use of content analysis should alleviate these problems, and provide for a more factual basis in comparing the multivariate statistics textbooks. The texts will only be analyzed, with no references given to pictures, graphs, charts, or any other visual aids, contained in the texts. Due to the many varied topics of multivariate statistics, only a few main techniques will be analyzed. These techniques will be consistent with all the texts analyzed.

Textbooks will be chosen from the publishers of statistical textbooks. The publishers web sites will be examined to determine possible candidates for selection. Most publishers give a synopsis of their current texts. The researcher is only interested in those texts that are listed as graduate social science multivariate texts. In addition, the researcher is requiring that the highest level of mathematics required for the texts be high school algebra. The study will be

limited to textbooks with copyright dates of 1995 to present.

Content analysis will be performed on selected textbooks to determine if there are differences in the chapters discussing various multivariate statistical techniques. The techniques chosen are multiple regression, discriminant analysis, multivariate analysis of variance (MANOVA), canonical correlation, and factor analysis. The hypotheses of this study will state that there are differences in the graduate social science multivariate statistical textbook chapters studied using an alpha level of .05. This is because each author employs an individual viewpoint to what they think are important for the various statistical techniques examined. Each places different emphasis and stresses different things in the same related chapters. An author might feel that there is more confusion about one statistical techniques than another, therefore they might place a greater emphasis on that chapter with more key statistical terms than their other chapters and other author's chapters. Another author might feel they convey one technique better to their students than other statistical techniques. Another author might write to the questions and comments by their colleagues, reviews, and students. Another might feel they can better write a chapter and examine it with either more detail or precision than other authors. Lastly, an author might be concerned about what students might be learning based on test scores.

Study Questions

There are five questions for multivariate statistics textbooks which this study is designed to address:

1. Are there significant differences in the multiple regression chapters for the selected graduate social science multivariate statistics textbooks?
2. Are there significant differences in the discriminant analysis chapters for the selected graduate social science multivariate statistics textbooks?
3. Are there significant differences in the multivariate analysis of variance (MANOVA) chapters for the selected graduate social science multivariate statistics textbooks?
4. Are there significant differences in the canonical correlation chapters for the selected graduate social science multivariate statistics textbooks?
5. Are there significant differences in the factor analysis chapter for the selected graduate social science multivariate statistics textbooks?

Definitions of Terms

CATEGORIES: Assignment of recording units into groupings (Weber, 1990).

CODING: The process whereby the raw communications are systematically transformed into units, which permit relevant analysis of the content characteristics (Holsti, 1969).

CONTINGENCY ANALYSIS: Number of times a combination of two or more coding units are found (Marcotte, 2005).

CONTENT ANALYSIS: A research method that uses a set of procedures

to make valid inferences from text (Holsti, 1969).

COMMUNICATIONS: The exchange of thought, messages, or information by speech, writing, art, or actions, involving a sender and a receiver of the messages (Krippendorff, 1980).

DICTIONARIES: Numerous categories in which most words from a text can be classified. They consist of category names, rules for assigning the text to the various categories, and the assignment of the actual words to the categories. The dictionaries are usually based on a single concept or topic of interest (Weber, 1990).

FREQUENCY COUNT: The actual counted amount of words in a category (Weber, 1990).

LATENT CONTENT: The meaning of the message embedded in the content, interpreted by an observer or content analyst. The message is not necessarily the stated message by the communicator but rather the communication characteristics which underlie the apparent message (Roberts, 1997).

MANIFEST CONTENT: The apparent message given by a communicator. It is the surface meaning or the apparent message given to a receiver of the communication (Roberts, 1997).

MULTIVARIATE STATISTICS: Statistical techniques used for analyzing complicated data sets, which usually have multiple dependent and multiple independent variables (Textbook Three and Fidell, 1989).

RECORDING UNITS: The basic unit of text to be classified. These can

include word, sentence, paragraph, and theme (Riffe et al. 1998).

Assumptions

1. All the multivariate textbooks used in this study were for graduate social science students.
2. The multivariate statistics textbooks used in this study have only a limited amount of mathematics contained in them, with a level of high school algebra used.
3. Students who use these textbooks have taken an introductory course in statistics.
4. The multivariate statistics course would have been taken within one year of the introductory course in statistics.
5. Counting assumes that higher relative counts reflect higher concern with the category.

Limitations

1. The results of this study would not be generalizable to any multivariate textbooks that were not used in this research.
2. The results of this study would not be generalizable to any other statistics books, such as introductory or design texts.
3. This study does not measure the course success of students who have used the multivariate statistics textbooks studied.
4. Inferences would be limited to the software and categories used for

this study.

5. Teaching methods and course content varies from professor to professor, regardless of the specific contents of the multivariate statistics textbooks researched.
6. This study is limited to the actual text of the chosen multivariate statistical textbooks. It does not include any other written clarification or elucidation in the form of graphs, illustrations, indexes, glossaries, or chapter and section headings or titles in these textbooks.

In summary, it is felt that this research is significant to help professionals in the education and social sciences to better pick multivariate statistical textbooks for use. Every professor, professional, and practioneer desires different types of knowledge from these type of textbooks. The books can help and assist in the social sciences like psychology, education, and business for research, teaching, reviewing and learning of multivariate statistical techniques. Many times reviews on these type of textbooks are subjective. This technique is both qualitative and quantitative. If for example a professor or instructor is more interested in confidence intervals than power or statistical testing, through a content analysis they will be able to determine which book they might want to use. This technique then determines usage based on what the individual desires for content, it will not tell you which book is "good" or "bad". This analysis will contribute to knowledge by examining textbooks based solely on their content and not on a subjective basis which can sometimes be skewed.

This topic was picked to advance multivariate statistical textbook examination by eliminating the subjectiveness usually used in evaluation reviews. I have an interest in teaching statistics and personally have found many statistical books beyond my limits. Reviews are many times confusing and very contradictor in nature. It was felt that a technique to better examine these type of textbooks, would also enable others to select the multivariate statistical textbooks they desired for their particular wants and needs.

CHAPTER 2

REVIEW OF THE LITERATURE

History of Content Analysis

The first documented case of content analysis occurred in Sweden in the 1640's (Krippendorff, 1980). Collections of hymns were blamed for undermining the clergy of the Swedish State Church. The hymns were examined, comparing the religious symbols of the accepted hymns with the suspect hymns. The conclusion arrived at was that there was no difference between the two groups of hymns.

"Historically, the label "content analysis" has been primarily associated with research in the field of journalism" (Stone et al., p. 21). A researcher by the name of Speed in 1893 analyzed four New York newspapers between the years 1881 through 1893. He argued that cultural topics were declining in the papers, while sensationalism such as scandals and gossips, were on the increase. Citations of the specific content of the papers were used as an argument that the papers were indeed becoming more sensational (cited by West, 2001). In 1903, Loeb analyzed newspapers according to the social functions they performed (cited by Weber, 1990). In 1913 Markov published a statistical analysis of a sample of Puskin's work, *Eugen Onegin* (cited by Krippendorff, 1980).

Researchers have always been interested in the reported news. In 1920, Lippmann and Merz compared press coverage in the New York Times from the Russian front during World War I. They compared the printed coverage to the

actual facts, which were released after the war. They concluded that the coverage was inadequate (cited in West, 2001). In 1926, Wiley examined the rural newspapers compared to large urban newspapers (cited in West, 2001). In the 1930's content analysis "expanded into the analysis of other mass communications media, particularity radio, and later, movies and television" (Stone et al. p.23). In 1933, Russell and Wright rated the attitudes expressed by Japanese newspapers during the early 1930's (cited in West, 2001). In 1934 Walworth compared how United States history books described our wars, versus those published by our former enemies. Walworth (1935) also compared how nationalism was expressed in American and European children's books (cited in Krippendorff, 1980). Daykin explored the African American as portrayed in fiction in 1937 (cited in Stone et al., 1966). Also in 1937, Lowenthal's research concluded the work of author Knut Hamsun displayed a tendency toward fascism (cited in West, 2001).

During World War II, the allied governments performed content analysis on Nazi propaganda. Harold D. Lasswell and his associates worked at the Library of Congress for the Experimental Division for the Study of Wartime Communications. This group worked on sampling, reliability and validity of content categories. The group was interested in how countries used propaganda as a military tool. They examined the themes of the propaganda messages through content analysis. Lasswell developed a theoretical structure of politics, and advanced the quantitative aspects of analysis (cited in Stone et al., 1966).

Another propaganda researcher during World War II was Han Speier. He assembled a team at the Foreign Broadcast Intelligence Service of the American Federal Communication Commission (FCC). The FCC used content analysis as a means in which to understand, and more importantly predict events, shifts in Axis relations, Nazi perceptions of evolving situations, political changes between the party members and events within Germany. The FCC successfully predicated several major military campaigns based on their propaganda. Speeches by Hilter and Goebbels were analyzed using content analysis, leading to successful inferences of deployment of weapons, troops movements, and launching of V-2 rockets at England.

Berelson and DeGrazia (1947), analyzed German and Italian propaganda to examine if they were similar, inferring that there was collaboration between the two countries. Content analysis proved there was no collaboration. These facts were shown to be correct after the war.

After World War II, much of the propaganda data collected was used for further analysis. For instance, George in 1959 (cited by West, 2001) gathered 119 verifiable inferences from a two-month period in 1943. He found that the intelligence community of the United States was able to correctly predict 101 situations correctly based on the propaganda gathered.

After the War, with the spread of television throughout most households in the United States, content analysis was used to trace trends on how various age groups, occupations, and races were portrayed in this new media. This has always been a rich field of study for the researcher. Perse and Rubin (1988)

examined soap operas and found that they are viewed for escapism and other types of gratification. In the 1950's educational material started being analyzed using content analysis. Research was based on trying to find value, and political, and attitudinal trends in textbooks. In 1950, Wolfenstein and Leites (cited by Stone, 1966) performed a content analysis on movies. Their analysis involved the plot of then current movies. Also in 1953, McClelland (cited by Stone, 1966) did a content analysis that measured psychological assertions by looking at different kinds of themes. Rashal used content analysis in 1953, to determine that patients judged by the medical staff to be more successful in therapy demonstrated higher variability in their word usage. Allport, Burner and Candor (cited by West) examined German essay contest applicants, on their responses to how their lives were before and after the Nazis took over Germany. The results were used to make inferences about the total German population. Sears, McCoy and Levin in 1957 (cited by Stone, 1966) studied patterns of child rearing practices by their mothers. A content analysis was performed on interviews, which allowed the mothers to talk freely about the joy and problems of raising children. It also analyzed the mothers feeling before and after birth, and the training techniques they used. Huge in 1959 (cited by Stone, 1966) analyzed press coverage of the 1828 Jackson-Adams, and the 1952 Eisenhower, presidential campaigns. He found that the press showed anti-intellectualism in their coverage when a so-called "intellectual" ran against the military hero. In both cases the hero won. Also in 1957, Horton used content analysis to analyze the theme of courtship in popular songs from 1955. He

found that in most songs a courtship theme existed that could be broken down into four distinct phases, existed. In 1958, Sebeok and Zeps performed content analysis using an IBM 650 computer to analyze 4,000 Cheremis folktales. In the 1960's computers were starting to be used to perform various forms of content analysis (Marcotte, 1969).

In the 1960's the main development of the General Inquirer did more to advance content analysis than any other technique or procedure prior to that time. The General Inquirer is a dictionary-based system, which allows researchers to substitute their own specific dictionaries. In 1961, Stone and Bales, both of Harvard University, used an IBM 709 computer at the Massachusetts Institute of Technology to perform content analysis using the General Inquirer. This eliminated the tedious elements of human coding. The first project with this computerized system was studying themes of long-term face-to-face groups. The research team was made up of many disciplines, including English, political science, sociology, psychology, and medicine. The General Inquirer was developed based on psychological and sociological material. Davis, Davis, and McClelland used the General Inquirer to investigate "psychological correlates of heavy drinking in primitive societies by relating the thematic content of folktales to drinking (Stone et al., 1966, pp. 569-570)." In another application, Ogilvie, Stone and Shneidmena were able to distinguish between genuine a simulated suicide note (Stone et al., 1966, p. 528). The General Inquirer was used to explore the personality of a person based on their personal letters, in the manner in which a clinical psychologist would explore the

persons' personality.

In 1965, Stempel studied newspaper coverage of the 1960 and 1964 presidential campaigns (cited by West, 2001, p. 21). He found that equal space was given to all the candidates involved. Holsti (1969) measured and examined documents by Soviet and Chinese leaders. He found that when high tensions occurred between the West and the Soviets, the Chinese and Soviet documents exhibited similar attitudes. The Soviet Union and the West were on more favorable terms, Chinese and Soviet documents differed in their attitudes. Thus, the East and West conflict was a predictor of Chinese and Soviet document consistency. In 1964, Mosteller and Wallace analyzed the 12 Federalist Papers and concluded that they were basically the work of Madison (cited by West, 2001).

The early computer systems that ran content analysis programs were expensive to buy and run. They possessed limited power, were physically large and bulky, and presented problems of access to individual researchers. Only the largest of universities possessed the necessary funding to indulge themselves, which at the time, was considered "state of the art technology." With the revolution of the personal computer of the 1980's continuing into the present, computerized content analysis has become available to most persons who have an interest or desire to do research in this subject area. The increased power, low cost, and small physical size of the personal computers have interested a new generation of potential content analysts. Coupled with the fact that many new and relative inexpensive content analysis software

programs have come out in the market the last twenty years, the field of content analysis and its literature has increased tremendously. In addition, many practiceoners of content analysis now refer to the field as computer-assisted content analysis. It has also been referred to as text analysis.

Many new methods and techniques have been advanced by content analysis. Gottschalk and Bechtel in 1982 developed an artificial content analysis intelligence program that was capable of analyzing five minutes worth of speech. Measured were hostility, anxiety, social alienation, and cognitive impairment. Rather than starting with categories, Wigand (as cited by West - Sherblom, Reinsch, and Beswick, 2001) used a network approach to content analysis in 1988. Wigand allowed nodes of activity to merge from the data. This was called network analysis. Carley and Palmquist (1992) used neural network analysis to use words that came from a message as nodes. Word occurrence represented an increased picture showing the patterns among the predominant themes in a text, and the relationships among the themes. In 1997, Miller used frame mapping, which analyzes competing points of view by quantifying words and phrases through content analysis. Themes are mapped according to specific words and phrases. In this study, news media groups and advocacy groups were framed to compare their news releases in terms of their wetland polices. Conservation groups were framed more often where the conservation frame was more dominant.

There has been much content analysis research on textbooks (e.g., Barron, 1990; Eltinge and Roberts, 1993), journals (e.g., Crase and Hamrick,

1993; Davis and Liddell, 1997; Fennel, 1991; Goodrich, 1995; Miner and Baker, 1994; Thompson and Schied, 1996), and even dissertations (e.g., Chang and Hsiech, 1997; Kantonski, 1995; Nelson and Coorongh, 1994). The research includes a broad scope of subject areas, from music (e.g., Koza, 1993; Sample, 1992) and chemistry (e.g., Bazler and Simonis, 1991; Niaz, 1998; Thiele and Trengust, 1994), to business (e.g., Foxman and Easterling, 1999; Grosse and Uber, 1992; Sims, 1997) and psychology (e.g., Hobbs, Westling, and Haroum, 1996; Maddux and Candler, 1990; Hill, Nutte, and Jackson, 1994; Wiese, 1992).

Content Analysis Applied to Professional Journals

Content analysis has successfully been applied to professional journals (e.g., Brittin and Standley, 1997; Crase and Hamrick, 1993; Goodrich, 1995; Hayes and Smith, 1994; Hays, 1992; Kantorski, 1995; Twombly, 1993; Riffe, Hedgepeth, and Ziesenis, 1992). Many authors desire to see the trends and directions of their profession by analyzing their journals. "The content in a journal reflects the profession's concerns and research interests over time" (Rachael and Sargent, 1995, p. 15). Most journal analyses are qualitative in nature, with descriptive methods being used to interpret the results (e.g., Gough, 1997; McDowell, 1990; Reagan, 1991; Schmidt and Zdzinski, 1995; Iwamasa and Smith, 1996). Rachael and Sargent (1995) break down the journal analysis into two main components, "Content analyses tend to fall into two types; comprehensive analyses, which examine a journal (or journals) in an attempt to classify all the articles into subject areas; and theme analyses, in which a journal

(or journals) is examined for inclusion of articles dealing with a particular theme or topic" (p. 15). Foley, Keener, and Branch (1994) performed a content analysis to determine the percentage of articles written by women in a five-year period in instructional technology journals. Welle, Kittleson, and Ogletree (1995) state, "content analysis seeks to reveal patterns of meanings which are not evident from raw data" (p. 369). Godkin and Endoh (1995) conducted a study on 21 academic journals between 1981 and 1990, to determine the proportion of Japanese-focused organizational behavior articles, which were published. Wilson and Smith (1996), after reviewing 30 different educational journals from fall 1993 through summer 1993, concluded that environmental education "is generally a low priority in the schools and in teacher-education programs" (p.42). Bennett, Rowe, and Hill (1991) performed a content analysis of the *Journal of Multicultural Counseling and Development* to determine the type of articles being published. Short (1995) performed a comprehensive examination of the first 10 volumes of the *Journal of Curriculum and Supervision. Koza* (1993) did a theme content analysis on the *Music Supervisors' Journal.* Buboltz, Jr. and Savickas (1994) state, "Journal articles provide a documentary measure of the progress of a scientific field" (p. 367).

When performing content analysis on journal articles, many authors use all the articles published during a specific time period. Koza (1993) states, "Evidence was collected by reading all articles in the first ten volumes of the *Music Supervisors' Journal*" (p. 214). Wiese (1992) research published between 1975 and 1990 of "all articles from the three major school psychology journals"

(p. 267). Samples (1992) three refereed music education research journals, "from their inceptions through fall 1989" (p. 154). "Longitudinal designs often involve extended time periods with issue populations of more than a single year" (Lacy, Riffe, and Randle, 1996, p. 408; Kawano, Kehle, Clark, and Jenson, 1993; Wandersee, 1990). Crase and Hamrick (1993) examined 21 years of *Health Education* due to a name change, and refocused editorial direction. Foley, Keener, and Branch (1994) analyzed 11 instructional technology journals during a five-year period. Rachel and Sargent (1995) examined a single journal for a period of ten years, comparing the two five year segments. Hays (1993) used "all journal articles published in *Gifted Child Quarterly*, *Roeper Review*, and *The Journal for the Education of the Gifted* from their first issues through 1989" (p. 41).

Ducan (1989) states, " Establishing coding categories is one of the most critical steps in the planning of a content analysis study" (p. 29). In many cases the categories for journal studies come from other studies (e.g., Tomhave, 1992, Buboltz, Jr. and Savickas, 1994). Miner and Baker (1994) state, " The coding form included 12 categories for tabulation on a literature review of educational materials" (p. 235). Foley, Keener, and Branch (1994) state, "the categories in table 1 were used and defined by Ely (1992) in his content analysis" (p. 56). Bennett, Rowe, and Hill (1991) content analysis was, "to report the findings of this follow-up content analysis that occurred during the last half of the past decade" (p. 98). They then used the categories of another researcher.

In most of the journal articles the keyword is the method used for

tabulation. "In content analysis the unit of analysis is a document or some element of mass communication" (Duncan, 1989, p. 29). Creamer (1994) states, "The method of counting the frequency of the appearance of the keyword (such as gender, sex, female, woman, women, or girl) was used in these studies to identify articles about women" (p. 35). In content analysis, the unit of analysis may be the reference citations (e.g., Goodrich, 1995). Crase and Harmirck (1993) determined whether articles has been "written by one, two, or three or more authors and to determine whether multiple authorship increased during the 21-year period" (p. 151).

In some cases examined on journal content analysis, coders were used to agree upon the use of categories and reliability. Wiese (1992) had a 93% reliability on topics addressed, when "two raters reviewed the journals independently" (p. 268). Lacy, Riffe, and Randle (1996) had a 93% coder reliability also, when two coders were used. Miner and Baker (1994) stated, "Two coders achieved the pre-established target intercoder reliability coefficient of .85" (p. 235). Hill and Radimer (1996) found, "Intracoder reliability was calculated to be 99% using the method defined by Krippendorf" (p. 315). Bowen (1992) stated, "The reliability of the study was checked in terms of interrater agreement. First, a sample of articles was chosen to represent all major categories and most subcategories. This sample, along with the categorization procedure, was given to a doctoral student in science education. The categorization arrived at by the student was compared with the researcher's categorization of the same articles. " (p. 133-134). The reliability in this case

was 82% for the major category, and 65% for the subcategory.

