Florida Journal of Educational Research, 2004, Vol. 42, pp. 71 - 89

Statistics Courses in the Business Curriculum: The Relationship Between Text and Context

Deborah J. Gougeon
University of Scranton

Abstract

Focusing on statistics courses in the business curriculum, this paper examines the data on topical coverage in thirty-one college Business Statistics textbooks. While there is general agreement among business educators that the development of quantitative skills, especially in statistics, should be a core requirement in all business curricula, there is very little that is certain about what the specific content of such courses should be. Because there is little agreement on the specific content of Business Statistics courses, it is often difficult for teachers to find a text that actually "fits" in terms of topics taught, and that is also pedagogically satisfying in terms of organization, numbers, and types of problems, levels of difficulty, etc. A presentation and analysis of the results of this topical survey are provided, along with suggestions for future research.

Background

A survey of the literature shows that American high school students perform poorly on standardized tests in comparison to students in other industrialized countries, especially in quantitative areas (Investor's Business Daily, 1999; Moloney, 1996; Rasberry, 1996). There is, understandably, a great concern among educators in this country, at all

levels, regarding efforts to improve the performance of U.S. students, especially given the growing competitiveness among industrial economies in what is increasingly a global economy. The United States has barely begun to feel the impact of this achievement problem in the economic marketplace. But as educators we can already see quite clearly the deleterious effects of low and stagnating elementary and high school achievement levels on American colleges and universities (Steinberg, 1996).

This concern is especially evident at higher levels of education because a student's poor preparation in high school, and earlier, can make the teaching of core courses especially difficult and intimidating to students and teachers as well (Cox, Key, & Helms, 1990). Despite a recent move toward more rigorous standards for high school graduation, a pronounced knowledge gap has opened between secondary and post-secondary schools (Savage, 2000). Nowhere is this more evident than in the teaching of Business Statistics courses. Many business educators maintain that undergraduate Business Statistics is a foundation for the business curriculum and essential for any graduate program (Tabatabai & Gamble, 1997). However, at the same time, in many programs statistics course requirements are being considered for elimination to make room for other courses, this, despite the fact that the AACSB (International Association for Management Education, formerly the American Assembly of Collegiate Schools of Business), requires that the undergraduate

curriculum for business students include foundation courses in a variety of areas, including mathematics and statistics (AACSB, 1993). Trying to escape their embarrassing reputations of being the least scholarly units on campus, business schools created this sanctioning body to be sure that business school degrees carried sufficient depth and rigor (Jennings, 1999).

Some of the pressure to reduce the teaching of statistics in business programs derives from the fact, as one researcher reports, that business school undergraduates and alumni rank statistics lowest among their business courses (Zanakis, 1997). Students perceive statistics courses to have little value in practice, to be extremely difficult, and to be only average in instructional effectiveness (Swanson, Meinert, & Swanson, 1994). In addition, business school students have identified statistics as the most difficult and least pleasant course; mathematics was described as easier and more pleasant (Jordan & Stroup, 1984). Indeed, statistics courses are viewed by most college students as obstacles standing in the way of attaining their desired degrees (Perney & Ravid, 1991). I am sure that it is no surprise to most of us that some students refer to the course as "sadistics". At the same time, however, surveys of business professionals consistently indicate statistical analysis is the most frequently needed quantitative methodology (Lane, Mansour, & Harpell, 1993; Philip & Schultz, 1994). For nearly twenty years, business, political and academic leaders have been sounding this warning: American students are global

underachievers in math and science, posing a serious threat to the competitiveness of the U.S. economy (Strauss, 2000).

Some researchers suggest that this student resistance to the study of statistics has resulted in a situation where students are inclined to rate their statistics courses, and their statistics instructors, low in student evaluations. Because of the increasing emphasis on such evaluations in determining tenure and promotion questions, student evaluations may create incentives for instructors to avoid pushing students to address the challenging problems that force them to learn and understand vital concepts (Rustagi, 1997). In some cases, professors have turned to the use of software so that students who often express fear of quantitative subjects can develop a statistical competence without emphasizing the underlying theory simply by using equipment normally found in working environments (Burrows, 1996), a dubious approach at best.