Many journal articles do not discuss content analysis as a research topic, or refer to it slightly (e.g., Fennell, 1991; Schmidt and Zdzindski, 1995; Xiaotian, 1993), when they are using it as a research technique. Most times, the topic or subject being researched is referenced in the literature, but not content analysis as the research procedure being used. Hay (1993) states that "Content Analysis can provide valuable information about the persons contributing to the literature, the amount and type of research conducted, and the topics addressed in a field of study" (p. 41). Pratt and Pratt (1995) discuss content analysis by stating, "Content analysis is a research technique that systematically examines the frequencies and meanings of linguistic elements" (p. 12). Vealey (1989) while discussing content analysis said that "the research design used in this study was based on Krippendorff's content analysis framework " (p. 218). Duncan (1989) devoted his entire journal article discussing content analysis and its' application to health education research. He stated, "This set of techniques involves quantifying the frequency with which certain qualities appear in a sample of documents" (p. 27). Eisenberg (1989) stated that "Content analysis is a commonly used research methodology for investigating trends, subject emphasis, biases, values and tendencies in print" (p. 45).

Content Analysis Applied to Dissertations

Content analysis has also been applied to dissertations. In 1995 Kantorski used content analysis to identify and analyze trends in music

education research. Specifically, his purpose in studying doctoral research was to "analyze the contents of doctoral research written between 1936 and 1992 that related to string education" (p.289). Nelson and Coorough (1994) performed a content analysis on Ph.D. and Ed.D. dissertations. They found "the percentage of PhD degrees is increasing, the nature of the Ed.D. continues to be more oriented to professional practice than the PhD is" (p. 169). Interestingly, they found that simple frequencies and percentages were the primary types of analysis found in the Ed.D. They also found that "ANOVA was the most prevalent statistical model used in dissertations in both degrees" (p. 167). In view of this dissertation analyzing multivariate statistical textbooks, they found "there was not a pronounced increase in the use of multivariate statistics over the years in educational dissertations; however, there were a higher percentage of PhD dissertations with multivariate statistics than the Ed.D. dissertations" (p. 167). They reported that 7% of Ph.D. dissertations use multivariate statistics, while only 2% of Ed.D. dissertations use multivariate statistics. Chang and Hsieh (1997) performed a content analysis on doctoral dissertations in management in Taiwan. They referred to this analysis interestingly as "content-analyzed" (p. 119). Their categories chosen were based on the Ph.D. programs designed by the graduate schools of management in Taiwan. They found that financial management was the dominant doctoral category, with 18% of the dissertations accounting for this category. They reported that 68% of the financial dissertations focused on the stock market.

Content Analysis Applied to Newspapers

As noted in chapter one, there has been a long history of analyzing newspapers with content analysis, which continue into today. Ramsey (1999) performed a content analysis of science and technology stories in eight major newspapers in the United States. She choose the time period of 1991 to 1996. Three coders attended three training sessions. After training the coders, they obtained "final intercoder reliability, by Holsti of 94%" (p. 90). She showed that newspapers with greater resources do not necessarily "ensure increased elaboration or use of a variety of sources" (p. 95). Using the principles of content analysis, Keller et al. (1990) researched the coverage of persons with disabilities in American newspapers. They used two coders which obtained an agreement of 96% for "determining whether the individual with a disability or disability topic served as a major or minor focus in the articles" (p. 274). They found that there was little mention made of the effect of the disability on the person's life. Furlow analyzed 128 articles for issues on the spotted owl debate. He found that no single article covered all the aspects of the spotted owl issue. Casady and Stanford (1993) examined the "want ads" in 20 major newspapers in the United States for a one-year period. Their research yielded that the most requested skill was communication skills.

Other Applications of Content Analysis

Content analysis has been applied to other printed materials. Merskin

and Huberlie (1995) reported a study of teaching positions advertised by schools. They examined 1,500 announcements and coded them into twelve categories. It was found that most of the ads were too general. They did not list "rank, tenure status, salary (within some reasonable range), degree required and (sic) experience" (p. 84). In many cases, content analysis is used only for descriptive purposes with no formal hypotheses set forth (e.g., Haven and Wenson, 1996; Levxand and Bryant, 1993; Meier and Davis, 1990; Stearns and Borna, 1998). "No formal theories or hypotheses were tested, therefore only descriptive statistics are required" (Merskin and Huberlie, 1995, p. 80).

Weems (1993) used content analysis to study dialect. One hundred and twelve urban college students listened to an audiotape containing standard and nonstandard dialects. Four coders analyzed responses to the tape as positive, negative, or neutral. It was found that standard dialect was perceived as positive and nonstandard as negative. O'Hear and Aikman's (1996) research showed that main ideas as presented in textbooks are also used in popular non-fiction bestsellers. Beyer, Ogletree, Ritzel, Drolet, Gilbert, and Brown (1996) did a content analysis "to examine differences in sexuality education curricula" (p. 361). They found greater female representation in topics related to dating, love, hygiene, and parenting. Males' representation topics were drug/alcohol effect, self-esteem, and sexual activity.

Weiller and Higgs (1998) found that "texts for elementary schools are largely free from sex stereotyping, but many reading materials available in the school libraries present certain prescribed roles for girls and boys in sports

activity" (p. 66). For this study they had examined 1,380 books. Smeltzer (1992) in examining e-mail messages, found that the messages "can lead to conclusions on message complexity, variability, and comprehensibility which can be used to eventually analyze message suitability effectiveness" (p. 52). Ducan (1989) recognized the advantages of content analysis by stating, "content analysis is a research technique more health educators should be familiar with" (p. 28). Health researchers Fetro and Drolet (1991) conducted a content analysis on state conference components for school worksite wellness. They cited Krippendorff (1980) when they state that "this research method employs a defined set of rules and procedures to classify content according to meanings and provides frequencies with which certain things, groups, or concepts are referenced" (p. 80).

Gustanfson (1998) has used content analysis in the history class, as "an effective technique when they want to enrich history and to introduce practical social science research skills to their students" (p. 39). He goes on to state, "typical research problems examine trends in content, style of writing, and inferences about the author's attitudes or the culture producing the source" (p. 40). Jones (1990) did a study on gender differences published in the first 22 volumes of *Educational Administration Quarterly*. Pugh and Hu (1991) did a content analysis on the use and interpretation of canonical correlation analysis in *Journal of Educational Research* articles from 1978-1989. They found a wide variation in the use of terminology across ten articles reporting eleven studies. They also found that sample sizes used did not always achieve a desired level

of stability in the interpretation of the results. Seibert and Drolet (1993) in their research on death themes in literature for children ages 3-8, used Holsti's formula for intercoder reliability. They reported an agreement rate of 85% (p. 87), which was very good when one considers "an agreement of 60% of the coders was considered sufficient for the instrument" (p.87).

Advantages In Using Content Analysis

Content analysis is a technique whereby researchers are able to analyze communications. A persons' conscious beliefs, values, attitudes, and ideas are revealed in their communications. Communications can be in the form of books, newspapers, movies, literature, and textbooks. Content analysis is an accepted scientific research technique, which has many advantages.

Content analysis is an unobtrusive technique. The researcher analyzes messages from documentary evidence. By analyzing the text directly, the analyst is able to keep the message from the communicator and the receivers separate. This enables the analyst to examine the evidence directly without being influenced by the originator of the textual message. The communicator might not want to have contact with the researcher, due to location, agenda, or a prejudice to the researcher for what they might find or discover. Content analysis can be used for research without influencing the subject being studied as can occur by interviewing, testing, or questionnaires, the subject being studied. The subjects can, themselves, be influenced by their awareness of being observed. The interviewer, researchers, or investigator in most instances

assumes a certain amount of control over the stimulus conditions to which the subjects are asked to react to. All these can jeopardize the validity of the tests, interview, or questionnaire. Content analysis can help prevent these through its unobtrusive techniques. The experimenter or interviewer interaction is thus eliminated with the subject or originator of the communication. The unobtrusive technique eliminates contamination of the observations. Content analysts only have to research the actual generated communication in the form of hard text, which will not become biased. Analysis of the communicated material enables the researcher to gain results without the author, publisher, or communicator being aware that they are being examined.

Another advantage to using computer content analysis is that it can deal with large volumes of data rapidly and quickly. Twenty years ago, content analysis calculations were done by hand, and required months to perform. After the inputting of the material, a modern program can give content analysis results in a manner of minutes. Content analysis permits reduction to numbers of large amounts of data texts. Crase and Hamrick in 1993 performed a content analysis on twenty-one years of the journal, *Health Education.* In 1991, Fennell did a content analysis on Aid/HIV articles published in selected professional health journals from 1981-1990.

Thirdly, content analysis has a life beyond the initial presentation of the textual material. Authorship of literary works is being determined hundreds of years after they have been written. Famous leaders, speeches and works, can be analyzed through their existing record of documentation. Whatever works

have been left behind, contemporary analysts can research. A subject can be researched by their records. Content analysis has in many cases been viewed as a last resort when a communicator is not present, to help interpret their views, and reveal the circumstances which might have influenced these views. Longitudinal studies can be performed where attitudes, opinions, and beliefs can be shown to be changed during historical time spans.

Content analysis is unlimited in its application to the variety of important questions that can be used for many of the disciplines. It has been used in education, anthropology, communications, art, economics, and medicine. It has been used to explain and research problems in television, radio, publishing, and movies. It has been used to analyze advertising, newspaper, propaganda, textbooks, and literature. It can be used in any type of communications, where a giver and receiver of information, entertainment, and facts are involved.

Content analysis can be used as a supplementary source of data. The source can be returned to time and time again, as desired. It can be used as an independent source for validation of other research, which has been performed. A researcher may compare subjects' answers to a questionnaire or survey, to a content analysis of their printed statements in the press, journals, texts, or speeches. When at least two approaches to a problem yield the same or similar results, the researcher's confidence in the findings assure them that the findings do indeed reflect the phenomena they are interested in studying. When using two test methods for the same problem, and coming up with similar results we can conclude that the results are reliable (Holsti, 1969).

Content analysis accepts unstructured material. In most studies the researcher organizes their research instruments such as surveys and questionnaires, so they will leave the respondent choices with predefined choices, which can be easily coded to obtain their results. In content analysis, the data is extracted from communications of the subject. The analysis is based solely on this, giving a pure unhindered source of data. Content analysts accept and go with the original data, while other researchers can not proceed because the source might not contain the proper language to meet the requirements of their survey or questionnaires. The researcher might not be able to anticipate all the categories and forms of expression that the communication contains. In other words, the researcher might find data, which is not compatible with the requirements of their analyses.

Finally, content analysis can be used as a means of exploratory data analysis. This can be helpful when there is not much theoretical knowledge about the subject one is researching. It can serve as a starting basis for new research.

Content Analysis and Textbooks

The literature is rich with content analysis on textbooks. "Educational material, long the focus of attention by social scientists, became recognized as a rich source of data both to make inferences about processes of reading and to understand larger political, attitudinal, and value trends to be found in its textbooks." (Krippendorff, 1980) Vacc (1993) argued that "computer-generated

content analysis is a valuable method for determining concerns from text" (p. 339). Wade and Iowa (1993) stated that "content analysis has the potential to mobilize textbook reform" (p. 233). Content analysis has been used in many textbook evaluations (e.g., Allen and Preiss, 1990; Brummelen, 1991; Gordy and Pritchard, 1995; Gross, 1996, Livingston, 1997; Reagan, 1991).

Textbooks are important. Stolley and Hall (1994) stated that "educators rely on textbooks to frame courses and convey information to students" (p. 267). Baron (1990) states, "Textbooks represent the most important resource used by teachers and students ..." (p. 452). "Students ... rely on textbooks as their most readily available source of information about the course topics: their text is the logical place to turn when seeking information about various issues" (Stolley and Hall, 1994, p. 267). Wade and Iowa (1993) make a definite point by stating, "Textbooks are a pervading presence in the lives of teachers and students" (p. 233). Maddux and Candler (1990) feel that "choice of a textbook for a college course is an important and complex task" (p. 115). They further stated that "the complexity of the task combined with the press of time, may result in selection without careful consideration of all relevant variables or all available textbooks" (p. 115).

Much of the research in many cases purport to be content analysis, but no discussion of content analysis ever ensues in the articles. Some of the distinguished practioneers of content analysis such as Holsti, Krippendorff, and Stone are never mentioned or alluded to. The name content analysis might be used in the title, and the articles might even be indexed under content analysis,

but in many cases the articles are a mere description of a text (e.g., Mbuyi, 1988; Osborne, 1994; Wilson, 1995). In another study, Titus (1993) stated that he "reviewed and evaluated the texts through interpretations of the explicit statements in the surface content of the texts" (p. 38). An interesting study by Still (1996) analyzed online searches as presented in British and American textbooks. Her conclusion was that the textbooks differ, due to cultural differences in vocabulary. But in many cases the British are forced to use American terms because many of their databases are produced in America.

Content analysis has been used in textbooks to support gender stereotypes. Many analysts have found that many textbooks are still sexist and biased in their presentation of women. In 1997 Sims performed a content analysis on business textbooks to determine the gender equity of the texts, as presented by the test questions the texts presented. Her findings indicated that two-thirds of the questions referred to males. In addition, she found that females were listed in the questions by their first names significantly more than males. Other studies by Graci (1989), Xiotian (1993), and Hayes and Smith (1994) have researched women as portrayed in foreign language textbooks, magazines, and journals. In 1994 Foley, Keener, and Branch performed research to determine the percentage of articles written by women during a five-year period, 1988-1992, for instructional technology journals. The analysis also revealed that the women's articles were technological in nature. Foxman and Easterling (1999) performed a content analysis study on marketing textbook cases to determine the portrayal of the workplace. It was found that minorities, including women,

were underrepresented in the cases.

In 1991, Lumpe and Scharmann analyzed the content of the laboratory activities from two high school biology books. They concluded that neither book provided activities that would help develop problem solving or decision making in experiments. In 1990, Lloyd performed an analysis to determine how three biology texts presented photosynthesis. It was found that all the texts had different levels of elaboration. Elaboration, it was assumed, gives more educational opportunities to the student to learn. In 1992, Potter and Rosser investigated five seventh-grade life science books to determine the effect on girls' interest in science. It was found that all five textbooks had overt forms of sexism. Lieberman, Hampton, Littlefield, and Hallead (1992) studied race in biology and anthropology texts. A recurring study is evolutionary topics covered in biology textbooks (e.g., Swarts, Anderson, and Swetz, 1994, Jeffrey and Roach, 1994, Aleixandre, 1994, and Glenn, 1990).

Business textbooks have been analyzed with great success. In 1992, Grosse performed a content analysis on business Spanish texts for their cultural content. He analyzed eight texts, examining one chapter very closely and counted the pages devoted to language, business, and culture. He concluded that more Spanish influence needed to be in all the texts. Bracken and Urbancic (1997) assessed the degree that internationalization of accounting topics appeared in introductory accounting textbooks. In 1994, Doane assessed textbook coverage of quality topics in business education. He concluded that production and operations management textbooks contained stronger coverage

of the topic than business statistics textbooks.

The samples used in textbook content analyses are usually small. Commeyras and Alvermann (1994) used three high school world history textbooks in their analysis. Hartung (1998) analyzed the ethical discussions of four technical communication textbooks. Kim (1993) used only two textbooks in his research of mathematics textbooks. He found that American textbooks were more repetitious of measurement and geometry content than Korean texts. This then creates a better learning experience from grade level to grade level. Bellitto (1996) used a sample of four high school textbooks on European history. Regester (1991) used a total of four textbooks for analysis. Richgels and Tomlinson (1993) sampled four textbooks.

The small samples represent a large amount of data. This data is usually analyzed from chapters, which may contain more than forty pages of text, to whole textbooks with hundreds of pages. In most cases there are only a limited amount of publishers and texts for a particular subject area. In some instances, the authors pick only the leading publishers of the most popular text. "These are among the leading high school history texts used in the first half of the 1990's" (Bellitto, 1996, p. 275). Other texts might be picked "on the basis of there being distinguished books on the topic" (Richgels, Tomlinson, and Tunnel, 1993, p. 163). Other small samples might be selected due to longitudinal studies, "the present study, then, examined two 1950's and two 1980's U.S. history textbooks" (Regester, 1991, p. 15). Commeyras and Alvermann (1994) informed their readers, "we choose these textbooks for their recent publication dates, their

marketability, and the reputation of their publishers" (p. 268). Obviously, with each criteria listed, the sample becomes more limited. Many researchers just use texts "that are currently being used" (Gregson, 1996, p. 31). Some larger samples have occasionally been used. Osler (1994) analyzed 36 texts, Sims 1997) 17 texts, and Rowell (1997) 19 texts.

Categories are the assignment of recording units into groupings. The groupings are related to the topic of interest in content analysis. For example, Bracken and Urbancic (1997) choose 17 categories to perform their content analysis on the internationalization of introductory accounting books. Some of the categories they chose included analysis of foreign financial statements, issues in multinational transfer pricing, unique management accounting issues for multinationals, and harmonization of international accounting systems. All of these categories were important links for the researchers to answer their questions about internationalization in introductory accounting books. Reynolds (1993) chose eight categories in her analysis to access English textbooks as a second language. These were based on prior authors' categories such as top-down thinking, problem-solving methods, examples of grammatical structures, encouraging students to find information on topic being discussed, and reading selections which stimulated opinions. In all eight categories, no text was identified as meeting all the criteria. Bishop and Orden (1998) used four categories in their research, while Witt (1996) based her analysis on only two categories, male and female characters to determine gender role orientation of basal readers. Knopp (1995) analyzed Christopher Columbus in social studies

textbooks. He used categories such as adjectives used to describe him, treatment of him as a hero, and noting his frequency of appearance in the text (p. 57). Graci (1989) used six categories, as determined by Kingston and Lovelace (1978), to analyze if foreign language textbooks are sexist. Some of these categories included more male than female pronouns, double standards, stereo typed male/female roles, and criticism.

Recording units are the basic unit of text to be classified. Recording units include word, sentence, paragraph, and theme. In some instances researchers use pages, chapter headings, citations, and other various units. Richgels et al. (1993) uses what they deem as a T-unit. "A T-unit is an independent clause and any modifiers and dependent clauses occurring with it" (p. 363), to compare history textbooks and trade books. This allowed comparisons of "sentence length, sentence complexity, degree and nature of subordination, macro-level use of organizing predicates, and micro-level coherence (p. 161). Vacc (1993) used "a computer-generated word frequency content analysis procedure ... to determine the relative frequencies of specific words or phases within a text for the purpose of making inferences" (p. 334). She further states "the primary datum for the program was the semantic unit, which is a small group of words that has meaning only as a set. The data analysis provided a set of alphabetically ordered semantic units from the narrative and their surrounding words" (p. 336). Hobbs, Westling, and Hatoum (1996) used "tables of contents, indexes, chapter headings, and all chapter summaries in each text were reviewed for references to key words, phrases, and topics" (p. 74), relating to

positive behavioral support in special education textbooks. Shen (1994) in examining the changing image of the United States in China's geography textbooks for elementary to high school, used paragraphs and pages as the unit for content analysis. Grosse (1992) in researching the cultural content of business Spanish texts used as a content analysis unit "counted pages, devoted to business, language, and culture" (p. 224). Stolley and Hall (1994) studied content analysis of abortion and adoption in marriage and family textbooks. The "material to which we were directed by each citation was coded for primary thematic content" (p. 269).

Coders are used for reliability and validity purposes. Schumm, Haager, and Leavell (1991) used three coders to evaluate ten randomly selected texts. "Interrater reliability (.85) was established, differences were resolved through conferences, and guidelines were revised accordingly" (p. 44). Foster and Iannaccone (1994) used a graduate assistant as a coder for their research on multicultural content in introductory special education textbooks. "Independent interrater reliability was established utilizing several samplings from a second text that was independently analyzed by the investigators and the graduate student" (p. 80). They claimed an interrater agreement of 99%. Reqester (1991) used only one coder for her research on United States history books of the 1950's and the 1980's. "This coder was trained for coding the data into appropriate categories. An 80% agreement rate was obtained" (p.17). Bishop and Orden (1998) acted as their own coders for their research. They "found two differences in the category assignment, with discussion, these two differences

were easily settled: (p. 152). It was noted that they "discussed the terms and categories on the two coding sheets to ensure a common understanding" (p. 152). Witt (1996) research was to determine gender role orientation on basal readers. "The master list of behaviors was rated by three individuals using the masculine and feminine traits on the Bem Sex Role Inventory" (p.307). Raters would read a behavior and rate it according to males or female traits. "After all rating was completed, raters were in agreement on all but seven" (p. 307). Wade and Iowa (1993) state, "The social studies doctoral student was trained in the coding procedures for this study. Both of us coded the entire sample; the interrater agreement for coding of the sample was 92%. We discussed any differences in coding until we achieved consensus" (p. 234).