While there is general agreement among business educators, and such accrediting agencies as the AACSB, as well as the business community, that the development of quantitative skills, especially in statistics, should be a core requirement in all business curricula, on both the undergraduate and graduate levels, there is very little that is certain about what the specific content of such courses should be or the relationship of such content to the actual needs and expectations of the business world. Thus, one researcher notes, in speaking of the AACSB requirement for

foundation courses in statistics, that the requirements do not clearly define what constitutes an adequate foundation, with the interpretation of the guideline being left largely to the individual school's discretion (Parker, 1999). Of course, the determination of course content would inform the choice of an appropriate text to support the course. Unfortunately, because there is no agreement on the specific content of Business Statistics courses, it is often difficult to find a text which actually "fits" in terms of topics taught, and which is also pedagogically satisfying in terms of organization, numbers and types of problems, levels of difficulty, and the use or non use of supporting software. A survey of the literature shows that there is very little information available on specific statistics requirements in various business programs, less on the specific content of the course or courses required, and still less than that on the content of Business Statistics texts which are currently available to instructors. Lastly, there are few studies of businesses regarding what quantitative skills they would ideally like to see in potential employees. It is also uncertain what expectations exist among MBA and other graduate programs regarding undergraduate preparation in this area. The lack of such information may contribute to the dissatisfaction which many students feel with their undergraduate Business Statistics courses, and also the generally poor performance of American students at the college level in quantitative courses, especially those which are business related. To complicate matters, most Business

Statistics texts present a broad variety of different topics, resulting in a fragmented approach (McLean, 2000).

A sample of thirty-one Business Statistics textbooks was analyzed comprising approximately twenty-six thousand pages in total. The effort was made from a sample of the majority of Business Statistics textbooks presently in print. The purpose of this count was to determine what topics are covered, the extent of the coverage in terms of percentages of pages in the book as a whole, the average number of pages for each area, as well as the nature and extent of supporting materials such as chapter problems, supplementary problems, and tables. An effort was made to select most, if not all, major topics covered in a two-semester Business Statistics textbook. The thirty-one books had a range of eleven to twenty chapters; the average number of chapters being seventeen. Book content was then categorized into approximately eighty different areas. In addition, the number of chapter problems was tabulated as well as the total number of supplementary problems for each chapter. The number of tables as well as the types of tables contained in each textbook was also noted.

Results

Analysis of the results showed that the areas most thoroughly covered by narrative (see Table 1) were descriptive statistics with 2,435 pages or 9.4% of total book coverage, linear regression with 1,388 pages or

Table 1.
Summary of the Written Coverage (Excluding Tables, Graphs and Charts) of Statistical Topics in 31 Business Statistics Textbooks.

Statistical Topics	Total Pages	Mean Pages
Descriptive Statistics	2,435	78.5
Linear Regression	1,388	44.8
Multiple Regression	1,378	44.5
Hypothesis Testing (one sample)	1,105	35.6
Random Variables	1,058	34.1
Time Series	1,037	33.5
ANOVA	1,017	32.8
Probability	888	28.6
Confidence Intervals (one sample)	795	25.6
Sampling Distributions	755	24.4
Chi-Square Test	748	24.1
Hypothesis Testing (two samples)	681	22.0
Non-Parametric	678	21.8
Decision Theory	411	13.3
Confidence Intervals (two samples)	299	9.6
Index Numbers	222	6.5

5.3% of the text; followed by multiple regression with 1,378 pages or 5.3%, then confidence intervals with 1,105 pages or 4.3%, and then random variables with 1,058 pages or 4.1% of the narrative. The two areas with the fewest number of pages of narrative were confidence intervals for two samples with 299 pages or 1.2% coverage and lastly index numbers with 222 pages in all thirty-one books, or .8% coverage. It should be noted that only eight of the thirty-one books covered index numbers.

In addition to actually counting pages of the narrative for all of the important topics covered in a Business Statistics textbook, these numbers were compared to total chapter pages for each respective topic (see Table 2). Chapter pages would include, for example, charts, graphs, problems, tables, etc. For example, overall, the highest coverage was given to descriptive statistics with 2,435 pages of narrative while the total chapter coverage was 2,792 pages followed by linear regression with 1,388 pages of narrative, and total chapter coverage of 2,110 pages. A close second in actual narrative coverage was multiple regression with 1,378 pages but the total book chapters on multiple regression were 2,212 pages. Confidence intervals for one sample had 795 pages of narrative but total chapter coverage was 1,253 including graphs, problems, etc. The largest page discrepancy in actual narrative pages versus actual number of pages in a chapter occurred with the coverage of random variables. The narrative page coverage was 1,058 pages, but the chapter coverage was 2,187 for a

Table 2.
Summary of the Book Coverage (Excluding Tables, Graphs and Charts) of Statistical Topics in 31 Business Statistics Textbooks.