Content Analysis and Statistical Textbooks

Statistics, mathematics, and the other sciences such as chemistry, biology, and physics are usually thought of jointly as the "sciences." There has been much research on science textbooks for high school level and the lower grades (e.g., Anderson and Botticicelli, 1990; Chiappetta, Fillman, and Sethna, 1991; Lloyd, 1990; Pizzini, 1992; Smarts, Anderson, and Swetz, 1994). There has been much research on science textbooks in small areas of interest. Burrow (1990) performed a content analysis on elementary science textbooks on the topic of potential magnet misconceptions. He choose ten textbooks and concluded that students have knowledge of magnets. "Frequently, this knowledge is in conflict with scientific knowledge" (p. 720). Dall'Alba, Walsh,

Bowden, Martin, Masters, Ramsden and Stephanon (1993) examined how acceleration was treated in physics textbooks.

Three textbooks were analyzed by Groves (1995) to assess "a measure of vocabulary loads presented in current science textbooks" (p. 231). It was found that far too many vocabulary words are presented in the texts. Chiang-Soong (1993) used eleven of the most frequently used secondary science textbooks in the United States to "provide information concerning the match of current goals and direction for science education" (p. 341). She examined the main ideas, lab activities, science and technology-related issues and problems, as related to society. Parmar and Cawley (1993) examined science textbooks for their "appropriateness of the science instruction that students with disabilities are receiving in general education or special education settings" (p. 518). Most of the texts examined did not address the needs of the disabled students.

Biology or life science books have been examined using content analysis (e.g., Eltinge and Roberts, 1993; Chiapetta, Sethna, and Fillman, 1993; Liebermann, Hampton, Littlefield, and Hallead, 1992). Several articles dealt with analyzing these textbooks (e.g., Aleixandre, 1994; Glenn, 1990; Jeffery and Roach, 1994). Lucas and Scharmann (1991) analyzed two textbooks for their laboratory instruction. They state, "Content analysis is a useful tool in making predictions about written materials, the receiver of the materials, and the relationships between the materials and the receiver" (p. 232). An interesting study by Potter and Rosser (1992) on five seventh grade life science textbooks was performed to examine factors, which actually deter girls' interest in science.

It was found that the texts "represent a relatively low level of integration of achievements of women scientists" (p. 677). They further state; "it is difficult to find a book that is uniformly female friendly" (p. 684).

Chemistry textbooks have also been a rich field for the content analyst. Staver and Lumpe (1993) examined 36 high school and introductory college chemistry textbooks with their presentation of the mole concept. They quoted Stake and Easley (1978), "that 90% of all science teachers use science textbooks 90% of the time" (p. 324). They also stated that content analysis "is useful to describe content of communications" (p. 324). De Berg and Treagust (1993) analyzed gas properties in chemistry textbooks. They used 14 Australian high school chemistry textbooks. They reported that "current pedagogic practice involves minimal use of the qualitative relations of gas laws" (p. 880). Niaz analyzed 23 textbooks on the structure of the atom. He concluded that "most of the textbooks seem to emphasized experimental details based on observation and generally ignore the "heuristic principles" that lead the scientist in the first place to design their experiments" (p. 547).

Chiappetta, Sethna, and Fillman (1991) examined the content of seven high school chemistry books for curriculum balance and emphasis on science as a body of knowledge, as a way of investigating, and as a way of thinking. "Chemistry textbooks, as well as science textbooks, should help to make science interesting, relevant, and understandable to students" (p. 940). Interestingly, the three coders used for this analysis were a precollege chemistry teacher, a science educator, and a chemist. The interrater agreement was from 82% to

92%. Thiele and Treagust (1994) use 13 categories in their examination of ten Australian chemistry texts. These categories included such areas as chemical bonding, acids and bases, atomic structure, periodic table, reaction rates, and solutions.

The literature for college textbook evaluations is far from satisfactory though. "There is far less literature on evaluating college texts than on evaluating the lower grades (Harwell, Herrick, Curtis, Mundform, and Gold, 1996, p.3). Unfortunately, the literature has had very little research performed on statistical textbooks and in particular, multivariate statistical textbooks. It is recognized that statistical textbooks are very important. "Statistics as an applied science is applied in the service of science itself; it serves as a tool in other scientific investigations" (Bradley, 1982, p.2). It is also recognized that statistical courses are acknowledged as being very difficult. "Required courses in statistics are among the most feared by graduate students" (Bradley, 1982, p.3). Bradley further states that "the first course in statistics is often dull and badly taught" (p. 14). Cobb (1987) feels that, "It is no wonder that survivors of such courses regard their statistical tools more as instruments of torture than as diagnostic aids in the art and science of data analysis" (p.331). It is therefore important that one should evaluate textbooks to ultimately help the student to enhance their knowledge of statistics. "Evaluating texts is an important activity associated with teaching statistics. Surprisingly, the statistical literature offers little guidance on how these evaluations should be conducted" (Harwell et al, p.3).

Only a handful of studies appear on statistical textbooks. Even with introductory statistics textbooks, one would expect to find a larger smattering of studies. One would envision less so, with multivariate statistical textbooks. If not the actual textbooks, one would expect to find studies on classroom techniques to help enhance and reinforce the students understanding of statistics. Chervany, Collier, Fienberg, Johnson and Neter (1977) state, "One would expect to find a multitude of studies evaluating the various teaching tools and techniques that have been tried in introductory statistics classes" (p. 18). For statistical courses most "students are bored, find the course difficult, unexciting, and look forward to being done with it" (Chervany et al., 1977, p. 18). A good textbook would definitely aid in the understanding of the material, which would subsequently, enhance their comfort level to the subject. Hopefully, this then would also help to increase their enjoyment level of the subject. "For many students, this a terminal course that provides the only systematic exposure to statistical concepts and methods dealing with the collection and analysis of the data which they receive in their college career" (Chervany et al., 1977). Chervany et al. (1977) shifts the interest from a textbook to the classroom, "One would expect to finds a multitude of studies evaluating the various teaching tools and techniques that have been tried in the introductory course. Unfortunately, this expectation has not been realized; such evaluative studies are a scarce commodity" (p.18). Cobb (1987) states, "Judge a statistics book by its exercises, and you cannot go far wrong" (p. 331). He goes on further, "the quality of a book's exercise, is the one that I regard as most important, because I believe

that a student's experience with a statistics course is shaped far more by doing homework than by attending lectures and reading chapters" (p. 321).

Although, Harwell et al. (1996) state, "there is surprising little literature on how evaluations should be conducted" (p.4). They feel that the absence of theory based rationale and empirical evidence supporting the usefulness of criteria that the "instruments have not been carefully constructed often resulting in subjective evaluations of statistics texts" (p. 4). They further state, "While subjective evaluations have some merit, subjective and experimental evaluations can usefully be complemented by information obtained from theoretically sound, empirically based instruments" (p. 5).

Other authors have expressed concerns with the mathematics used in the textbooks. Kempthorne (1980) stated that "statistics is not mathematics, the foundations are not in mathematics; mathematics should be the servant of statistics and not the master" (p.17). Cobb (1987) brought up a thought provoking statement, "The authors' assurance that their book uses only high school algebra often carries with it an unstated assumption that their readers, like their book, include use of high school algebra. Sadly, many have been exposed, but few have truly assimilated" (p. 322). The preface in most books indicates the math level intended for the user of the book. Cobb states once again that "I no longer put as much faith as I once did in what the preface claims" (p. 322).

Much of the minute research in statistical instruction, comes down to, in many cases, research associated with classroom techniques and teaching.

Evaluation of the textbooks many times have to do with the particular topic, which the researcher is interested in, or what they can successfully publish. Shvyrkov (1984) states "we do not need to preach what should be practiced. Certainly judging what is practiced and should be practiced in statistics is not easy" (p. 151).

In 1980, Brogun used a rating system to evaluate various aspects of texts, including an introductory statistics text for nurses. Cockerill and Fried (1991) analyzed some introductory statistical texts, but offered no rationale for the rating system they used. Huberty and Barton (1980) used Likert type questions to evaluate text exercises, how-to-do, coverage, and readability in multivariate statistics textbooks. Cobb (1987) compared sixteen introductory statistical texts by their topics covered, quality of exercises, and technical level. Cobb relied solely on his own subjectiveness to evaluate these texts. Brewer (1985) evaluated six behavioral statistics textbooks. His purpose in this instance was to find statistical "myths and misconceptions" in the texts. Kahneman based this on the premise in 1971 (cited by Brewer) that many behavioral statistics books were guilty of misunderstanding and application of statistical concepts. This has always been of concern to those who are mathematics statisticians. They feel that more pure math has to be applied to any textbook purporting to be a statistical textbook. His research concentrated on inferential statistics because this is one of the main subjects in statistics, which has a propensity to misinterpretation. Brewer stated, "The area of inference is chosen ... because it is probably the most misunderstood, confused, and abused of all possible

behavioral statistics topics" (p. 255). Brewer also performed a content analysis on the texts for confidence intervals, sampling distributions, and central limit theorem. His analysis showed that, "In their attempt to explain inferential statistics in such a way as to make sense to the readers, authors of some behavioral statistics have sacrificed correctness" (p. 264). Another reason he gives for bad textbooks is "If an author is ignorant of statistical theory, the editor is ignorant of which reviewers are knowledgeable of statistical theory, and textbook purchasers are ignorant of statistical theory, then it is no wonder that misconceptions are fostered through published texts" (p. 264). He further writes that those with the theoretical and mathematical knowledge of statistics, "are often less than cooperative in structuring and teaching social and behavioral statistics courses that provide a practical, sound, and conceptual foundations in statistics with the usual multiple mathematics prerequisites" (p. 265). Thus, behavioral researchers teach the courses. He additionally feels that these same researchers also will write textbooks on the subject, which they are ill prepared to write.

Liu and Stone (1999) performed a content analysis on 44 introductory business and economics statistical textbooks to examine their coverage of hypothesis tests. They concluded that 40 of the 44 textbooks used the simple null hypothesis, and only four used the composite null hypothesis approach. They stated that the authors of introductory and business statistics textbooks face a difficult tasks trying to "explain and illustrate complicated mathematical and statistical concepts to students who typically find these concepts difficult to

comprehend and to use" (p. 62).

Prave and Trussler (1995) performed a content analysis on twenty introductory business statistics textbooks to determine the amount of internationalizing represented by problems, exercises, and applications in the texts. Surprisingly, in this day and age of globalization, in "one quarter of the textbooks examined, less than 1.00% of the exercises dealt with international material of any kind" (p. 230). The authors feel that this is a great opportunity for imparting international knowledge. They surveyed their students who felt that "more international examples should be added to the business statistics texts, and to the business statistics course" (p.241).

Huberty (1993) performed an analysis on 52 statistical textbooks to determine the treatment of Fisher versus Neyman-Pearson views of statistical testing. He expressed that introductory and advanced statistical texts, stress using an alpha level equal to 0.05. He stated that most authors would cite Fisher as support for their choice of this alpha level. The author cites Fisher to contradict this misconception, "no scientific worker has a fixed level of significance at which from year to year, and in all circumstances, he rejects hypotheses; he rather gives his mind to each particular case in the light of his evidence and his ideas" (p. 301). Secondly, and more importantly for this dissertation he states in his conclusion, "it is not statistical testing itself, but rather the textbook presentations ... that should be scrutinized" (p. 331). Doane (1994) analyzed principles of total quality management, in introductory business statistics and production operations management textbooks. He found that

production and operations management textbooks contained more coverage than statistics textbooks. He examined chapters, which were identified as being devoted to quality through the table of contents. He then scanned them for fifteen key words such as quality, Taguchi, Deming, and control charts. He then counted pages that were devoted to quality. In examining 95 texts, he found that before 1982, textbooks showed little or no coverage of quality. He brought up two important points. First he stated, "business statistics texts include applications from accounting, economics, finance, human resources, marketing, management information systems, and production" (p. 301). This is very similar to the social science statistics textbooks, which use many examples and exercises from the various fields. Secondly, for the actual evaluation of the text he states, "a more precise metric for measuring quality would be to count words rather than pages" (p.302). In content analysis, usually a topic is investigated by using counts of words, sentences, or paragraphs.

In summary , this comprehensive review of the literature on content analysis shows that it is a viable and successful technique used for quantitative and qualitative analysis without using subjective or impressionistic judgment. Content analysis enables researchers to identify the important variables or relationships among the variables. It is a analytical technique used for a wide range of purposes. It is clear that while content analysis has been used in a variety of settings, such as analyzing newspapers, advertising campaigns, television content, songs and propaganda literature, it has not been used as frequently in the evaluation of statistics textbooks. Of those statistics textbooks

evaluated, most were introductory texts concerned with classroom techniques and teaching. Most times, the authors own subjectiveness is used for evaluations. There has been no content analysis used to analyze graduate social science multivariate statistical textbooks.

CHAPTER 3

METHODS AND PROCEDURES

Introduction

This dissertation was concerned with the content analysis of multivariate statistical textbooks for the social sciences. Files were created by optically scanning documents from the textbooks. Chapters on canonical correlation, discriminant analysis, factor analysis, multiple analysis of variance (MANOVA), and multiple regression were scanned in, resulting in approximately 1,100 pages of text. The files were then loaded into a Hewlett Packard Pavilion computer. Categories were developed which were relevant to analyzing the multivariate textbook chapters. Words were used to identify pertinent text, which were related to the categories.

A study of reliability of content analysis on this subject matter were instituted. The study involved two reviewers analyzing text on the same sample that had been analyzed by the researcher.

Multivariate Statistics Textbooks

Using the websites of the following mathematical and statistical publishers, a search for social science multivariate statistical textbooks was conducted:

Academic Press

Addison-Wesley

Allyn & Bacon

Bobbs-Merrill

Brooks-Cole

Cambridge University Press

Charles E. Merrill

Freeman and Company

Harper and Row

Holden-Day

Holt, Rinehart and Winston

Houghton-Mifflin

John Wiley & Sons, Inc.

Lawrence Erlbaum Associates

Little-Brown

McGraw-Hill

Norton and Company

Oxford University Press

Sage Publications, Inc.

Scott Foresman

Springer

Wadsworth

In addition, the amazon.com website was searched under statistics and multivariate statistics. General and self-help multivariate books and textbooks were excluded from this research. Only books designed for classroom use were

included in this study. Only those texts published in the United States were also considered for use. Those texts with only a mathematical level of high school algebra was examined. After reading the reviews, comments by both the publisher and in many cases the authors, and noting the comments by people who have purchased the textbooks, the possible candidates were then presented to my major advisor. After a discussion and review by him of all the possible contenders, a winnowed list of books was obtained. These books were then purchased and presented once again to my major advisor. From these textbooks came those books which were used for this research.

Not included in the analysis were graphs, charts, or illustrations in the textbooks, even though content analysis has been used quite successfully in such studies in the past. Files were generated using only text from the currently chosen published multivariate statistics textbooks. Indexes and outlines to chapters were also excluded. In addition, definitions and glossaries were also not considered.

Defining the Recording Units

There are basically three types of content analysis, (a) qualitative, (b) contingency, and (c) frequency counts. Qualitative content analysis determines if certain categories or themes are represented in the document being analyzed. For example, a statistics text mentions the term Lisrel. In frequency counts, the units for coding are stated, and coding categories are defined. A frequency count is then made of the units in each category. The third and final category is

contingency analysis. In this technique, the researcher wants to see the number of times a combination of two or more categories are found together in the same document. This might occur when a researcher for example, wants to find the number of times bad statements are made in connection with the president of the United States in a document. It is the last category, contingency analysis that this research used in analyzing multivariate statistical textbooks. Contingency analysis enabled the research to note the emphasis that the authors placed on the various statistical categories in the texts.

In content analysis units can be broken down into whole text, paragraphs, word sense, theme, sentence, and words. Whole text involves defining the whole text as one unit. If the article or document is very short, it can be analyzed according to this method. This is difficult to do so with any reasonable longer texts and the reliability tends to be very low. In addition, whole text can be used if categories are of a general nature. Low reliability once again is a problem with coding of paragraphs. Paragraphs can cause problems when more than one subject is contained per paragraph, although, some studies use paragraphs to categorize whole article content. At one time analyzing paragraphs was a short cut to using smaller units, but with the availability of the personal computer, paragraph analysis is no longer a necessity. Computer programs can now use word sense coding. Word sense can distinguish between words with multiple meanings. Word sense might be used in political speeches where a jumbling of similar words or terms is common. Theme is another coding unit, which is good in analyzing speeches. It preserves

important information, and provides a means of distinguishing between phrases in different sentences. Themes can sometimes give more information than words. Themes are a single idea or item that information can be extracted from. The sentence is a commonly used content analysis code. This is because researchers are often interested in words and phrases which occur closely together. The final technique uses words as codes. Word coding codes each word of a text.

Word coding was chosen for this content analysis of multivariate statistical textbooks. These texts used very specific statistical words in their explanations, and it is these very words that made up the specific keywords and synonyms under the various categories for this analysis. The content unit is the material surrounding the coding unit. In this study the sentence was the content unit that contained the word coding unit.

Categories

"No content analysis is better than its categories" (Budd, et al, 1967. p. 139). Categories can be viewed as variables, which are mutually exclusive. This should be the case when using multivariate procedures such as factor analysis, regression, and multiple analysis of variance. They formed the actual counting of words in this study and the actual basis on the difference of multivariate statistical textbooks. The categories are compartments, which define boundaries into which the material would be grouped for analysis. The categories must be fit to the study, be exhaustive, and be mutually exclusive.

In this study, the categories were suggested by the chapter titles in the texts, and also by the main topics which are usually associated with multivariate statistics. The following categories were used:

Multiple Regression

Discriminant Analysis

MANOVA

Canonical Correlation

Factor Analysis

These categories were explicit and also relevant to the investigation. Under each category were the key words and their synonyms, which were used in this analysis. Each word was also explicit and relevant, so that other researchers will be able to examine this material and be able to come up with the same results.

Key Words

As mentioned, each category had key statistical words or related terms that were used for the analysis. The initial search of these words were determined by software written and developed by Dr. Donald Marcotte, professor of Educational Evaluation and Research, College of Education, Wayne State University, Detroit, Michigan. Dr. Marcotte has successfully used this software for papers, research, and consulting. The words were examined and winnowed by using Dr. Marcotte's years of teaching experience and consulting until a successful group of ten words per each category was found and agreed upon.

Coders

Two coders were used for text content analysis. One is a supervisor in engineering at Ford Motor Company with a degree in engineering and a master's degree in statistics; he currently is a Master Black Belt in the Six-Sigma program. The second coder is also an engineer at Ford Motor Company. Both of these coders are familiar with statistics and have a working knowledge of multivariate statistics. By analyzing the results of the coders and comparing them to the results of this research, it was anticipated that a reliability of at least 0.70 could be obtained.

Computer Search

The actual computer search of the text, after the scanning process, involved the highest frequency multivariate statistical words. This was done when the computer searched through the text to retrieve sentences, which had at least one word in a category. The amount of sentences retrieved were expanded or narrowed based on the amount of key words picked for each category. More criteria created more sentences, less criteria created less sentences. No general guidelines exist in content analysis for criteria retrievals.

It was assumed that the most frequently occurring statistical words were also the more important words. This translated into observing the words, which should fall under the chosen categories. Those words accounted for the largest proportion of each chapter in the texts. This type of analysis assumed that the

most frequently appearing words reflect the authors greatest concern or emphasis. What we most often repeat is what is most important to us. There is a caution, which goes along with this assumption. A word can possibly have more than one meaning, and if the word is used a lot in one text, it can cause problems with inferences and validity. This researcher felt that with the selected statistical words, no such problems occurred due to their precise nature.

Spearman Rho Correlation Coefficient

Researchers in content analysis have used a variety of statistical data analysis techniques to analyze data from text. It this research, it was decided to use the Spearman Rho Correlation Coefficient. The Spearman Rho Correlation Coefficient is a nonparametric test. This means that there are limited assumptions about the distribution of the data. In parametric testing, there are assumptions that the groups of data are independent random samples from a normal population and that the group variances are equal. When we analyze the data from these small samples, we see that there are serious departures from the aforementioned assumptions. Nonparametric tests are sometimes called distribution free tests. In the Spearman Rho Correlation Coefficient test, actual data is replaced by ranks. The lowest point of data is ranked as 1, going from lowest data score to the highest scores of data for the two variables combined. In this test, the strength of the linear association is measured between the two variables being investigated. A positive relationship indicates high scores of one variable corresponding with high scores of the other variable.

A positive relationship also indicates low scores with one variable corresponding with low scores with the other variable. A negative relationship indicates low scores corresponding with high scores of the two variables, or high scores corresponding with low scores. The values of the coefficients are between -1.00 and +1.00. A value of +1.00 reflects a perfect positive relationship, while a -1.00 reflects a perfect negative relationship. A value of 0.00 indicates no relationship between the two sets of variables.

Reliability

Reliability means repeating results with consistency. It basically means using the same techniques on the same material, and getting similar results. Split halves, test-retest, and equivalent forms can be used to check reliability in content analysis.

In split halves the text is divided into two halves, and analyzed. The results are then compared. In test-retest, the same text is analyzed. If the scores do not change by much, reliability has been established. A simple percentage can be used to compute reliability by coders analyzing the same material. It is also a test of the coder's ability to understand and follow instructions. If correlation is low, one coder might need to be eliminated. If all coders are having troubles, then keywords and instructions must be reassessed.

Reproducibility was used in this study. It refers to intercoder reliability, which is the extent to which the same text is coded by more than one coder. In this research, two coders analyzed 220 randomly chosen sentences of

concatenated text from the multivariate statistics textbooks. Each coder was given the Sentence Category and Associated Word and Phases Key Guideline to help them determine the various sentence categories. The results of this analysis by the coders served as a measure of reliability. In content analysis there is no acceptable level of reliability. High reliability has been achieved in simple forms of content analysis, which has been demonstrated in the literature. In this study a coder reliability of 0.70 was considered an acceptable level of reliability.

Another measure of reliability is the actual key words chosen for each specific category. Some categories and keywords have been widely employed in dictionaries, which are used automatically when performing content analysis on topics related to the social sciences. This was an exploratory study, and thus there were no such categories or keywords for studying multivariate statistical textbooks. It certainly would have been useful to have had such an instrument.

In addition, there is some evidence in the literature that the reliability of content categories and keywords vary by the level of aggregation. In content analysis of the same texts, the sentence has the highest reliability, whereas the reliability for paragraphs is slightly lower. The reliability at all levels of aggregations is substantially less that the reliabilities for specific word or phrases.

In summary, the multivariate statistical textbooks investigated were for graduate social science students. The texts were only to have a mathematical level of high school algebra, and were only published in the United States.

Through a winnowing process only three texts were chosen. Multivariate statistical technique categories chosen for this study were multiple regression, discriminant analysis, MANOVA, canonical correlation and factor analysis. Word coding was used for this content analysis. The key words picked for each category were initially determined by content analysis software developed by Dr. Donald Marcotte. The words were then finally winnowed down to a list of ten for each category. Two coders were used to determine the reliability of the concatenated sentences. Spearman rho correlation was used to analyze the concatenated sentences from each chapter and text.

CHAPTER 4

RESULTS AND DISCUSSION

Textbook Selection

Every major publisher of statistical and mathematical textbooks has published numerous statistical textbooks. Many used calculus and were beyond the confines of this research. Others had many basic statistical textbooks which they publish but very few editions of multivariate statistical textbooks. Most publishers had only a few, and in some cases up to ten or twelve, multivariate statistics textbooks they publish. There are general publishers of textbooks who also publish general multivariate statistical textbooks for non-classroom use. Amazom.com listed approximately 570 multivariate textbooks. Many of these books are soft cover editions of the hardcover books. Many of these books after investigating their indexes, summaries, write-up, and reviews were deemed not to be in the textbook category. Many others were eliminated due to the publishers being outside the United States. Lastly, many of the remaining books used higher mathematics (calculus). After the initial sorting process approximately 30 books remained. The various write-ups were reviewed, which could be obtained off the web from amazon.com and also their publishers.

From the original list of 30 books, seven were chosen for further examination. This was done by reading the write-ups and discussing if these texts matched graduate social science students' needs. Surprisingly, some books did not contain the five basic multivariate statistical techniques that were

to be examined. Other books, after reading the comments more carefully, were truly at a higher mathematical level than what the research required. Other texts did not mention the social sciences in their reviews, summaries, or comments. It was finally decided to order seven textbooks for final review.

The remaining seven texts were reviewed. Along with the visual review, examination of the text and introduction, and returning back to reviews, three textbooks were selected for this study. Two of the three books selected had been used many times at Wayne State University's college of Education, Research and Evaluation Department. The third book coincidentally had been used at Wayne State University's Department of Psychology. Three of the last seven texts examined were deemed too difficult for the graduate social science student. Matrix algebra and calculus were employed. One of the textbooks though, did get a five star out of five star rating from those who reviewed the text on amazon.com. One of the texts eliminated had only a three-and-a-half star rating on this website. The two textbooks eventually winnowed down to be involved in this study had five star ratings from amzaon.com, while the other text picked for this study had a four-and-a-half star rating.

Mathematical Emphasis

There were no mathematical formulas or expressions analyzed in this research for evaluation. Only written text was scanned into the content analysis software. To obtain a mathematical focus of each textbook and their authors, specifically as they related to matrix algebra, a search of two keywords for each

of the chapters included in this study were performed. As stated earlier, it was felt that graduate social science students having a limited mathematics background, many having only a level of high school algebra. It was decided to use the keywords matrix and vector, to examine the mathematical emphasis of the various textbooks and their chapters. The word matrix is usually representative of higher mathematical expression. It deals with the knowledge of matrices, which means the students using these textbooks are expected to have had a college matrix algebra mathematics course. The word vector also is associated with matrices. Therefore, we would not expect to see either word employed to a great extent in the examined textbooks.

Table 1 shows the amount of word usage of the words matrix and vector from the chosen texts, broken down into the various statistical techniques. Out of 30 possible chapters examined, 14 chapters did not use either one or the other, chosen keywords. This told us that the level of the mathematical emphasis chosen for these chapters had a lower level of mathematics. Comparing individual authors, it was noted that Textbook Three did not make use of the word vector for any of the multivariate techniques. She did though use the word matrix for all her chapters. Thus, Textbook Three had a higher mathematical usage by using the word matrix, rather than the word vector. Textbook Three did state in the preface of her book, "The math is wonderful and we suggest that students follow along through the fourth section of each chapter using readily available software for matrix manipulations or spreadsheets" (p. XXV). When we compared Textbook Three with Textbook

Table 1

Matrix and Vector Word Percentage Usage

Multivariate Technique	Matrix			Vector		
	Book One	Book Two	Book Three	Book One	Book Two	Book Three
Canonical Correlation	0.0	0.0	0.2	0.0	0.0	0.0
Discriminant Analysis	0.2	0.1	0.3	0.1	0.1	0.0
Factor Analysis	0.3	0.4	1.1	0.0	0.0	0.0
MANOVA	0.0	0.2	0.8	0.1	0.1	0.0
Multiple Regression	0.0	0.1	0.2	0.0	0.1	0.0

Note. Percentages were calculated by the number of times the words matrix and vector appeared in a given chapter, divided by the total word count for that specific chapter. This will hold for all tables when speaking of percentages in this research.

One and Textbook Two we fdound that she used the word matrix more often. It can then be suggested that this text might be more difficult for a graduate student in the social sciences with a limited mathematics background than the two other authors. Textbook One on the other hand used the word matrix less than either Textbook Two or Textbook Three, suggesting that the material was possibly easier to read and promoting a better comprehension by the students. Textbook One states, "We have continually striven to reduce our reliance on statistical notation and terminology and instead identify the fundamental concepts that affect our use of these techniques and express them in simple

terms" (p. XV). He further goes on, "Feedback from earlier editions indicates that even readers with advanced statistical backgrounds find the book useful for review and convenient reference" (p. XVI). Textbook Two had a slightly higher mathematical expression than did Textbook One. Textbook One and Textbook Two usage percentage for the term vector were the same.

Comparing the words matrix and vector across the various multivariate techniques, a greater mathematical emphasis for discriminant analysis, factor analysis, and MANOVA were found. In particular, factor analysis and MANOVA use of the word matrix was greater than the other techniques. When examining the word vector across the various statistical techniques examined, it was found that canonical correlation and factor analysis had no vector usage, while discriminant analysis, MANOVA, and multiple regression had slight usage.

This examination for the usage of the words matrix and vector in the chosen multivariate statistical textbooks gave us a focus of these books in terms of mathematical emphasis. We obtain a feeling of how the authors are trying to write and express the various statistical techniques employed in these chapters and books. It is a starting point without examining the actual mathematical formulas, theories, and derivations of the calculations, which might be involved in multivariate statistics. The fact that some differences have been noted was a starting point in this exploratory content analysis research.

Power

Power is a fundamental consideration when working with multiple

variables. Power is the probability for rejecting the null hypothesis when it is actually false. Power is defined as 1 minus the probability of a Type II error. If beta represents the probability of Type II error, then the definition of power is 1 minus beta.

Table 2

Power Word Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation	0.0%	0.0%	0.0%
Discriminant Analysis	3.0%	0.3%	0.5%
Factor Analysis	0.6%	0.0%	0.5%
MANOVA	10.0%	21.7%	1.2%
Multiple Regression	5.7%	8.1%	3.8%

Table 2 shows the word power percentage usage from the chosen texts, broken down into the various statistical techniques. Out of a possible fifteen chapters, eleven chapters used the word power. This researcher would have thought that all fifteen chapters would have used the word power in some type of discussion of the statistical techniques being deployed. All the texts examined did have introductory or preliminary chapters, which did discuss the fundamentals of statistics in which power was discussed. These chapters were

out of the confines of this research. When comparing individual authors it was noted that Textbook Two did not use the word power for either canonical correlation or factor analysis. Textbook One and Textbook Three also did not use power in their canonical correlation discussion. Interestingly enough, Textbook Two, with two chapters lacking the word power, had a higher usage percentage for the chapters with power (0.3%, 21.7%, and 8.1%) than does Textbook One (3.0%, 0.6%, 10.0%, and 5.7%) and Textbook Three (0.5%, 0.5%, 1.2%, and 3.8%). It was suggested, that Textbook Two with a more higher usage percentage per techniques would better serve the student in understanding the concept of power and how it relates to multivariate statistics and it's techniques.

Comparing the word power across the various multivariate techniques we found a greater emphasis for MANOVA (10.0%, 21.7%, and 1.2%) and multiple regression (5.7%, 8.1%, and 3.0%) by all three of the authors. Discriminant analysis (3.0%, 0.3%, and 0.5%) and factor analysis (0.6%, 0.0%, and 0.5%) had a lesser percentage usage of the word power. None of the authors used power in their discussion of canonical correlation.

Before proceeding, an explanation of the format of the appendixes will be discussed. All the appendixes were formatted the same way. Each appendix was broken down into the various statistical techniques along with the numbering of the textbooks heading up the columns. The first line of each technique gives the total number of sentences involved in each chapter for that specific technique. The second line of each statistical technique listed gives a

baseline number for that particular textbook. The baseline number of 1.00 was used to calculate expected word count from actual word count for each statistical procedure. It was determined by using the middle count or second highest number of total sentences for each technique. For example, when determining the baseline number for the three textbooks for canonical correlation, there were 304 sentences for Textbook One, 229 sentences for Textbook Two, and 445 sentences for Textbook Three. Textbook Three (445) had the highest word count, followed by Textbook One (304), and then Textbook Two (229). Therefore, Textbook One was picked as the baseline number of 1.00. All actual word counts in the canonical correlation category by Textbook One were given a baseline number of 1.00 in determining the expected word count from the actual word count. This means then that if the word correlation had a sentence count of 55 in the canonical correlation category, its expected sentence count would be 55 times the base number of 1.00 (55 X 1.00) or 55. In other words, all expected sentences are the same as the actual count for a particular word in a statistical technique for the same textbook deemed as having a baseline number of 1.00.

In determining the two other textbooks baseline numbers' for a particular statistical technique, the total number of sentences in a category were used to determine baseline against the total number of sentences against the ordained baseline. For canonical correlation, we once again looked at the total number of sentences of the two other textbooks compared to the determined baseline of 304 sentences. Textbook Two had 229 sentences, which would be compared to

the baseline or the second highest sentence total of 304. What we were doing was performing a simple division by placing the chosen baseline sentence total in the denominator and comparing it to the baseline total sentences. Therefore, 229 sentences of Textbook Two were divided by 304 sentences of Textbook One or the baseline, giving us an answer of 0.75. This baseline number was used to multiply all the sentence counts for the various words being examined under canonical correlation for Textbook Two. Thus, if we had an actual sentence count of 46 and wanted to find the expected sentence count we would multiply the expected sentence count by 0.75. For example, if we had an actual sentence count of 46 sentence for Textbook Two and wanted to find the expected sentence count we would multiply the baseline number of 0.75 by the actual sentence count of 46 (0.75 X 46), giving an expected sentence count of 35.

The percentage of total sentences were merely the actual count of sentences for a particular word(s) divided by the total amount of sentences in each statistical category by a particular author. If for example Textbook Three has 445 sentences in the canonical correlation statistical technique, and we found that there were an actual sentence count of 70 for the words canonical and loading, we divided the actual sentence count by the total sentence count in Textbook Three for the canonical correlation technique. We would divide 70 actual sentences by 445 total sentences (70 / 445) giving us a percentage of 15.7%. This then told us that 15.7% of the sentences in the canonical correlation statistical technique by Textbook Three had the words canonical and

loading in them.

If we examined for the key words power/alpha we observed only 3 chapters in which they are used. Textbook One used the power/alpha word combination ten times under the MANOVA chapter, and two times under multiple regression. Textbook Three used the words only once under her multiple regression chapter. Thus, we saw a very limited use of these keywords. If we compared this very slight usage to the one keyword power, we did observe that the highest amount of usage was also for MANOVA and multiple regression. Textbook One for both of these categories of keywords used these more than the other textbooks. When comparing the three combination words power/effect/size, we again saw that Textbook One has a usage under MANOVA and multiple regression again, with Textbook Two having some under MANOVA, and Textbook Three having only one sentence under multiple regression. For the three keyword combination of power/sample/size, Textbook One had more than the other textbooks with seven sentences under MANOVA, and seven for multiple regression. Textbook Two had seven sentences under MANOVA also, while Textbook Three had one sentence under the multiple regression technique. These numbers are small but do show that the authors are more concerned with power under MANOVA and multiple regression techniques. We also observe that Textbook One was more concerned under these two techniques than the other two textbooks about power, how every slight the numbers.

Keywords

Table 3 shows the ten most frequently occurring substantive words for the

Table 3

Ten Most Frequently Occurring Substantive Words

Multivariate Technique

Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
analysis	accuracy	analysis	dependent	coefficient
canonical	analysis	common	effect	colinearity
correlation	classification	component	error	correlation
dependent	dependent	correlation	group	dependent
independent	discriminant	factor	independent	determination
loading	function	loading	MANOVA	independent
redundancy	group	rotation	power	prediction
variable	independent	solution	univariate	regression
variate	maximize	variable	variable	standardized
set	variate	variance	variate	weight

various statistical chapters or techniques. The basis for this research was determined by the accumulated listing of the top occurring words for each statistical category. The words chosen for this listing were all statistical in

nature. Frequently occurring words such as and, the, and a, were not considered crucial for this research. This research attempted to analyze text through the use of the selected statistical words or terms. Plurals of words were counted in the totals. For example, the word variables were counted under the sentence totals for the word variable. The term independent and predictor were counted together, as were the terms dependent and criterion. In the case of the coefficient of determination (R^2), the words coefficient and determination were used. Ultimately any term not related to be statistical in nature was not considered to be a keyword. In addition, the top twenty terms were winnowed down to ten, based on the researchers knowledge of the various statistical techniques and more importantly, his major advisors' experience of over 30 years of teaching and consulting.

One Word - Keywords

After selecting the ten main statistical words under the five multivariate statistical techniques, if was decided to look at each of these words in terms of total amount of words used in each chosen chapter and in terms of each of the authors. Table 4 lists findings that were gleaned from Appendix A.

The highest word percentage under canonical correlation was the word canonical with Textbook One having 3.8%, Textbook Two 2.5%, and Textbook Three 3.0% usage. The second highest word percentage usage was correlation with Textbook One having 3.5%, Textbook Two with 2.5%, and Textbook Three with 1.2%. This would stand to reason that these two words have the largest

usages because they are connected with the statistical technique being

Table 4

One Word - Keywords - Word Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
Canonical	3.8%	2.5%	3.0%
Correlation	3.5%	2.5%	1.2%
Variable	2.7%	1.9%	2.1%
Discriminant Analysis			
Analysis	0.9%	0.6%	0.5%
Discriminant	1.9%	2.0%	1.4%
Group	2.1%	1.3%	2.4%
Factor Analysis			
Analysis	1.4%	0.4%	0.3%
Factor	4.7%	1.6%	3.3%
Variable	2.3%	2.7%	1.6%
MANOVA			
Dependent	1.1%	0.5%	3.0%
Group	1.3%	1.0%	0.4%

Table 4, Cont'd.

One Word - Keywords - Word Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Variable	1.2%	1.5%	0.7%
Multiple Regression			
Independent	1.9%	0.5%	0.8%
Regression	1.5%	0.8%	2.3%

discussed by the various textbooks in the canonical correlation chapters. The next highest word was variable, with Textbook One having 2.7% usage, Textbook Two 1.9%, and Textbook Three 2.1%. The single highest word usage across all textbooks and words for canonical correlations was the word canonical, with Textbook One having a usage of 3.8%. Second in highest percentage usage total was Textbook One once again at 3.5% with the word correlation. Finally, the third highest word usage percentage was by Textbook Three with 3.0% for the word canonical.

Under the multivariate technique discriminant analysis, the word group had the highest word percentage usage across all three textbooks. Textbook Three had a word percentage usage of 2.4%, Textbook One had 2.1%, and Textbook Two had 1.3% usage. The researcher would have thought as with the prior statistical technique canonical correlation, that discriminant analysis would

have also had the highest percentages for both discriminant and analysis. The word analysis had word usage of only 0.9% by Textbook One, 0.6% by Textbook Two, and 0.5% by Textbook Three. The highest individual word usage by a textbook was the word group by Textbook Three with 2.4%. The second highest was also group, with Textbook One having 2.1% usage.

Under factor analysis the word with the highest percent usage across the three textbooks was factor, with Textbook One having 4.7%, Textbook Three with 3.3%, and Textbook Two with 1.6% usage. The word variable had the second highest usage across the three textbooks with 2.3% by Textbook One, 2.7% by Textbook Two, and 1.6% by Textbook Three. Again, the researcher would have thought that there would be a fair amount of usage for the word analysis because it is associated with the statistical technique which is being discussed, factor analysis. This is not so. There was word percentage usage of 1.4% by Textbook One, 0.4% by Textbook Two, and 0.3% by Textbook Three. The highest word percentage for a word by a textbook was the word factor by Textbook One with 4.7%, followed by 3.3 % by Textbook Three for the word factor. This was followed by Textbook Two at 2.7% usage for the word variable.

Under MANOVA, the word dependent had the highest percentage sentence usage across all three textbooks. The usage was 1.1% by Textbook One, 0.5% by Textbook Two, and 3.0% by Textbook Three. This was followed by the word variable, with Textbook One at 1.2%, Textbook Two at 1.5%, and Textbook Three at 0.7%. The third highest word across all textbooks was the word group, with 1.3%, 1.0%, and 0.4% by Textbook One, Textbook Two, and

Textbook Three respectively. The highest individual terxtbook percentage was Textbook Three with the word independent with a 3.0%.

Finally, under multiple regression the word regression had the highest percentage total across all textbooks with 1.5% for Textbook One, 0.8% for Textbook Two, and 2.3% for Textbook Three. The second largest total was the word independent with Textbook One having a usage of 1.9%, Textbook Two a usage of 0.5%, and Textbook Three having a usage of 0.8%. The individual textbooks with the highest one word percentage usage was Textbook Three with 2.3% for the word regression. The second highest one word percentage of usage for a textbooks was Textbook One, at 1.9%, for the word independent.

Two Word Combinations

Under canonical correlation, two combinations stood out, canonical/correlation, and canonical/ variate. The combination words canonical/correlation had a large sentence usage, which reflected the statistical technique being investigated, canonical correlation. Textbook One had 31.9% sentence usage, Textbook Two 35.8%, and Textbook Three 17.8%. The other two word combination under canonical correlation with large sentence usage was canonical/variate. Textbook One had 19.4% sentence usage, Textbook Two 14.4%, while Textbook Three had a sentence usage of 32.4%. In comparing individual authors we observe no usage of the word combination dependent/independent for Textbook Two or Textbook Three.

Table 5

Two Word Combination - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
Canonical/Correlation	31.9%	35.8%	17.8%
Canonical/Loading	8.2%	0.0%	4.7%
Canonical/Variate	19.4%	14.4%	32.4%
Dependent/Independent	19.1%	0.0%	0.0%
Discriminant Analysis			
Analysis/Discriminant	11.0%	9.2%	3.1%
Dependent/Independent	1.8%	0.0%	0.3%
Discriminant/Function	6.0%	29.9%	21.6%
Factor Analysis			
Analysis/Factor	24.7%	8.0%	5.9%
Factor/Loading	15.4%	12.4%	13.5%
Factor/Variable	30.0%	15.6	36.0%
MANOVA			
Dependent/Variable	15.4%	11.8%	0.5%
Group/Variable	7.5%	10.2%	0.7%

Table 5, Cont'd.