Statistical Topics	Total Pages	Mean Pages
Descriptive Statistics	2,792	90.1
Multiple Regression	2,212	71.4
Random Variables	2,187	35.0
Linear Regression	2,110	68.1
ANOVA	1,698	54.8
Hypothesis Testing (one sample)	1,493	48.2
Time Series	1,423	46.0
Probability	1,401	45.2
Confidence Intervals (one sample)	1,253	40.4
Sampling Distributions	1,037	33.5
Non-Parametric	1,002	32.3
Chi-Square Tests	885	28.5
Hypothesis Testing (two samples)	706	22.0
Confidence Intervals (two samples)	705	22.0
Decision Theory	564	18.2
Index Numbers	---	---

difference of 1,129 pages. I believe this large difference occurred because in covering random variables, discrete as well as continuous, along with their respective distributions such as the normal, student t, binomial, hypergeometric, exponential, and uniform, there are many insertions in the narrative consisting of tables and graphs in order to more clearly explain the statistical concepts. Overall the five lightest areas of coverage were index numbers, confidence intervals for two samples, decision theory, non-parametrics, and sampling distributions.

On the issue of the number of problems in all books, there were a total of 30,762 problems (see Tables 3, 4, 5). Sixty five percent of these problems or 20,140 problems were contained in the chapter narrative, and 10,622 or 35% appeared as supplementary problems. Descriptive statistics had the highest narrative coverage and the highest number of problems with a total of 3,423 or 11.4% of all problems in all areas. Linear regression which was second in narrative coverage ranked eleventh in terms of total problem coverage. The reason for this ranking may be because some authors feel that problems with large sets should be done on the computer. The area with the least number of problems was index numbers and decision theory followed by rarely covered topics that were treated in just a book or two such as report writing, data transformation, and ethics in statistics.

Table 3.
Summary of Chapter Problems Related to Statistical Topics.

Statistical Topics	Chapter Problems	Percentages
Descriptive Statistics	2,204	10.9%
Hypothesis Testing	1,711	8.5%
Linear Regression	1,613	8.0%
Analysis of Variance	1,459	7.2%
Probability	1,372	6.8%
Multiple Regression and Model Building	1,353	6.7%
Confidence Intervals	1,320	6.6%
Discrete Random Variables	1,271	6.3%
Statistical Inference (two samples)	1,233	6.1%
Continuous Random Variables	1,118	5.6%
Sampling Distributions	978	4.9%
Time Series	939	4.7%
Non-Parametric	885	4.4%
Control Charts	745	3.7%
Chi-Square Tests	671	3.3%
Introduction to Business Statistics	509	2.5%
Decision Theory	418	2.1%
Others	341	1.7%
Total	20,140	

Table 4.
Summary of Chapter Supplemental Problems Related to Statistical Topics.

Statistical Topics	Supplementary Problems	Percentages
Descriptive Statistics	1,219	11.5%
Hypothesis Testing	749	7.1%
Probability	746	7.0%
Statistical Inference (two samples)	705	6.6%
Discrete Random Variables	697	6.6%
Confidence Intervals	688	6.5%
Linear Regression	686	6.5%
Time Series	642	6.0%
Continuous Random Variables	622	5.9%
Analysis of Variance	583	5.5%
Multiple Regression and Model Building	568	5.3%
Sampling Distributions	546	5.1%
Non-Parametric	468	4.4%
Chi-Square Tests	437	4.1%
Control Charts	375	3.5%
Introduction to Business Statistics	346	3.3%
Decision Theory	208	2.0%
Others	337	3.1%
Total	10,622	

Table 5.
Summary of Total Problems Related to Statistical Topics.