Two Word Combination - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Multiple Regression			
Coefficient/Regression	8.3%	3.3%	6.0%
Correlation/Independent	0.0%	1.2%	0.0%
Dependent/Independent	9.9%	0.7%	0.0%
Dependent/Regression	9.1%	2.4%	0.1%

Textbook One has in this instance a usage of 19.4%. Textbook Two has no sentence usage of the word canonical/loading, while Textbook One has 8.2% and Textbook Three 4.7%.

Under discriminant analysis, as in canonical correlation, the two word combination for the statistical technique under discussion had a fair amount of sentence usage, Textbook One (11.0%) and Textbook Two (9.2%). Textbook Three had a usage of only 3.1%. The keyword combination discriminant/function had a large usage for Textbook Two (29.9%) and Textbook Three (21.6%). Textbook One had a lower usage at 6.0%. The two word combination dependent/independent had very low usage by all the textbooks, Textbook One at 1.8%, Textbook Three at 0.3%, while Textbook Two had no usage.

The word combination analysis/factor, under factor analysis also had

large sentence usage. Textbook One had 24.7%, followed by Textbook Two with 8.0%, and lastly, Textbook Three with 5.9%. Factor/loading had even higher sentence usage, with Textbook One at 15.4%, Textbook Two at 12.4%, and Textbook Three at 13.5%. The highest two word combination for factor analysis was factor/variable. Textbook One was observed at 30.0% usage, Textbook Two at 15.6%, and Textbook Three at 36.0%.

Under MANOVA the largest sentence usage for two of the three texts was the word combination dependent/variable. Textbook One had a usage percentage of 15.4, and Textbook Two 11.8%. Surprisingly, Textbook Three had a usage of 0.1%, with only one sentence having this word combination. Looking at individual textbooks, Textbook One had a usage of 7.5% for word combination group/variable with 40 sentences. Textbook Two also has a similar result with 40 sentences, in which this word combination appears for 475 total sentences, giving a percentage of 10.2.

In the multiple regression technique category, the two word combination coefficient/regression was the only keyword combination in which all three texts had a noticeable usage. Textbook One had 8.3% usage, Textbook Two 3.3%, and Textbook Three 6.0%. Individually, Textbook One had a sentence usage of 9.9% for the word combination dependent/independent. While for dependent/regression the text had a usage of 9.1%. Textbook One had 0.0% usage for correlation/independent. Textbook Two and Textbook One had many combinations in which there was no usage what so ever. Textbook Two had zero usage for the following combinations: coefficient/standardized,

colinearity/independent, dependent/weighted, independent/weighted, and prediction/weighted. Textbook Three had no sentence usage for the following two word combinations: colinearity/independent, correlation/dependent, correlation/independent, dependent/independent, dependent/prediction, dependent/weighted, independent/weighted, and prediction/weighted.

Three Word Combinations

Under canonical correlation, three, three word combinations had a fair amount of sentence usage. The combination canonical/correlation/variate had usage of 11.8%, 10.9%, and 7.2% by Textbook One, Textbook Two, and

Table 6

Three Word Combination - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CANONICAL/CORRELATION/ ANALYSIS	9.9%	5.7%	1.8%
CANONICAL/CORRELATION/ VARIABLE	7.6%	11.8%	6.5%
CANONICAL/CORRELATION/ VARIATE	11.8%	10.9%	7.2%
DEPENDENT/INDEPENDENT/ VARIABLE	12.8%	0.0%	0.0%

Table 6, Cont'd.

Three Word Combination - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
DISCRIMINANT ANALYSIS			
DISCRIMINANT/FUNCTION/ GROUP	2.2%	5.1%	6.4%
FACTOR ANALYSIS			
ANALYSIS/FACTOR/VARIABLE	11.1%	2.5%	2.4%
FACTOR/LOADING/VARIABLE	10.2%	6.3%	8.0%
MANOVA			
DEPENDENT/INDEPENDENT/ VARIABLE	3.2%	1.8%	0.0%
MULTIPLE REGRESSION			
DEPENDENT/INDEPENDENT/ REGRESSION	4.3%	0.0%	0.0%

and Textbook Three respectively. The usage is not as high as the prior sentence usages, which should be expected. As the amount of word combinations increase, one would assume that usage gets less due to the difficulty in finding more increased combinations in sentences. The combination canonical/correlation/variable has sentence usage of 7.6% for Textbook One, 11.8% for Textbook Two, and 6.5% for Textbook Three. Finally, 9.9% sentence

usage for Textbook One was observed for the word combination canonical/correlation/analysis, 5.7% for Textbook Two, and 1.9 for Textbook Three. Interestingly enough Textbook One had a 12.8% sentence usage for dependent/independent/variable, while both Textbook Two and Textbook Three had no usage. Observing all the data for this combination under canonical correlation we saw that Textbook One had a lot more sentence usage in general for the three word combinations, while Textbook Two had ten combinations where there were no usage what so ever. Likewise, Textbook Three had seven combinations of no usage.

Under discriminant analysis the three word combination discriminant/function/group was the only notable combination which had slight usage. Textbook One had 2.2% usage, Textbook Two 5.1%, and Textbook Three 6.4%. The 6.4% usage was the highest percentage under this category. Textbook One once again had more percentage usage, be it ever so slight. Textbook Two had two three word combinations with no usage, while Textbook Three had three, three word combinations with no usage.

Under factor analysis 11.1%, 2.5%, and 2.4% sentence usage for the combination analysis/factor/variable for Textbook One, Textbook Two, and Textbook Three respectively was observed. The combination factor/loading/variable had 10.2%, 6.3%, and 8.0% for sentence usage for the Textbook One, Textbook Two, and Textbook Three. The highest percentage sentence usage was for Textbook One at 11.1% for analysis/factor/variable. Once again Textbook One has higher percentage usage than the other two

texts. Textbook Two has six, while Textbook Three had four three word combinations with no usage.

The statistical technique MANOVA largest three word combination sentence usage was for the combination dependent/independent/variable for Textbook One at only 3.2%. Looking at all three texts, Textbook Three had no sentence usage for eight or her three word combination. Textbook Two had five combinations with no sentence usage, and Textbook One had one.

The highest sentence percentage of usage under multiple regression was only 4.3% with the three word combination dependent/independent/regression, for Textbook One. The other two texts had no usage under this combination. Comparing texts, Textbook One with all combinations had some usage, while Textbook Two had 14 combinations with no usage, and Textbook Three had 12 three word combinations with no usage.

Four Word Combinations

Textbook One, under canonical correlation, using the four word combination dependent/independent/variable/variate had a sentence percentage of 9.9, while Textbook Two and Textbook Three both had zero usage. Likewise, for the combination correlation/dependent/independent/variable, both Textbook Two and Textbook Three had no usage, while Textbook One had 5.6% sentence usage. Comparing the three texts in terms of all the five word combinations we observe that Textbook Two and Textbook Three both do not have any usage at all, while Textbook One had very slight usage for all the nine word

Table 7

Four Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CORRELATION/DEPENDENT/ INDEPENDENT/VARIABLE	5.6%	0.0%	0.0%
DEPENDENT/INDEPENDENT/ VARIABLE/VARIATE	9.9%	0.0%	0.0%
Discriminant Analysis			
ANALYSIS/DISCRIMINANT/ FUNCTION/GROUP	0.2%	1.0%	0.8%
Factor Analysis			
ANALYSIS/CORRELATION/ FACTOR/VARIABLE	2.3%	0.6%	0.3%
CORRELATION/FACTOR/ LOADING/VARIABLE	1.3%	0.8%	2.8%
MANOVA			
DEPENDENT/GROUP/ MANOVA/VARIABLE	0.9%	0.8%	0.0%
Multiple Regression			
COEFFICIENT/DEPENDENT/ INDEPENDENT/REGRESSION	0.5%	0.0%	0.0%

Table 7, Cont'd.

Four Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Multiple Regression			
DEPENDENT/INDEPENDENT/ PREDICTION/REGRESSION	0.5%	0.0%	0.0%

combinations.

There was very little sentence usage under the four word combinations under discriminant analysis. The highest usage was for the combination analysis/discriminant/function/group, with Textbook Two having the highest with only 1.0%, while Textbook Three had a usage of 0.8%, and Textbook One at 0.2%. Once again, when observing the three texts for these four word combinations we observed that Textbook One has some usage for every combination, however slight. Textbook Two has zero usage for four out of the five combinations, and Textbook Three has two zero sentence usages.

For the statistical technique factor analysis, there were only two combinations out of eleven, which had any noticeable usage. For the combination analysis/correlation/factor/variable observed was 2.3% usage for Textbook One, 0.6% for Textbook Two, and 0.3% for Textbook Three. The next highest combination for usage was correlation/factor/loading/variable. Textbook Three had the highest sentence usage with 2.8%, with Textbook One at 1.3%,

and Textbook Two with only 0.8%. Textbook One had two zero usage combinations, while Textbook Two had eight, and Textbook Three had six.

MANOVA, with seven combinations, had a slight usage by Textbook One of 0.9%, Textbook Two with 0.8%, and Textbook Three with zero usage for the combination dependent/group/MANOVA/variable. Textbook One had four zero usage combinations, while Textbook Two had six, and Textbook Three had no usage for seven word combinations.

Finally, for multiple regression, identical sentence usage for the two combinations, coefficient/dependent/independent/regression and dependent/independent/prediction/regression were observed, with Textbook One at 0.5% usage, and Textbook Two and Textbook Three both with zero usage. A total of 15 word combinations were used for this statistical technique. Textbook One once again had the most usage with 6 combinations. Both Textbook Two and Textbook Three had zero usage for all 15 combinations.

Five Word Combinations

There were five word combinations selected for the five word combinations. Textbook One had the highest usage for the combination canonical/dependent/independent/variable/variate under canonical correlation with a percentage of 9.5. Textbook One also had the second highest usage for the combination canonical/correlation/dependent/independent/variable with a

sentence usage of 8.9%. In both instances, neither Textbook Two nor Textbook Three had any sentence usage. Textbook One once again had usage for all the combinations selected, while Textbook Two and Textbook Three had zero usage for all five word combinations.

The statistical technique discriminant analysis had no five word combinations that were picked for this study, and hence, there was no data for this category under five word combinations.

Factor analysis had only one five word combination which was used in this study, analysis/common/components/factor/variance. Textbook One had a sentence usage of 1.5% for the aforementioned combination, while Textbook Three and Textbook Two had no usage.

The statistical technique MANOVA used only the five word combination effect/group/independent/main/variable. There was no usage by any of the texts in this study. One could surmise that once again it is was very difficult to find sentences which had five key statistical terms contained in their structure.

Multiple regression had nine five word combinations picked for this study. Textbook One was the only text, which had any sentence usage for these combinations. Textbook Two and Textbook Three had no sentence usage. Textbook One had usage for the combinations coefficient/dependent/independent/regression/standardized and dependent/determination/independent/prediction/regression. There was sentence usage of 0.3% and 0.1% respectively for both combinations.

Table 8

Five Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CANONICAL/CORRELATION/ DEPENDENT/INDEPENDENT/ VARIABLE	8.9%	0.0%	0.0%
CANONICAL/DEPENDENT/ INDEPENDENT/VARIABLE/ VARIATE	9.5%	0.0%	0.0%
Discriminant Analysis			
No five word combinations for this statistical technique			
Factor Analysis			
ANALYSIS/COMMON/ COMPONENT/FACTOR/ VARIANCE	1.5%	0.0%	0.0%
MANOVA			
EFFECT/GROUP/ INDEPENDENT/MAIN/ VARIABLE	0.0%	0.0%	0.0%
Multiple Regression			
COEFFICIENT/DEPENDENT/ INDEPENDENT/REGRESSION/ STANDARDIZED	0.3%	0.0%	0.0%

Table 8, Cont'd.

Five Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Multiple Regression			
DEPENDENT/DETERMINANT/ INDEPENDENT/PREDICTION/ REGRESSION	0.1%	0.0%	0.0%

Conditional Words

Conditional words enable us to express clearly whether or not we consider a statement contrary to fact. They express a hypothetical possibility, which is sometimes called the subjunctive mood. Mood is the term that refers to the verb function. In statistical texts conditional words are important for teaching, informing, explaining, and instructing students about the basic techniques employed in multivariate statistics. They are used to better explain the techniques and how they relate by examples, and also by comparing and contrasting statements. These will helped in this study to give us more understanding about the texts being investigated.

In this study the conditional words if, unless, although, and provided were used. Table 9 shows that across all the statistical techniques there was a fair amount of sentence usage. Under canonical correlation usage of 7.2%, 10.9%,

and 9.9% by the authors Textbook One, Textbook Two, and Textbook Three, respectively were observed. The aforementioned texts showed more usage under discriminant analysis with 11.1%, 9.2%, and 10.3%. An even larger usage was shown under factor analysis by Textbook One with a 10.0% sentence usage, Textbook Two with 16.8% usage and Textbook Three with

Table 9

Conditional Words - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation	7.2%	10.9%	9.9%
Discriminant Analysis	11.1%	9.2%	10.3%
Factor Analysis	10.0%	16.8%	15.6%
MANOVA	12.1%	8.7%	12.4%
Multiple Regression	12.7%	17.4%	13.4%

15.6% usage. There was a great amount of usage by Textbook One, Textbook Two, and Textbook Three of 12.1%, 8.7%, and 12.4% respectively for MANOVA. Lastly, under multiple regression there was once again large sentence usage of 12.7%, 17.4%, and 13.4% by Textbook One, Textbook Two, and Textbook Three. The individual texts were about the same in usage, with Textbook Two having the two largest amounts of sentence usage for conditional words under

factor analysis at 16.8%, and 17.4% under multiple regression

Cause or Reason Words

Cause or reason words indicate the reason or cause for a particular circumstance, condition, event, or explanation. Many times cause or reason words have a cause and effect relationship for explaining happenings. Cause or reason words help to explain why something might be occurring, why something works, or in our case, how a specific statistical technique might be explained or understood.

Cause or reason words for this study included the words as, because, since, and whereas. Table 10 shows that there was a large amount of cause or reason words associated across all statistical techniques and all three texts. Canonical correlation had sentence usage of 17.8% for Textbook One, 20.1% for Textbook Two, and 15.7% for Textbook Three for cause or reason words. Textbook One, Textbook Two, and Textbook Three had 12.6%, 17.0%, and 18.0% respectively, for sentence usage under discriminate analysis. Factor analysis contained the largest percentage of sentence usage under factor analysis by Textbook Two at 31.8% and by Textbook Three with 28.2%, while Textbook One had 16.8% usage. Under MANOVA Textbook Three registered the highest of the three authors with 22.0% usage, with Textbook One the second highest with 17.5% usage, and lastly, Textbook Two with 15.9%. Under multiple regression Textbook One had a total of 24.8% usage, Textbook Two with 24.8%, and Textbook Three with 17.2%. All textbooks had a large amount of

Table 10

Cause or Reason Words - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation	17.8%	20.1%	15.7%
Discriminant Analysis	12.6%	17.0%	18.0%
Factor Analysis	16.8%	31.8%	28.2%
MANOVA	17.5%	15.9%	22.0%
Multiple Regression	24.8%	24.8%	17.2%

sentence usage for cause or reason words.

Contrasting Connective Words

Contrasting connective words point or show the similarities and differences on the topic being discussed. They act as a comparison or opposition, which can be either faint or expressed with much force or emphatically. This type of expression makes it easy for people and students to remember various points in comparing with which they know to a new topic, idea, or concept. In this study contrasting connective words were but, however, never the less, still, and yet. Table 11 shows the main sentence usage for contrasting connectives. Under the statistical technique factor analysis, the highest usage for an individual textbooks was 14.7% by Textbook Three. This was followed by Textbook Two with 12.8% sentence usage and Textbook One by 7.6%. Under

Table 11

Contrasting Connective Words - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Factor Analysis	7.6%	12.8%	14.7%
MANOVA	10.9%	9.5%	10.0%
Multiple Regression	14.6%	9.5%	5.9%

MANOVA Textbook One had sentence usage of 10.9%, Textbook Three had 10.0%, and Textbook Two 9.5% for contrasting connective words. Under multiple regression Textbook One had the second highest sentence percentage usage under the contrasting connective words with 14.6%, Textbook Two 9.5%, and Textbook Three with 5.9% sentence usage. Comparing the individual textbooks, observed was that their usage was about the same across all the statistical techniques.

Connectives Adding Idea Words

Connectives adding idea words used for this study are also, and, besides, both, furthermore, likewise, moreover, and then. These words imply the meaning of additionally, in other words an idea is added to another idea, concept, or explanation. They usually join two phrases in a sentence. In Table12 one would expect to see a large percentage of sentence usage across

Table 12

Connectives Adding Idea Words - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation	30.9%	41.5%	38.9%
Discriminant Analysis	29.0%	32.7%	29.1%
Factor Analysis	30.3%	52.8%	55.6%
MANOVA	30.3%	36.6%	33.6%
Multiple Regression	48.0%	29.4%	35.5%

all statistical techniques and textbooks for connectives adding idea words. The largest amount of usage was 55.6% by Textbook Three under factor analysis. This was followed by Textbook Two with 52.8% usage, also under factor analysis. Textbook One had a sentence usage of connectives adding idea of 48.0% under multiple regression. Looking under each textbook we saw that each has a very large amount of sentence usage. The lowest sentence usage was by Textbook One with 29.0% under discriminant analysis.

Result Connectives Words

The result connectives words used in this study are accordingly, consequently, hence, and therefore. These words imply a step by step process, which is performed in conjunction with directions or to a prescribed method. An

author might then inform his/her readers that they have completed what they have set out to do in explaining a concept, technique, or delivering a set of instructions.

Table 13 clearly shows that across all statistical techniques and individual authors, there was hardly any sentence usage of result connectives. The highest usage of result connectives was by Textbook Two with 1.9% under multiple regression. Textbook Two also had the second highest percentage usage with 1.3% under factor analysis. There was no usage across discriminant analysis.

Table 13

Result Connectives Words - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation	0.3%	0.0%	0.0%
Discriminant Analysis	0.0%	0.0%	0.0%
Factor Analysis	0.0%	1.3%	0.0%
MANOVA	0.0%	0.8%	0.0%
Multiple Regression	0.0%	1.9%	0.0%

Negation - One Word

A great amount of teaching and learning has to do with using negative

words such as no, not, cannot, and shouldn't. When explaining concepts and techniques, many times authors will use these words to give various examples, instructions, and details. They will also use these words in comparing and contrasting various ideas, points, and procedures. Negative words are used to simplify or express a negative quality or character of concepts and ideas, which are being taught. They are also used to express the opposite view point on a particular point or subject. These words are also used to question and explore the various points, theories, and facts being taught. Thus, negative words are used with an amount of regularity in teaching and learning, and are an important basis in education in general.

The largest amount of sentence usage for negation one word sentences under canonical correlation was the word canonical. Textbook One had 5.6%, Textbook Two 4.4%, and Textbook Three 3.1% usage. The third largest amount of negation one word usage was correlation. Here again the largest was Textbook One with 4.3%, Textbook Two second with 3.5%, and Textbook Three with 1.3%. Again one would expect to see these two words with large usage due to the fact that both word make up the statistical technique canonical correlation. The word with the second largest amount of usage was variable, with Textbook One having 4.9% usage, Textbook Two with 4.8% usage and Textbook Three with 1.8% usage. Textbook One had the largest amount of usage for a word with 5.6% for canonical. Textbook One had the second largest usage for variable at 4.9%. Observing all the authors under canonical correlation we observe that there was usage for all chosen words by Textbook One, while Textbook Two had

one instance of no usage for the word independent, and Textbook Three had three words where no usage occurred for dependent, independent, and redundancy.

Under discriminant analysis the largest usage of negation for one word across all textbooks was function. Textbook One had 2.7% usage, Textbook Two 3.1%, and Textbook Three 1.7%. The word discriminant had 2.6% usage by Textbook One, 3.1% by Textbook Two, and 1.6% by Textbook Three. The word with the largest amount of usage was function by Textbook Two 3.1%. Group was the second largest used word by Textbook One at 3.0%. Textbook Three and Textbook Two had no usage for four words, while Textbook One had only one instance of no word usage.

Under factor analysis, the largest usage of negation for one word across all textbooks was factor. Textbook One had 8.7% usage, Textbook Two, 5.7%, and Textbook Three 9.0%. The word variable had 3.8% usage by Textbook One, 2.9% by Textbook Two, and 5.5% by Textbook Three. The word with the largest amount of usage was factor by Textbook Three 9.0%. Factor was the second largest used word by Textbook One at 8.7%. Textbook One and Textbook Two had usage in all the chosen words, while Textbook Three had no usage for the word common.

The largest usage of one word negation by an author was dependent by Textbook One with 10.0%. The second largest usage was group by Textbook Two, dropping down dramatically to 3.1%. Textbook One had usage in all the words, while Textbook Two had no usage in the word variate, and

Table 14

Negation - One Word - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CANONICAL	5.6%	4.4%	3.1%
CORRELATION	4.3%	3.5%	1.3%
VARIABLE	4.9%	4.8%	1.8%
Discriminant Analysis			
DISCRIMINANT	2.6%	3.1%	1.6%
FUNCTION	2.7%	3.1%	1.7%
GROUP	3.0%	1.4%	1.6%
Factor Analysis			
FACTOR	8.7%	5.7%	9.0%
VARIABLE	3.8%	2.9%	5.5%
MANOVA			
DEPENDENT	10.0%	1.0%	0.0%
EFFECT	2.4%	0.5%	1.3%
GROUP	2.6%	3.1%	0.5%

Table 14, Cont'd.

Negation - One Word - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Multiple Regression			
INDEPENDENT	3.0%	0.5%	0.0%
PREDICTION	2.6%	1.2%	0.4%
REGRESSION	4.3%	1.4%	2.0%

Textbook Three had no usage for the words dependent, variable, and variate.

The largest amount of usage for a word across all three textbooks was regression under multiple regression. Textbook One had a usage of 4.3%, Textbook Two 1.4% and Textbook Three 2.0%. The second highest usage across the authors was prediction. Textbook One had a usage of 2%, Textbook Two 1.2%, and Textbook Three 0.4%. The word with the highest usage for an individual author was Textbook One for the word regression at 4.3%. The word with the second highest usage for an individual author was independent, once again by Textbook One with 3.0% usage.

Negation - Two Word Combinations

Table 15 shows for negation two word combinations under canonical correlation, the combination canonical/correlation had the highest usage across

all three authors. Textbook One had 3.9% usage, Textbook Two 1.3%, and Textbook Three 1.1%. The combination canonical/variate had the second highest with Textbook One having a usage of 1.6%, Textbook Two with 2.6% usage, and Textbook Three with 2.0% usage. The highest single usage was by Textbook One at 3.9% for the combination canonical/correlation. Second highest was Textbook Two for the combination canonical/variate at 2.6% usage. The third highest was Textbook One at 2.3% with the combination variable/set. Textbook One had usage for all the chosen combinations, while Textbook Two had two combinations (canonical/loading, and dependent/independent) with no usage, and had Textbook Three had three combinations (canonical/loading, correlation/set, and dependent/independent) with no usage.

Under discriminant analysis the largest usage occurred with the two word combination discriminant/function. Textbook One had 2.6% usage for this combination, Textbook Two 2.7% and Textbook Three with 1.5% usage. Textbook One had no usage for the combinations dependent/independent, independent/function, and independent/variate. Textbook One had no usage for the five combinations classification/function, classification/group, dependent/independent, independent/function, and independent/variate. Textbook Three had no usage for the combinations dependent/independent, discriminant/analysis, independent/function, and independent/variate.

Under factor analysis the highest percent usage of a negation two word combination was factor/variable with Textbook One having a usage of 3.0%, Textbook Two with a usage of 1.7%, and Textbook Three with a usage of 4.7%.

Table 15

Negation - Two Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CANONICAL/CORRELATION	3.9%	1.3%	1.1%
CANONICAL/VARIATE	1.6%	2.6%	2.0%
VARIABLE/SET	2.3%	1.7%	0.7%
Discriminant Analysis			
DISCRIMINANT/FUNCTION	2.6%	2.7%	1.5%
Factor Analysis			
ANALYIS/FUNCTION	3.2%	1.1%	0.2%
FACTOR/VARIABLE	3.0%	1.7%	4.7%
MANOVA			
GROUP/VARIABLE	0.9%	2.0%	0.0%
INDEPENDENT/VARIABLE	1.3%	0.0%	0.0%
Multiple Regression			
There were no negation - two word combination sentences above 1.0% usage			

The second highest combination was analysis/function with Textbook One at 3.2%, Textbook Two at 1.1%, and Textbook Three at 0.2%. The highest usage

by an author for a combination under factor analysis was Textbook Three at 4.7% for factor/variable. Second highest was analysis/function by Textbook One at 3.2% usage. Textbook One had only one instance of no usage under factor analysis with the combination common/variance. Textbook Two had seven instances of no usage, while Textbook Three had two, two word combinations with no usage, analysis/component and common/variance.

Under MANOVA the highest across all authors percentage was thecombination group/variable at 0.9% for Textbook One, 2.0% for Textbook Two, and 0.0% for Textbook Three. The highest single percentage was contained in this combination with Textbook Two at 2.0%. The second highest was Textbook One with 1.3% usage for the combination independent/variable. Textbook One had only one combination in which there was no usage, effect/power. Out of twelve combinations Textbook Three had nine combinations with no usage, while Textbook Two had six. Under multiple regression none of the authors had any combinations with usage greater than 1.0%. Out of 21 combinations Textbook One had 13 with no usage, Textbook Two had 16 with no usage, and Textbook Three had 17 with no usage.

Negation - Three Word Combinations

Under canonical correlation, the negation three word combination canonical/correlation/variate had the highest percentage of usage across all three authors, with Textbook One at 11.8%, Textbook Two at 10.9%, and Textbook Three at 7.2%. The second highest was the combination

canonical/correlation/variable with Textbook One at 7.6%, Textbook Two at 11.8%, and Textbook Three at 6.5% sentence usage. The third highest was Textbook One at 9.9%, Textbook Two at 5.7%, and Textbook Three at 1.8% sentence usage for the combination canonical/correlation/analysis. The author with the highest sentence percentage usage was Textbook One at 12.8% for the combination dependent/independent/variable. Both Textbook One and Textbook Two had the second highest usage at 11.8% for the combinations canonical/correlation/variate and canonical/correlation/variable, respectively. Textbook One had usage for all 14 combinations, while Textbook Two had no usage for nine combinations, and Textbook Three had no usage for 7 combinations.

The highest usage across all authors under discriminant analysis was the combination discriminant/function/group, with Textbook One at 2.2% usage, Textbook Two at 5.1% and Textbook Three at 6.4%. The second highest usage was the combination analysis/discriminant/function, with Textbook One at 1.8%, Textbook Two at 1.7% and Textbook Three at 2.4%. The highest sentence percentage usage by an author was Textbook Three with 6.4% for discriminant/function/group. Textbook One had usage for all 8 combinations, while Textbook Two had only 6, and Textbook Three with 5.

The largest amount of sentence percentage usage under factor analysis was for the combination factor/loading/variable with Textbook One at 10.2%, Textbook Two at 6.3% and Textbook Three at 8.0%. Second highest was analysis/factor/variable. Textbook One had 11.1% usage for this combination,

Table 16

Negation - Three Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CANONICAL/CORRELATION/ ANALYSIS	9.9%	5.7%	1.8%
CANONICAL/CORRELATION/ VARIABLE	7.6%	11.8%	6.5%
CANONICAL/CORRELATION/ VARIATE	11.8%	10.9%	7.2%
DEPENDENT/INDEPENDENT/ VARIABLE	12.8%	0.0%	0.0%
Discriminant Analysis			
ANALYSIS/DISCRIMINANT/ FUNCTION	1.8%	1.7%	2.4%
DEPENDENT/DISCRIMINANT/ FUNCTION	0.8%	2.4%	0.1%
DISCRIMINANT/FUNCTION/ GROUP	2.2%	5.1%	6.4%
Factor Analysis			
ANALYSIS/FACTOR/ VARIABLE	11.1%	2.5%	2.4%
FACTOR/LOADING/ VARIABLE	10.2%	6.3%	8.0%

Table 16, Cont'd.

Negation - Three Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
MANOVA			
DEPENDENT/INDEPENDENT/ VARIABLE	3.2%	1.8%	0.0%
DEPENDENT/VARIABLE/ VARIANCE	2.1%	1.0%	0.0%
Multiple Regression			
COEFFICIENT/INDEPENDENT/ REGRESSION	2.4%	0.0%	0.1%
DEPENDENT/INDEPENDENT/ REGRESSION	4.3%	0.0%	0.0%

Textbook Two a smaller percentage of 2.5, while Textbook Three had2.4%.Textbook One had the highest sentence percentage usage for the combination analysis/factor/variable at 11.1%. Textbook One had usage in all 13 combinations, while Textbook Two had 7, and Textbook Three 9.

Under MANOVA the combination dependent/independent/variable had usage of 3.2% by Textbook One, 1.8% by Textbook Two, and 0.0% by Textbook Three. This was the highest usage for any combination under MANOVA by the three authors. Contained in this was the highest usage of a combination by an individual author, 3.2% by Textbook One. The second highest usage was also

by Textbook One at 2.1% for the combination dependent/variable/variance. Under this statistical technique Textbook One had the most usage with only the combination effect/main/group not having usage. Textbook Two had six combinations out of the eleven with no usage, while Textbook Three had eight combinations with no usage.

Multiple regression had many combinations with little or no usage. The highest usage for a single combination by an author was dependent/independent/regression by Textbook One with 4.3% usage. Textbook One also had the second highest percentage sentence usage at 2.4% for the combination coefficient/independent/regression. There were a total of 16 combinations under multiple regression, which were investigated. Textbook One had usage in 12 of the 16 combination, Textbook Two had only 4, and Textbook Three had 5.

Negation - Four Word Combinations

With negation four word combinations in Table 17 the amount of sentence usage was extremely reduced. Under canonical correlation there were only four combinations, which were investigated. Out of this combination the highest percentage of sentence usage by an author was by Textbook One at 4.3% for canonical/dependent/independent/variate. Textbook One had usage in all four combinations, while both Textbook Two and Textbook Three had no usage in the chosen combinations.

Under discriminant analysis for this study, there were no negation four

word combinations to be selected for this study. Under factor analysis there were only three word combinations, analysis/correlation/factor/variable, analysis/factor/variable/variance and correlation/factor/loading/variable. There was no combination by any author with over 1.0% usage. In fact, Textbook Two

Table 17

Negation - Four Word Combinations - Sentence Percentage Usage

Multivariate Technique	Book One	Book Two	Book Three
Canonical Correlation			
CANONICAL/DEPENDENT/ INDEPENDENT/VARIATE	4.3%	0.0%	0.0%
Discriminant Analysis			
No negation - four word combinations for this statistical technique			
Factor Analysis			
There were no negation - four word combination sentences above 1.0% usage			
MANOVA			
There were no negation - four word combination sentences above 1.0% usage			
Multiple Regression			
There were no negation - four word combination sentences above 1.0% usage			

had no usage what so ever under the combinations, and Textbook One and

Under MANOVA only the two combinations group/effect/independent/variable and group/MANOVA/univariate/variable were used. There was no usage by either Textbook Two or Textbook Three for the two combinations. Textbook One had usage of 0.2% for both of the combinations. Under multiple regression all usage which occurred was under 1.0%. The only usage was by Textbook One at 0.1% for the combinations correlation/dependent/prediction/regression and dependent/independent/prediction/regression. There were seven combinations, which means Textbook Two and Textbook Three had seven combinations both, with no usage. Textbook One only had usage of only two out of the seven.

Concatenated - Negation Words

A very important part of this content analysis research was in identifying the type of sentences used for negation. This helps us to better understand what type of sentences were used for instructing and teaching the various statistical techniques in the selected texts. For example, one might suppose that when dealing with multiple regression the authors would tend to be more definition driven, in addition, they might give clear and precise facts for this technique. They might be cut and dry, listing facts and details in a logical order. Factor analysis might have all types of sentences to help explain its concepts. There also might be more caution sentences associated with factor analysis than with discriminant analysis. Discriminant analysis might contain more definitions

than the other techniques, along with qualifying statements. MANOVA could have fewer definitions than say multiple regression or discriminant analysis. Discriminant analysis might have more explanations in the various chapters than MANOVA.

Randomly reading portions of the texts and making decisions to what the

Table 18

Sentence Category and Associated Words and Phrases

Assumption: it seems, obviously, generally, suppose, more likely, are usually, might be, perhaps, can be, in fact, we have shown, we mean, and suppose

Caution: we suggest, must guard against, may or may not, does not, but not, you may, does not expect, be careful, remember, reservation, may be wise, and whether or not

Conclusion: because, thus, so, finally, for this reason, concluding, therefore, between, and not only

Comparison/Contrast: versus, less than, between, whether, compare, different, equally, comparison, is related, and from

Definition: this means, author states sentence is a definition

Example: for example, and we consider

Explanation: since there is, that is, and because

Information: so and so notes, recall, and detail given in a sentence

Qualification: although, however, otherwise, unfortunately, do not necessarily, perhaps, and if not all

Question: any sentence with a question mark at it end

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researcher saw as possible types of sentence for the selected categories was a

very important part of this study. Text was read and checked for possible categories until there were no new categories to be found. As a check, text was reread to make sure no new categories were found and no errors had been made on my part in naming categories. When actually performing the concatenation of the sentences, no new categories became apparent to the researcher. Ten categories of sentence types were finally found. There was no desired number of categories at the start of this procedure. Ten categories just happened to be the number that was derived, nine or eleven sentence categories would have been satisfactory if found to be so. The various sentence categories, along with keywords and phrases, which were observed while selecting the various categories, are in Table 18. The keywords and phrases are used only to act as a guideline in helping to select sentence categories. They are not an absolute, and in many cases identical keywords or phrases are used in several categories. They are only a guideline to assist and help the researcher to discovery and identify the various category sentences. They hopefully make for a more consistent and logical choice for a sentence type or category.

Concatenated - One Word Negation Sentences

An example of a concatenated one word negation sentence, using the sentence category information as selected by the software, was "Recall from section 12.4 that at least 20 subjects per variable are needed for reliable results, and the investigator is not near that ratio". This sentence comes from Textbook

Two. The negation word not is used in this sentence. The key indicator portion of the sentence used in determining this was an information sentence was "at least 20 subjects per variable are needed for reliable results". Another example of a concatenated one word negation sentence, using the sentence category caution as selected by the software is "It may be useful to think of one set of variables as IVs and the other set as DVs, or it may not". This sentence came from Textbook Three. The negation word not, is once again used. The key

Table 19

Concatenated - One Word Negation Sentences by Author

Sentence Category	Book One	Book Two	Book Three
Assumption	48	41	30
Caution	40	16	15
Comparison/Contrast	50	35	40
Conclusion	37	18	23
Definition	15	6	2
Example	12	13	3
Explanation	57	24	61
Information	186	78	103
Qualification	56	24	56
Question	7	0	0

indicator portion of the sentence used in determining this was a caution sentence was "may not". In Table 19 we observe the ten categories of words when using concatenated one word negation sentence usage by the three authors. Across all three authors we observe that the heaviest use of category sentences was information. There were a total of 367 usages, 186 by Textbook One, 78 by Textbook Two, and 103 by Textbook Three. This would stand to reason when we consider that textbooks are to inform students, hence we should see a lot of informational sentences. In contrast, the least amount of usage in a category was the category question, with only seven usages by the author Textbook One while both Textbook Two and Textbook Three had no usages. The use of the question has been a time-honored way of teaching, reaching back to the ancient Greeks. This type of format, which is used in the training of lawyers, is probably best applied with face-on-face teaching, enabling the questioned person to respond to the questioner. The definition category had only 23 sentences of usage. Textbook One had 15 usages, Textbook Two six, and Textbook Three two. Many textbooks including these statistical books usually have a definition glossary at the end of the text. More than likely though, there was probably definitions that were not coupled with negation words. A definition was probably outright stated without any need for a negation. The example category had only a total of 28 usages. Textbook One had 12 sentence usages; Textbook Two had 13, and Textbook Three . This was probably stated in a similar manner as the definition category, appearing in the information category as a negative. The second highest category of usage was explanation

with Textbook One having 57, Textbook Two 24, and Textbook Three 61 sentences of usage. This certainly stands to reason when we consider that all the authors' main emphasis is to explain what they are trying to teach. There were a total of 142 sentences used across the three authors. The third highest category usage was the qualification category with a total of 136 sentences. In teaching there is a lot of qualification and one would expect to see this carried over into the texts. Qualification helps to teach by placing restrictions, limits, and exceptions in the sentences to better explain a concept, technique, or idea.

Looking at each individual author we see that all three authors had the highest sentence usage for the information category with Textbook One at 186 sentences, Textbook Two with 78 sentences, and Textbook Three with 103 sentences. Likewise, for the least amount of sentence usage in a category Textbook One had seven, with Textbook Two and Textbook Three both having zero sentence usage for the question category. Across the authors the second highest usage was explanation, Textbook One had 57, Textbook Two 24, and Textbook Three had 61 sentences used.

Textbook One's three top usages were information at 186, explanation at 57, and qualification at 56. Textbook Two's highest usages were 78 for information, 41 for assumption, and 35 for comparison/contrast sentence usage. Textbook Three's highest usage category was information with 103 sentences of usage, 61 for explanation, and 56 for qualification. Totally, Textbook One had 488 usages for the ten categories, Textbook Three had 315, and Textbook Two had 232.

Table 20 listed the category words in relationship to the various multivariate techniques, which are being investigated. Factor analysis had the greatest amount of sentence usage with 420 sentences. The second highest was multiple regression with 176 sentences, and third highest was MANOVA with 173 sentences of usage. Canonical correlation had 164 and discriminant analysis had 163 sentences of usage for all the category words under concatenated one word negation sentences.

The highest sentence count is 166 under factor analysis for the information category. This might imply that the chapters under factor analysis needed a lot of basic facts to help explain the technique. Under canonical correlation the highest rate of sentence usage was information at 50 sentences. There was also high usage with 48 sentences for qualification. Here once again, the texts are helping to explain canonical correlation by placing restrictions or limitations on the sentences used. The smallest amount of sentence usage under canonical correlation was the question category with zero usage, definition category with one usage, and the example category with four usages.

The largest category of use under discriminant analysis was information. The author breakdown has been previously explained. Following information was the comparison/contrast category with a total of 29 sentences of usage. Besides having a total usage of 166 for the information category, there was usage of 75 for the explanation category under factor analysis. The authors must feel that factor analysis is a difficult concept and needs to have a lot of explanation to make the subject more understandable. The smallest usage

sentence categories under discriminant analysis was the question category with three sentences, definition with six sentences, and the example category with nine sentences. Under factor analysis the fewest sentences used for categories was the question category with one usage, followed by the example category with four usages, and finally the definition category with seven sentence usages. MANOVA also had the largest category of information to help explain this

Table 20

Concatenated - One Word Negation Sentences by Statistical Technique

Sentence Category	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Assumption	18	20	40	24	17
Caution	11	13	31	8	8
Comparison/Contrast	18	29	30	23	25
Conclusion	5	17	27	12	17
Definition	1	6	7	6	3
Example	4	9	4	11	0
Explanation	9	18	75	20	20
Information	50	34	166	50	67
Qualification	48	14	39	18	17
Question	0	3	1	1	2

technique. There were a total of 50 sentences of usage. This was followed by 24 and 23 sentences of usage for the categories assumption and comparison/contrast, respectively. The categories with the smallest amount of usage under MANOVA was question with one sentence usage, followed by the definition category with six sentences, and the caution category with eight sentences. Under multiple regression observed was 67 sentences of usage for the information category. This was followed by 25 sentences of usage for comparison/contrast. The categories under multiple regression with least amount of one word negation sentences was example, with zero usage, question category with two sentences of usage, and definition with three sentences of usage.

Concatenated - Two Word Combination Negation Sentences

An example of a two word negation sentence, using the sentence category conclusion as selected by the software, was "Thus, a relatively strong canonical correlation may be obtained between two linear composites (canonical variates), even though these linear composites may not extract significant portions of variance from their respective sets of variables". This sentence comes from Textbook One. The key indicator portion of the sentence used in determining this was a conclusion sentence was "thus". The negation word used in this sentence was not. The two combination words were canonical and variates. Another example of a two word negation sentence, using the sentence

Table 21

Concatenated - Two Word Combination Negation Sentences by Author

Sentence Category	Book One	Book Two	Book Three
Assumption	20	7	13
Caution	17	4	9
Comparison/Contrast	27	7	34
Conclusion	25	11	3
Definition	13	2	1
Example	0	3	0
Explanation	51	10	8
Information	50	28	22
Qualification	24	13	7
Question	2	0	0

category explanation as selected by the software, was "Multivariate analysis of covariance (MANCOVA) is a simple extension of the principles of ANCOVA to multivariate (multiple dependent variables) analysis; this is, MANCOVA can be viewed as MANOVA of the regression residuals, i.e., variance in the dependent variables not explained by the covariates". This sentence comes from Textbook One. The key indicator portion of the sentence used in determining this was an explanation sentence is "that is". The negation word used in this sentence is "not". The two word combination is MANOVA and variance. In Table 21

observed was the word combination negation sentences by Textbook One, Textbook Two, and Textbook Three. The largest amount of usage across all three authors were once again the information category. Textbook One had 50 sentence of usage, Steven 28 and Textbook Three with 22, for a total of 100 sentences. Once again, the authors were all trying to convey and explain the principles of multivariate statistics by using information as the means to accomplish their task. The explanation and comparison/contrast categories were second and third for the highest amount of usage. Again, there were no surprise that the authors are trying to explain, give meaning, and make clear the concepts of the various statistical techniques being discussed. The explanation category had a total of 69 sentences, while comparison/contrast had 68 sentences. Under explanation Textbook One had 51 usages, Textbook Two had ten usages, and Tabachnik had eight usages. The question category was once again the category with the least amount of sentence usage, with Textbook One having two sentences, and both Textbook Two and Textbook Three having zero sentence usage. Following right behind the question category is the example category with a total of only three sentences used. Under this category Textbook Two had the only usage, while Textbook One and Textbook Three had zero sentence usage.