Statistical Topics	Total Problems	Percentages
Descriptive Statistics	3,423	11.4%
Hypothesis Testing	2,460	8.0%
Probability	2,299	7.5%
Discrete Random Variables	2,118	6.9%
Continuous Random Variables	2,042	6.6%
Sampling Distributions	2,008	6.5%
Confidence Intervals	1,968	6.4%
Hypothesis Testing	1,938	6.3%
Statistical Inference (two samples)	1,921	6.2%
Analysis of Variance	1,740	5.7%
Linear Regression	1,581	5.1%
Multiple Regression and Model Building	1,524	5.0%
Time Series	1,353	4.4%
Control Charts	1,120	3.6%
Non-Parametrics	1,108	3.6%
Chi-Square Tests	855	2.8%
Decision Theory	626	2.0%
Others	678	2.2%
Total	30,762	

With regard to tables in the thirty-one Business Statistics textbooks, the range was from four to sixteen with an average of eleven. All of the books contained the Student t distribution, the Chi-Square distribution, and the F distribution. Ninety-percent contained the standard normal distribution while some of the others used the cumulative normal distribution. Seventy-one percent contained the Binomial Probability Distribution table. The tables less frequently cited were the values of $e^{-\mu}$ with 13% and Hartley's F_{max} test table with 6%.

Summary

In conclusion, the results of this study have noted the most important statistical topics covered by the most commonly used Business Statistics textbooks. This relevant information will be eventually compared to and analyzed with the results of a three page survey on topical coverage in Business Statistics courses which was sent to all AACSB business schools. Further useful comparisons can be made by consulting the article, "Statistics in the Business Curriculum: Adjusting the Mix" (Gougeon, 2003). Of the 394 questionnaires sent, there was a 48% return rate. Obviously from this high return rate there is great interest among business educators in the results of this study. These eventual comparisons will be very informative to those who teach Business Statistics in a business school. In business, as well as education, government, health, etc. it seems

imperative that we teach and train our business students to think quantitatively and to think statistically, especially in the age of computers. This study on textbooks topical coverage will aid those deciding the business core curriculum in business schools. As most quantitative researchers know, our lives are inundated with data, and as one researcher stated, "as the enlightenment thrived on literacy, the information age thrives on numeracy" (Steen, 2000).

References

American Assembly of Colleges and Schools of Business (AACSB). (1993). *Achieving quality and continuous improvement through self-evaluation and peer review*. St. Louis: Author.

Burrows, G. (1996). Using computers to teach and test quantitative methods for business. *British Journal of Educational Technology*, *27*, 144-146.

Gougeon, D. (2003). Statistics in the business curriculum: Adjusting the mix. *Louisiana Education Research Journal*, *28*, 25-32.

Investor's Business Daily. (1996, December 18). Paying for failure, p. A2.

Jennings, M. (1999). What's happening in business schools?" *Public Interest*, Washington, 25-32.

Jordan, E. W. & Stroup, D. F. (1984). The image of statistics. *Collegiate News and Views*, 11-13.

Key, C. H., Cox, M. K. & Helms, S. J. (1990, October). *Are students retaining basic statistical principles and concepts? A comparative analysis of student performance in the business statistics core course*. Paper presented at the 25th Annual Meeting of the Institute of Management Science, Southwest Chapter, Myrtle Beach.

Lane, M. S., Mansour, A. H., & Harpell, J. L. (1993). Operations research techniques: A longitudinal update 1973-1988. *Interfaces*, *23*, 63-68.

McLean, A. (2000). The predictive approach to teaching statistics. *Journal of Statistics Education*, *8*. Retrieved from http://www.amstat.org/publications/jse/jse_archive.html#2000

Moloney, W. J. (1996, December 8). Reading at the 8th grade level in college. *The Washington Post*, p. C7.

Parker, R. S., Pettijohn, C. E. & Keillor, B. D. (1999). The nature and rule of statistics in the business school curriculum. *Journal of Education for Business*, *75*, 51-54.

Perney, J. & Ravid, R. (1991). *The relationship between attitudes towards statistics, math self-concept, test anxiety and graduate students' achievement in an introductory statistics course*. Unpublished manuscript, National College of Education, Evanston, IL.

Philip, G. C., & Schultz, H. K. (1994). Operations research in medium-sized companies and the microcomputer revolution: Educational implications. *Journal of Education for Business*, 69, 217-221.

Raspberry, W. (1996, November 29). Fact based education. *The Washington Post*, p. A27.

Rustagi, N. K. (1997). A study of the retention of basic quantitative skills. *Journal of Education for Business*, *73*, 72-76.

Savage, C. (2000, March). Make the leap from high school to college-level work in a single bound? *The Christian Science Monitor*, 13-15.

Steen, L. A. (2000). Reading, writing, and numeracy. *Liberal Education*, *86*, 26-37.

Steinberg, L. (October, 1996). Insight on news. *New World Communications*,1-4.