Looking at each individual author, Textbook One had the greatest amount of usage across all the categories with a total sentence usage of 229. This was followed by Textbook Three with at total of 97, followed closely by Textbook Two with 85. Textbook One had only one category, which had no usage, the

example category. Textbook Two also had only one category with no usage, the question category. Textbook Three had two categories, example and question with no usage.

Textbook One's greatest amount of usage was explanation with 51 sentences, and information with 50 sentences. Textbook Two's greatest amount of usage was for information with 28 sentences, followed by qualification with 13 usages. Textbook Three's largest sentence usage for two word combination negation sentences was comparison/contrast with 34 sentences used, and information with 22 sentences of usage.

Table 22 lists the category words in relationship to the various multivariate techniques, which were being studied. Factor analysis one again, as it was for the one word negation words had the largest amount of sentence usage with 179 sentences. The second highest was MANOVA with 71 sentences used across the categories. Third highest was canonical correlation with 66 sentences used. Next came discriminant analysis with 60 sentences, and lastly, multiple regression with 41 sentences.

The highest sentence count is 44 under factor analysis for the information category. This was also the case under the one word negation sentences. Once again, it might be that the authors felt that they have to give a lot of information about the technique to make it more understandable to their audience. The second highest sentence count is also under factor analysis, with 34 sentences for comparison/contrast.

Under canonical correlation the highest category with 17 sentences was

information, second highest with 16 sentences was assumption. One would again expect to see a great amount of information sentences in helping to explain the canonical correlation.

Under discriminant analysis, the largest usage is once again information, followed by surprisingly, the conclusion category. There were 16 sentences for information, and 13 for conclusion. The smallest amount of usage was for the category question with one sentence, and the qualification and definition categories, both with two sentences.

Under factor analysis observed was 44 sentences of usage for the information category, and 34 sentences for comparison/contrast and 33 for explanation. The smallest amount of usage occurred for the question category with zero sentence usage.

MANOVA's largest sentence usage was for the information category with 18 sentences, followed by 17 sentences for the explanation sentences. The smallest usage was for the question category with one usage. The next lowest usage was caution and conclusion, both with one sentence of usage.

Multiple regression had 13 sentences of usage for information, followed by 12 sentences of usage for comparison/contrast. With multiple regression having the lowest sentence total across all the categories, it is not surprising that we see zero usage for definition, and one sentence each of usage for conclusion, qualification, and question. The assumption category had also only two sentences of usage.

Table 22

Concatenated - Two Word Combination Negation Sentences by Statistical Technique

Sentence Category	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Assumption	16	4	12	6	2
Caution	5	5	15	1	3
Comparison/Contrast	2	10	34	7	12
Conclusion	14	13	10	1	1
Definition	0	2	7	7	0
Example	0	0	1	2	3
Explanation	7	7	33	17	5
Information	17	16	44	18	13
Qualification	5	2	23	12	1
Question	0	1	0	0	1

Concatenated - Three Word Combination Negation Sentences

An example of a concatenated three word combination negation sentence, using the sentence category qualification as selected by the software, was "The predictor variate, however, has a substantially lower redundancy index

(.2424), although in this case, because there is a clear delineation between dependent and independent variables, this lower value is not unexpected or problematic." This sentence came from Textbook One. The negation word "not" is used in this sentence. The key indicator portion of the sentence used in determining this was a qualification sentence was "however" and "although". The three word combination words used in this sentence were dependent, independent, and variables. Another example of a concatenated three word combination negation sentence, using the sentence category caution, was "The unrotated factor solution may or may not provide a meaningful patterning of variable loadings". This sentence comes from Textbook One. The negation word "not" is used in this sentence. The key indicator portion of the sentence used in determining this was a caution sentence was "may or may not". The three word combination words used in this sentence were factor/loading/variable. Looking at the individual authors across three word combination negation concatenated sentences we ssaw a reduced amount of usage in Table 23. This was to be expected, as the combinations increase the likelihood of having a large amount of sentences decreases. Textbook One is substantially above the two other authors in sentence count when observing the authors across all the categories. Textbook One has 68 sentences, versus Textbook Three with 13 and Textbook Two with 11 sentences. Textbook One had the largest individual usage for a category with comparison/contrast having 17 sentences, followed by 11 sentences of qualification, and ten sentences for both assumption and explanation categories. Textbook One had usage in nine

Table 23

Concatenated - Three Word Combination Negation Sentences by Author

Sentence Category	Book One	Book Two	Book Three
Assumption	10	1	3
Caution	6	2	1
Comparison/Contrast	17	0	3
Conclusion	3	2	0
Definition	1	0	0
Example	1	0	0
Explanation	10	0	1
Information	9	4	4
Qualification	11	2	14
Question	0	0	0

categories, only missing the question category, while Textbook Two had no usage in comparison/contrast, definition, example, explanation, and question categories. Textbook Three had no usage in the conclusion, definition, example, and question categories. Looking across all the categories were sentence usage for comparison/contrast category with 20 sentences, and the second highest usage of 17 sentences for the information category.

In Table 24 factor analysis had the highest amount of sentence usage across all the ten categories with 30 sentences. This was followed by canonical

correlation with 26 sentences, discriminant analysis with 17 sentences, and then MANOVA with ten and multiple regression with nine sentences. Individually looking at all the statistical techniques compared to the various categories, canonical correlation had the highest sentence total was only seven for

Table 24

Concatenated - Three Word Combination Negation Sentences by Statistical Technique

Sentence Category	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Assumption	6	1	6	0	1
Caution	4	3	1	0	1
Comparison/Contrast	1	2	5	8	4
Conclusion	3	1	1	0	0
Definition	1	0	0	0	0
Example	0	0	1	0	0
Explanation	1	5	3	2	0
Information	3	2	9	0	3
Qualification	7	3	4	0	0
Question	0	0	0	0	0

qualification, followed by six for the assumption category. There was no usage

for the example and question categories, while comparison/contrast, definition, and explanation categories had one sentence each of usage.

Discriminant analysis highest total was only five sentences for the explanation category. It had no usage for definition, example, and question categories. It only had one sentence usage for the assumption and conclusion categories. This was followed by two sentences of usage by comparison/contrast and information categories.

Factor analysis highest sentence total was nine for the information category. It had two categories, definition and question, with no sentence usage. It also had one sentence usage by the categories caution, conclusion, and example.

MANOVA had only two categories with any sentence usage, comparison/contrast with eight sentences, and explanation with two sentences of usage. All the other categories in MANOVA had no sentence usage.

Multiple regression had six categories with no sentence usage. The comparison/contrast category had four sentences of usage, information had three sentences and both assumption and caution had one sentence of usage for three word combination negation sentences.

Concatenated - Four Word Combination Negation Sentences

An example of a concatenated four word negation sentence, using the sentence category comparison/contrast as selected by the software, was "Factor analysis is not like the dependence techniques discussed is earlier chapters

Table 25

Concatenated - Four Word Combination Negation Sentences by Author

Sentence Category	Book One	Book Two	Book Three
Assumption	0	0	2
Caution	2	0	0
Comparison/Contrast	3	0	0
Conclusion	0	0	0
Definition	2	0	0
Example	1	0	0
Explanation	4	0	0
Information	8	0	0
Qualification	3	0	0
Question	0	0	0

(i.e., multiple regression, discriminant analysis, multivariate analysis of variance, or canonical correlation), where one or more variables are explicitly considered the criterion or dependent variables and all others are the predictor or independent variables". This sentence comes from Textbook One. The negation word is "not". The four word combination words are analysis, correlation, factor, and variable. In Table 25 observed was the concatenated four word combination of negation word categories. Textbook One had the

largest total across all categories with 23 sentences. Textbook Three only had one category of usage, assumption with two sentences. Textbook Two had zero usages of sentences across all the categories. Textbook One had the highest sentence usage with eight for the information category. He then had the second highest total with three sentences for both comparison/contrast and qualification. His lowest sentence total was zero for the assumption, conclusion, and question categories.

Table 26 lists the category words in relationship to the various multivariate statistical techniques, which were being studied. Canonical correlation had the largest amount of sentence usage with only 16 sentences used. The second highest was factor analysis with six sentences, followed by multiple regression with two, MANOVA with one, and discriminant analysis without any sentence usage. The single highest usage for concatenated four word combinations negation words was information under canonical correlation with seven sentences. The second highest usage was again under canonical correlation under the explanation category with four sentences. In addition, under canonical correlation there were five categories without any usage, they were assumption, comparison/contrast, conclusion, definition, and question.

Discriminant analysis did not have any usage for any of the ten categories. Factor analysis highest sentence usage was for the category assumption, with only two sentences used. There were four categories in which only one sentence was used; they were caution, comparison/contrast, definition,

Table 26

Concatenated - Four Word Combination Negation Sentences by Statistical Technique

Sentence Category	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Assumption	0	0	2	0	0
Caution	1	0	1	0	0
Comparison/Contrast	0	0	1	0	2
Conclusion	0	0	0	0	0
Definition	0	0	1	1	0
Example	1	0	0	0	0
Explanation	4	0	0	0	0
Information	7	0	1	0	0
Qualification	3	0	0	0	0
Question	0	0	0	0	0

and information. The other five remaining categories had no sentence usage. MANOVA had only one category of sentence usage, definition with only one sentence. Multiple regression also had only one category of sentence usage, under comparison/contrast two sentences were used.

Concatenated - Five Word Combination Negation Sentences

The software for this research was originally written to search for a

maximum of five word combinations. As stated earlier, as the combinations increase in complexity the number of sentences with such complexities go down dramatically. While looking for negation sentences, a three word combination plus the included negation word counts as a four word combination. Thus in reality, this software if capable of only searching for a maximum of a four word combination plus the negation word. Therefore, there were no five combination negation sentences.

One Word Concatenated Negation Sentences and Statistical Technique

Table 27

Spearman Rho Correlations for Statistical Techniques Have One Word Coding Units Concatenated with Negation Coding Units

	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Canonical Correlation		.815*	.827*	.839*	.775*
Discriminant Analysis			.794*	.964*	.926*
Factor Analysis				.818*	.804*
MANOVA					.853*
Multiple Regression					

*$p < .05$

Table 27 lists the correlation of the concatenated sentence categories

compared to the five statistical categories studied for one word negation sentences. The highest positive correlation using Spearman rho was .926 when comparing multiple regression category sentences to discriminant analysis category sentences. When all the correlations were observed for this analysis a high positive correlation resulted in all cases. The lowest correlation was .775 canonical correlation, discriminant analysis, factor analysis, MANOVA, and for multiple regression compared to canonical correlation. All the correlations for multiple regression correlations were significant at the .05 level.

Two Word Concatenated Negation Sentences and Statistical Technique

Table 28

Spearman Rho Correlations for Statistical Techniques Having Two Word Coding Units with Negation Coding Units

	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Canonical Correlation		.750*	.615	.399	.397
Discriminant Analysis			.748*	.388	.531
Factor Analysis				.762*	.720
MANOVA					.449
Multiple Regression					

*$p < .05$

Table 28 lists the correlation of the concatenated sentence categories compared to the five statistical categories studied for two word negation sentences. The highest positive correlation using Spearman rho was 762 when comparing factor analysis category sentences to MANOVA category sentences. The lowest correlation was .388 for MANOVA when compared to discriminant analysis. Discriminant analysis compared to canonical correlation, factor analysis compared to discriminant analysis, MANOVA compared to factor analysis, and multiple regression compared to factor analysis all had correlations significant at the .05 level.

Three Word Concatenated Negation Sentences and Statistical Technique

Table 29 lists the correlation of the concatenated sentence categories compared to the five statistical categories studied for three word negation sentences. The highest correlation was multiple regression compared to factor analysis with a correlation of .682. This correlation was also significant at the .05 level. MANOVA compared to canonical correlation concatenated sentence categories had a correlation of -.264, while multiple regression compared to canonical correlation had a correlation of .276, which was the lowest positive relationship. The second lowest positive relationship was multiple regression compared to discriminant analysis with a correlation of .280.

Table 29

Spearman Rho Correlations for Statistical Techniques Having Three Word Coding Units Concatenated with Negation Coding Units

	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Canonical Correlation		.536	.524	-.264	.276
Discriminant Analysis			.509	.455	.280
Factor Analysis				.281	.682*
MANOVA					.308
Multiple Regression					

*p < .05

Four Word Concatenated Negation Sentences and Statistical Technique

Table 30 lists the correlation of the concatenated sentence categories compared to the five statistical categories studied for four word negation sentences. The two highest positive correlations were MANOVA compared to factor analysis, and multiple regression compared to factor analysis, both sets having correlations of .257. The lowest negative correlation was comparing MANOVA to canonical correlation and multiple regression also to canonical correlation with correlations both of -.311. The correlation columns listed with an "a" mean that a correlation could not be computed because the statistical

Table 30

Spearman Rho Correlations for Statistical Techniques Having Four Word Coding Units Concatenated with Negation Coding Units

	Canonical Correlation	Discriminant Analysis	Factor Analysis	MANOVA	Multiple Regression
Canonical Correlation		a	-.219	-.311	-.311
Discriminant Analysis			a	a	a
Factor Analysis				.257	.257
MANOVA					-.111
Multiple Regression					

a Cannot be computed because at least one of the variables is constant

software interpreted the numbers as constants. The numbers were the all the same, fives. With the ten sentence categories, all the categories having the same sentence count gives them a rank of all five's.

One Word Concatenated Negation Sentences and Textbooks

Table 31 lists the correlation of the concatenated sentence categories compared to the three textbooks investigated for one word negation sentences. All three textbooks showed strong positive correlations. The highest was textbooks three when compared to Textbook One with a correlation of .976. The

Table 31

Spearman Rho Correlations for Textbooks Having One Word Coding Units Concatenated With Negation Coding Units

	Book One	Book Two	Book Three
Book One		.863*	.976*
Book Two			.888*
Book Three			

*p <.05

second highest correlation was .888 when Textbook Three was compared to Textbook Two. The last correlation was .863, comparing the second textbook to Textbook One. All three correlations were significant at the .05 level.

Two Word Concatenated Negation Sentences and Textbooks

Table 32 lists the correlation of the concatenated sentence categories compared to the three textbooks investigated for two word negation sentences. The highest correlation was textbook two when compared to Textbook One with a correlation of .802. The second highest correlation was .705 when Textbook Three was compared to Textbook One. Both of these correlations were significant at the .05 level. The last correlation was .555, comparing the third textbook to the second textbook.

Table 32

Spearman Rho Correlations for Textbooks Having Two Word Coding Units Concatenated With Negation Coding Units

	Book One	Book Two	Book Three
Book One		.802*	.705*
Book Two			.555
Book Three			

*p <.05

Three Word Concatenated Negation Sentences and Textbooks

Table 33

Spearman Rho Correlations for Textbooks Having Three Word Coding Units Concatenated With Negation Coding Units

	Book One	Book Two	Book Three
Book One		.224	.842*
Book Two			.517
Book Three			

*p <.05

Table 33 lists the correlation of the concatenated sentence categories compared to the three textbooks investigated for three word negation sentences. The highest correlation was textbooks three when compared to Textbook One

with a correlation of .842. This relationship was significant at the .05 level. The second highest correlation was .517 when Textbook Three was compared to Textbook Two. The last correlation was .224, comparing the second textbook to the first textbook.

Four Word Concatenated Negation Sentences and Textbooks

Table 34

Spearman Rho Correlations for Textbooks Having Four Word Coding Units Concatenated With Negation Coding Units

	Book One	Book Two	Book Three
Book One		a	-.414
Book Two			a
Book Three			

a Cannot be computed because at least one of the variables is a constant

Table 34 lists the correlation of the concatenated sentence categories compared to the three textbooks investigated for four word negation sentences. The only correlation obtained was -.414 for the relationship between Textbook Three and Textbook One. The comparison between Textbook Two and Textbook One, and also Textbook Three and Textbook Two were not computed by the SPSS software because the rankings were interpreted as constants. The numbers were the same, all five's in the rankings out of the ten sentence categories.

Reliability Study

The actual sentences used for the coding were the concatenated negation sentences, which required the coding key of sentence category and associated words and phrases. The sentences used were picked randomly by Minitab 13.1 Statistical Software. Numbering of the sentences were started with

Table 35

Reliability Study

Coder	Number of Randomly Selected Sentences	Number of Sentences in Agreement With Research	Rater Percentage
A	220	157	71.4%
B	220	160	72.7%

the concatenated one word negative sentences, starting with the word analysis and continued until the concatenated four word negative sentences, ending with the word combination dependent/independent/predication/regression. There were a total of 1,608 concatenated negation sentences. It was decided to pick 220 sentences for the coders to use. This is approximately 14% of the total sentences. This number was arbitrarily picked. With ten categories of sentences being used the research needed to have a large enough sample from the population, and yet one in which the coders would not be overwhelmed with all the sentences to code. Both coders felt that they were able to handle this

amount of sentences when asked before and after their coding.

The study demonstrated coder average of 72.1% for the 221 sentences of lines used for the reliability study. Coder A had a rater percentage of 71.4%, while the other coder (B) had a rater percentage of 72.7%. The number of matching sentence answers were 143 sentences or 65.0% of the total amount of sentences. These two measures indicate that the information from this sample was reliable.

The percentage obtained in this reliability study was the result of the content analysis coding sheet. The sheet was used to determine the type of sentence category. It therefore acted as a key to sentences selected. The coding sheet should be clear and precise. It enables a researcher or anyone reading the coding sheet, to code the selected sentences as the researcher has.

Differences in the coding of the sentences retrieved were due primarily to minor differences in the coding sheet and interpretation by the coders. The coding sheet acted as a guide but did not contain every example that might be encountered in this research for each particular type of sentence. In some instances both the researcher and coders disagreed to the classification of some sentences. The only type of sentence in which there was complete agreement was the question, which can be easily identified with a question mark. Therefore, even with a coding sheet in many instances the reviewers' judgment became an important factor. Reviewing the coding sheet with them and also going over a page of examples helped to give them a clearer understanding of the different sentence types. Each coder was given

approximately 45 minutes of training. Basically, the reviewers' judgment was enhanced by the coding sheet and the instructions given by the researcher. This then, enabled the sentences picked for coding to be reliable.

Using a content analysis program, a total of 18 procedures were run on the selected category chapters from the three texts. Sentence counts were obtained for one to five combinations of keywords. These results were compared and contrasted to the five statistical techniques and texts examined. Condition words, contrasting connective words, connectives adding idea words, result connective words and cause or reason words were also included. In addition, negation words with up to four statistical keywords were examined. Lastly, concatenated negation sentences were studied. This was accomplished by examining the negation sentences to determine sentence type by observing keywords or phrases in the sentences.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Summary

The purpose of this research was to use content analysis as a means of evaluating multivariate statistics textbooks. Content analysis was performed on selected textbooks to determine if there were any differences in the chapters discussing canonical correlation, discriminant analysis, factor analysis, MANOVA and multiple analysis. The text of the books were only to be evaluated and analyzed, without any references given to pictures, graphs, charts, or any other visual aids which the texts might contain. Textbooks chosen were to be intended only for graduate social science students. Only those texts published in the United States were to be considered. In addition, only texts that had a mathematical level of high school algebra were considered for this research.

Texts were reviewed as possible candidates from publishers of mathematical and statistical textbooks. In additional, possible multivariate textbooks for selection was investigated on the website amazon.com. Through reviews, book comments and summaries, and those who have purchased the texts, books were winnowed down to 30 possible candidates. After discussions with my advisor and thoroughly rereading what was available, seven books were picked for purchase. After reviewing the purchase texts four were eliminated, leaving three books for this research.

It was decided to use the sentence as the basic unit to be investigated for

this research. Approximately 1,100 pages of text were scanned and loaded into a Hewlett Packard Pavilion computer. Keywords for each of the five statistical categories or chapters were picked by have content analysis software determine the word count for each word used in all the chosen chapters. The actual content analysis software was written by Dr. Donald Marcotte, College of Education, Wayne State University, Detroit, Michigan. All statistical words with high counts were examined for possible inclusion as keywords. Words were eventually picked based on their count, and their importance based on my advisor's experience of over 30 years in teaching and consulting in statistics.

Actual content analysis of the various items picked for study was based on the principle that the more times a word or combinations of words appear in sentences, the more importance relegated by their authors. Mathematical emphasis, power, one, two, three, four, and five word combination sentences were evaluated. Conditional, cause or reason, contrasting connective, connectives adding idea words, and result connectives were also evaluated. Negation sentences with one, two, three, and four keyword combinations were also studied. Lastly, concatenated negation words were researched. Sentences were studied to determine category type. A key was composed to help in determining sentence category type by searching the sentences for possible keywords or phases. This aided the researcher and was also used by two coders to determine the reliability of the concatenated negation sentences.

Conclusions

The ability to use content analysis as a means to evaluate multivariate

statistics textbooks was demonstrated by this study. Content analysis has a long history of evaluating text in many forms. This is the first time that content analysis has been used to evaluate multivariate statistics textbooks. Key to this evaluation was choosing keywords. Keywords chosen were all statistical in nature due to the basis of this study. The category sentences chosen for the negation concatenated sentences were also a main key ingredient to the success of this research. The categories aided by the developed key, assisted both the researcher and the coders to make this research viable.

This research indicated that those textbooks chosen for this study had a low mathematical emphasis. In examining texts for the word "power" all three textbooks did not use the word power for canonical correlation. Textbook Two had a higher usage percentage per technique and would then probably better serve the student in understanding the concept of power, and how it relates to multivariate statistics and its techniques. Generally speaking, under each statistical technique for single keywords, the keyword representing the statistical chapter was used most often. With two keyword combinations, the combination which included the word involving the statistical chapter was used again most often. Both Textbook one and two had several combinations in which there was no usage whatsoever. As three word combinations were examined it became apparent that the longer the word combination the less amount of sentences for all texts existed. This would logically be what one would expect. Textbook One had a lot more sentence usage in general for the three word combinations than Textbook Two and Three. Under four word combinations, Textbooks Two and

Three once again had less usage than Textbook One. This is also true for five word combinations.

Conditional words, which are used to better explain techniques and how they relate by examples, were all used about the same amount of time across all three texts. Factor analysis and multiple regression techniques used the conditional words across all three texts the most. There was a large amount of cause or reason words associated across all statistical techniques and all three authors. Contrasting connective words, which point or show the similarities and differences on the topic being discussed, were used across all three texts approximately the same. They were used less in Textbook Three for multiple regression and in Textbook One for factor analysis. Connectives adding idea words, which imply an additional idea, were used extensively in all three textbooks. They were used in over 50% of the sentence in Textbook Two under factor analysis. Result connective words, which imply a step by step process, were hardly used. They were not used in Textbook Three at all, nor under discriminant analysis in all of the three texts. Ten percent of the sentences in Textbook One, used the word dependent with a negation word under MANOVA. Nine percent of the sentences in Textbook Three, used the word factor under factor analysis. For negation two word combinations under canonical correlation, the word combination canonical/correlation had the highest usage across all three authors. Multiple regression had many combinations of three word negation sentences with little or not usage. With negation four word combinations the amount of sentence usage is extremely reduced. Textbook

One had usage in all four combinations, while both Textbook Two and Three had no usage in the chosen combinations.

For concatenated one word negation sentences, the research showed all three authors had the largest number of sentences for information. The second highest usage was with the explanation sentence category. When comparing statistical technique factor analysis had the highest sentence usage. For concatenated two word negation sentences we observed that Textbook One had the greatest amount of usage across all the categories. Textbook One greatest usage was for the explanation and information category sentences. Textbook Two greatest sentence usages were for the information and qualification sentence categories. For concatenated three word combination negation sentences, the research showed a reduced amount of usage. Textbook One is substantially above the two other authors in sentence count across all the categories. Factor analysis has the highest amount of sentence usage across all the ten categories. Under concatenated four word combination negation sentences there are no sentence counts for textbook's two and three.

Using Spearman rho correlation for one word concatenated negation sentences the research found high positive correlations for all five statistical techniques when compared to the sentences categories. Two word concatenated negation sentences were lower than the one word concatenated negation sentences. Three word concatenated negation sentences were lower yet, with a negative relationship for MANOVA compared to canonical correlation. The four word concatenated negation sentences categories had three negative

relationships and several relationships that were not computable due to lack of numbers.

In looking at the main research questions, it is concluded that multiple regression one word concatenated negation sentences were all significant, meaning they are similar or alike in regards to statistical technique. When using Spearman rho correlation for statistical techniques having two word coding units concatenated with negation coding units, observed were differences in correlations among all the studied statistical techniques except the correlation between multiple regression and factor analysis. Likewise, multiple regression and factor analysis were alike for the three word coding units concatenated with negation coding units. There were differences in multiple regression with canonical correlation, factor analysis, and MANOVA for four word concatenated negation units. Discriminant analysis with multiple regression was unable to be calculated due to constants in the variables.

Discriminant analysis one word concatenated negation sentences were all significant, meaning they were similar or alike in regards to the statistical technique evaluated. When using Spearman rho correlation for statistical techniques having two word coding units concatenated with negation coding units, observed were differences in correlations among all the studied statistical techniques except the correlation between discriminant and factor analysis. All the correlations were not significant for the three word coding units concatenated with negation coding units. The four word concatenated negation sentences were not calculated due to some variables being constants.

MANOVA one word concatenated negation sentences were all significant, meaning they were similar or alike in regards to the statistical technique evaluated. When using Spearman rho correlation for statistical techniques having two word coding units concatenated with negation coding units, observed were differences in correlations among all the studied statistical techniques except the correlation between MANOVA and factor analysis. All the correlations were not significant for the three word coding units concatenated with negation coding units. The four word concatenated negation sentences were no significant when comparing their correlations.

Canonical correlation one word concatenated negation sentences were all significant, meaning they were similar or alike in regards to the statistical techniques evaluated. When using Spearman rho correlation for statistical techniques having two word coding units concatenated with negation coding units, observed were differences in all statistical techniques when compared to MANOVA except discriminant analysis. All the correlations were not significant or alike for the three word coding units concatenated with negation coding units. The four word concatenated negation sentences were not significant when comparing their correlations.

Factor analysis Spearman rho correlations for statistical techniques having one word coding units concatenated with negation coding units were all significant, meaning they were all alike. When using two word coding units concatenated with negation coding units, observed were significance to discriminant analysis, MANOVA, and multiple regression.

Multiple regression was the only statistical technique which was significant to factor analysis for the three word coding units concatenated with negation coding units. The four word concatenated negation sentences were not significant when comparing factor analysis to the other studied statistical techniques.

Comparing actual authors to the one word concatenated negation sentences; there was high positive correlation among all three textbooks. For two concatenated negation sentences and textbooks, Textbook Two compared to Textbook One, and Textbook Three and Textbook One had high positive correlations. For three word concatenated negation sentences and textbooks there was only one high positive relationship, Textbook Three compared to Textbook One. Observing four word concatenated negation sentences and textbooks, Textbook Three and Textbook One had a negative correlation. Textbook Two compared to Textbook One, and Textbook Three compared to Textbook Two were unable to be calculated due to all the numbers in the categories being zero.

The findings of this study are important to the statistical community because it gives another avenue in which textbooks can be compared and reviewed. This can then help in aiding professors in evaluating textbooks for classroom use. The old adage that textbooks are written to impress one's colleagues most definitely comes into play for writing a textbook. What a business, professor, industry, student, or individual desires from a textbook are varied for many reasons. All authors want to write clear, informative, precise

texts, which will help the reader understand the subject matter being discussed. Instead of relying on just subjective impressions by reviewers, textbooks can actually be quantitatively analyzed. In this research three multivariate statistical textbooks were compared quantitatively. In many instances, there were observed differences. This content analysis of these textbooks allows for a comparison of information, so the textbooks can be more readily explored and their full potential realized. Communications by interested parties can be better utilized by using content analysis, and the gathered information can be synthesized to understand the true contents of these textbooks. This research should be of benefit to all those interested in multivariate statistics.

It is hoped that this content analysis of multivariate statistics textbooks will improve the quality of the choices of the offered texts. The importance of a quality review can not be overemphasized. Content analysis is accurate and should make the authors of these types of texts aware of some of their possible shortfalls or omissions. No reviewer in analyzing a textbook possess the capability to effectively document a textbooks without having their prejudices, whims, pet peeves, and favoritism to authors and publishers subconsciously come into play during their evaluations. Content analysis can act as a neutral and fair judge in reviewing the various multivariate statistical textbooks. It is decisions or the sum total of reviews based on facts.

Content analysis is a time consuming endeavor. It takes time to scan in text, develop keywords, and select keywords and phases for sentence category guides. It, on the other hand, offers a detailed numerical evaluation of

textbooks. Information comes at a cost, and in content analysis the cost is in time. The learning of statistical technique and concepts are important in this day and age of computer generated reams of numbers. To be successful an individual needs to know and understand data and the concepts of multivariate statistics. Content analysis can help and assist leaders, students, professors, businesses, and individuals in evaluating the correct multivariate statistical text for their needs and purposes.

In summary, this research has shown that content analysis can be used to analyze graduate social science multivariate textbooks. Using content analysis helps to circumvent much of the subjectivity used in viewing and analyzing textbooks. It can be considered another tool in which a text can be examined. It was found that there were differences between the statistical techniques amongst the three texts examined when using two, three and four word concatenated negation sentences. Content analysis then can be used to examine other social science multivariate statistical textbooks. The knowledge gained from this research can be used to advance the knowledge in examining and evaluating other statistical texts such as graduate and undergraduate basic statistical texts, business statistical texts, and also mathematical statistical texts. This ultimately then can be another technique used in evaluating texts to help the end users of the texts gain the all important information they desire. The more information that can be gathered on texts, the better the choices will be made in selecting the proper texts for the needs of their readers.

Recommendations for Future Research

The use of content analysis for analyzing qualitative data is of interest in many fields of the social sciences. There has been much research on individual topics. While this research continues to grow, there has not been a lot of research in reliability as it relates to content analysis. Usually a quick comparison of coder results is all that is performed in most research. It would be interesting to compare the individual researcher results with their own later results. If we expect coders to obtain a minimum reliability number that is selected before the research begins, it stands to reason that the researcher themselves should also be made to adhere to these standards. It is suggested that the researchers involved code a portion of randomly selected text, then after an interval of time has passed, to recode the prior coding. Therefore, a study of reliability comparing various authors' results with their initial numbers would be most helpful for future researchers. This will also help the researchers in determining if their coding guideline is too general, resulting in low reliability scores. If for instance the researcher comes up with a reliability score of under .70, they might want to look at their guidelines to make them more specific or understandable, to enable those less familiar with the research to obtain higher and more consistent results.

Secondly, it comparing the results of the individual coders to a particular study it might be interesting to see how their backgrounds affect the reliability of the coding. For a study involving history, a coder with a background in economics might not possibly obtain the same reliability of a coder whose

economics might not possibly obtain the same reliability of a coder whose background is history. It would be assumed that the coder with the history background might possibly have a higher reliability score based on their knowledge of history. The idea of a coding form is to help the coders come upon a logical and repeatable result. The research might want to answer the question, "Does the coding form enable coders with varying degrees of knowledge and familiarity with the subject help in obtaining similar reliabilities?". It would be up to the researcher to determine what ranges of reliability would be acceptable. Another study could compare students to professor results. The professors pick the textbooks to be used in a class but the students are ultimately the end users of the texts. Once again, it would be a comparison of knowledgeable persons on a topic to those who are less knowledgeable on the subject being investigated.

Along with the reliability of human coders, a study could be initiated comparing an automated coding process to human coders. In this day and age of automated content analysis, there are several programs which will automatically process the data. Writing a program with very specific criteria for each sentence category would enable a comparison with the human coders for the same criteria. In other words, would the use of a computer result in a higher number, be the same, or be below the reliability number of the human coders. Currently, many researchers that use content analysis are using automated coding processes and are stating that the results are reliable. This would be an opportunity to perform a study to actual results to compare human coder results

with an automated computer result.

A concern by both of the coders used in this study was sentences with multiple categories. In explaining the process to both coders they were told to go with what they thought was the best category. They were not to agonize over any particular sentence. In discussing the results with the coders it was mentioned by the one coder that they did actually agonize over many of the sentences. A study placing time limits on the sentences, say for instance ten seconds per sentence, and then comparing the results with those who were given no time limits would make an interesting study. One coder, without being asked, did mark down multiple categories they felt the sentence belonged in. They did place their top rated category first in the listing. The one coder had four possible categories for one sentence. A study could be set up in which multiple sentence choices would be included in the study. One could compare these to see if the same sentences gave the coders problems, and also if they did agree with the multiple choices. One might also be able to see from these results if the categories for sentences were too broad, or detailed and specific enough to come up with good reliable answers. This then might result in the phrases and words for the various categories becoming more selective.

A study could be performed in which word scanners are tested to show the best scanners for use for content analysis. The research would test for word order and keeping the sentences intact, reproducing the original text exactly. A lot of time for this research was spent on making corrections to scanned data that was jumbled and fragmented. The researcher many times questioned if it

would have been easier and quicker to type in all 1,100 pages of text into the computer. After the scanning-in process, time was needed for deleting all pictures, charts, matrixes, and formulas. When a formula was in the text, it tended to scatter the written text before and after its appearance. In many cases whole sentences or paragraphs had to be deleted and retyped. In some instances whole pages needed to be corrected. In other instances a whole page of text was mingled in a disorderly manner for no apparent reason. As time goes on it is assumed that scanners will become better but now make the work of content analysis harder than what it needs to be.

There has not been, as earlier stated, a great amount of content analysis performed on statistical textbooks. It would be interesting to perform this same research on other multivariate statistical textbooks. It would also be interesting to see what other keywords other researchers might pick. Other statistical textbooks could also be investigated, such as elementary statistical textbooks. Another large area would be the content analysis of business statistical textbooks. Practically every college and university in the United States has a business department. Most of these require some type of business statistics course for both their undergraduate and graduate departments. It is felt that this is a field which is very ripe for content analysis. There is a multitude of business statistical textbooks available from publishers of business books. One could compare the undergraduate texts with the graduate texts. Research could also compare junior college statistical textbooks to four year college texts.

Most multivariate statistical textbooks begin with an introductory chapter,

which usually explains statistical concepts. In this research the textbooks used, had the concept of power in their introductory chapters. It would be interesting to perform a content analysis on these chapters in relation to their discussion on power and in addition, to multivariate statistical techniques in general. Likewise, definitions are an important and necessary function of any textbook. It might be good to do a content analysis on definitions to see if they are similar or differ from author to author. As stated many times in this paper, no charts, pictures, graphs, or tables were included in this study. A content analysis can be used on all the aforementioned items. Research comparing and contrasting the similarities and differences of these items by the author and also the various statistical techniques could be performed.

Another content analysis, which could be performed, would be to compare multivariate textbooks that were written ten years ago to the present textbooks. One could compare the individual authors to note any major changes, and also, compare the differences in the textbooks as a whole from the past to the present. What statistical techniques are being emphasized, which techniques are in vogue, and possibly what new techniques are starting to arrive could be studied. There are textbooks, which are also written for a particular statistical technique such as structural equation modeling. A content analysis of these individual technique books can be performed to find out the differences between the authors and the various chapters in these books. This would be very specialized studies but meaningful for those who use these books for their studies, learning, research, and jobs. Many studies could then expand into

mathematical statistical textbooks, physics, engineering, and other statistical books related to the various fields.

In this research all the conditional, cause or reason, contrasting connective, connective adding idea, result connective, and negation words were all evaluated under their own groupings. Each individual word under these groupings was not evaluated. For example, under conditional the words if, unless, although, and provided were evaluated as one group, not as individual words. Breaking down the individual words might give more meaning to the content analysis.

Lastly, it would be most useful to see how the statistical community views this type of research. Surveying students, professors, and those actively involved in statistics in government, business, and industry might be helpful for furthering this type of research. In addition, it might also be enlightening to ask actual reviewers of statistical texts from the various journals how they feel about this type of research. Would they change their outlook from a subjective to a more quantitative analysis in evaluating multivariate statistical textbooks? This research is as good as the people accepting or rejecting it. If there is a need, want, and desire for change, then this study could indeed be a good basis to begin such change.

Appendix A

Power

Multivariate Technique	Book One	Book Two	Book Three
CANONICAL CORRELATION			
Total Sentences	304	229	445
Baseline	1.00	0.75	1.46
POWER			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual	0	0	0
POWER/ALPHA			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual	0	0	0
POWER/EFFECT/SIZE			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual	0	0	0
POWER/SAMPLE/SIZE			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual			
DISCRIMINANT ANALYSIS			
Total Sentences	791	475	577
Baseline	1.37	0.82	1.00
POWER			
Percentage of Total Sentences	3.0%	0.3%	0.5%

Appendix A, Cont'd.

Power

Multivariate Technique	Book One	Book Two	Book Three
Discriminant Analysis, Cont'd.			
Expected	30	0	3
Actual	26	1	3
POWER/ALPHA			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual	0	0	0
POWER/EFFECT/SIZE			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual	0	0	0
POWER/SAMPLE/SIZE			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual			
FACTOR ANALYSIS			
Total Sentences	791	475	577
Baseline	1.37	0.82	1.00
POWER			
Percentage of Total Sentences	0.6%	0.0%	0.5%
Expected	7	0	3
Actual	5	0	3
POWER/ALPHA			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual			

Appendix A, Cont'd.

Power

Multivariate Technique	Book One	Book Two	Book Three
Factor Analysis, Cont'd.			
POWER/EFFECT/SIZE			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual			
POWER/SAMPLE/SIZE			
Percentage of Total Sentences	0.0%	0.0%	0.0%
Expected	0	0	0
Actual	0	0	0
MANOVA			
Total Sentences	791	475	577
Baseline	1.37	0.82	1.00
POWER			
Percentage of Total Sentences	10.0%	21.7%	1.2%
Expected	53	63	13
Actual	53	85	9
POWER/ALPHA			
Percentage of Total Sentences	1.9%	0.0%	0.0%
Expected	10	0	0
Actual	10	0	0
POWER/EFFECT/SIZE			
Percentage of Total Sentences	1.3%	2.8%	0.0%
Expected	7	8	0
Actual	7	11	0

Appendix A, Cont'd.

Power

Multivariate Technique	Book One	Book Two	Book Three
MANOVA, Cont'd.			
POWER/SAMPLE/SIZE			
Percentage of Total Sentences	1.3%	1.8%	0.0%
Expected	7	5	0
Actual	7	7	0
MULTIPLE REGRESSION			
Total Sentences	791	475	577
Baseline	1.37	0.82	1.00
POWER			
Percentage of Total Sentences	5.7%	8.1%	3.8%
Expected	43	19	3
Actual	43	34	3
POWER/ALPHA			
Percentage of Total Sentences	0.3%	0.0%	0.1%
Expected	2	0	1
Actual	2	0	1
POWER/EFFECT/SIZE			
Percentage of Total Sentences	0.1%	0.0%	0.1%
Expected	1	0	1
Actual	1	0	1
POWER/SAMPLE/SIZE			
Percentage of Total Sentences	0.9%	0.0%	0.1%
Expected	7	0	1
Actual	7	0	1

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ABSTRACT

A CONTENT ANALYSIS OF SELECTED MULTIVARIATE STATISTICAL TEXTBOOKS

by

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The purpose of this research was to use content analysis as a means of analyzing multivariate textbooks. It was demonstrated that content analysis can be used to numerically analyze multivariate statistical textbooks. The sample for the analysis consisted of three present day multivariate statistical textbooks. The textbooks studied were for use by graduate social science students. Only textbooks published in the United States were used. The textbooks were only to have a mathematical level of high school algebra. The original listing of textbooks came from publishers of mathematical and statistical textbooks. In addition, textbooks listed on amazon.com were also considered. Through a winnowing process using publisher reviews, text table of contents, reader's summaries and reviews, and inspection, three books were chosen that met the criteria.

A content analysis software program was used for the actual analysis.

Multivariate statistical techniques chapters investigated were canonical correlation, discriminant analysis, factor analysis, MANOVA, and multiple regression. Key statistical words were determined by the number of times they appeared in the text coupled with their statistical significance. Sentence counts were obtained for one to five combinations of keywords. These results compared and contrasted these combinations in relation to the five statistical techniques and the texts examined. Also studied was the use of mathematical emphasis and power in the texts. Conditional words, contrasting connective words, connectives adding idea words, result connective words, and cause or reason words were also included in this research. In addition negation words with up to four word statistical keyword combinations were examined. Lastly, concatenated negation sentences were studied. This was accomplished by examining the negation sentences to determine their sentence type or category. A coding guide was constructed to help determine sentence category by observing key words or phases in the sentences. Two coders determined a 72.1% reliability of the concatenated negation sentences. There were differences per textbook and statistical technique among the one, two, three, and four concatenated negation sentences using Spearman rho. These results then demonstrate that content analysis is capable of being used as an evaluation tool to analyze multivariate statistical textbooks.

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