Strauss, V. (2000, December 26). When success doesn't add up, how can a 'Nation at Risk' continue to thrive when U.S. students score so poorly on math and science tests? *The Washington Post,* p. A12.

Swanson, J. C., Meinert, D. B., & Swanson, N. E. (1994). Business communications: A highly valued core course in business administration. *Journal of Education for Business*, *69*, 235-239.

Tabatabai, M. (1997). Business statistics education: Content and software in undergraduate business statistics courses. *Journal of Education for Business*, *73*, 48-53.

Zanakis, S. H. & Valenzi, E. (1997). Student anxiety and attitudes in business statistics. *Journal of Education for Business*, *73*, 10-16.

Books Analyzed

Abramovic, W. A. (1997). *Statistical thinking and data analysis methods for managers*. Reading, MA: Addison-Wesley Publishing Company.

Aczel, A. (1996). *Complete business statistics*. Chicago, IL: Irwin Publishing.

Anderson, D. R., Sweeney, D. J. & Williams, T. A. (2001). *Contemporary business statistics*. Cincinnati, OH: South Western Publishing.

Anderson, D. R., Sweeney, D. J. & Williams, T. A. (1996). *Statistics for business and economics*. St. Paul: West Publishing.

Becker, W. E. (1995). *Statistics for business and economics*. Cincinnati, OH: South Western College Publishing.

Berenson, M. L. & Levine, D. M. (1999). *Basic business statistics: Concepts and applications*. Upper Saddle River, NJ: Prentice Hall.

Black, K. (2001). *Business statistics: Contemporary business statistics*. Cincinnati, OH: South Western Publishing.

Bowerman, B. L. & O'Connell, R. T. (1997). *Applied statistics: Improving business processes*. Chicago, IL: Irwin Publishing.

Bowerman, B. L., O'Connell, R. T. & Hand, D. J. (2001). *Business statistics in practice*. New York, NY: McGraw Hill Publishing.

Canavos, G. C. & Miller, D. M. (1999). *An introduction to modern business statistics*. Pacific Grove, CA: Duxbury Press.

Daniel, W. W. & Terrell, J. C. (1986). *Business statistics*. Boston, MA: Houghton Mifflin.

Groebner, D. F., Shannon, P. W., Fry, P. C., & Smith, K. D. (2001). *Business statistics: A decision making approach*. Upper Saddle, NJ: Prentice Hall, Inc.

Hanke, J. E. & Reitsch, A. G. (1994). *Understanding business statistics*. Burr Ridge, IL: Irwin Publishing.

Keller, G. & Warrack, B. (1991). *Essentials of business statistics*. Belmont, CA: Wadsworth Publishing.

Keller, G. & Warrack, B. (2000). *Statistics for management and economics*. Pacific Grove, CA: Duxbury Press.

Larsen, R. J. & Marx, M. L. (1990). *Statistics*. Englewood Cliffs, NJ: Prentice Hall Publishing.

Lind, D. A. & Mason, R. D. (1994). *Basic statistics for business and economics*. Chicago, IL: Irwin Publishing.

Mason, R. D., Lind, D. A., & Marchal, W. G. (1999). *Statistical techniques in business and economics*. Boston, MA: Irwin/McGraw Hill Publishing.

McClave, J. T., Benson, P. G., & Sincich, T. (2001). *Statistics for business and economics*. Upper Saddle River, N.J.: Prentice Hall, Inc.

Minieka, E. & Kurzeja, Z. D. (2001). *Statistics for business with computer applications*. Cincinnati, OH: South Western College Publishing.

Ovedovitz, A. C. (2001). *Business statistics in brief*. Cincinnati, OH: South Western College Publishing.

Picconi, M. J., Romano, A. & Olson, C. L. (1993). *Business statistics: Elements and applications*. New York, NY: Harper Collins College Publishers Inc.

Sandy, R. (1990). *Statistics for business and economics*. New York, NY: McGraw Hill.

Shiffler, R. E. & Adams, A. J. (1990). *Introductory business statistics with computer applications*. Boston, MA: PWS Kent Publishing Co.

Siegel, A. F. (1997). *Practical business statistics*. Chicago, IL: Irwin Publishing.

Siegel, A. F. & Morgan, C. J. (1996). *Statistics and data analysis: An introduction*. New York, NY: John Wiley and Sons, Inc.

Sincich, T. (1992). *Business statistics by example*. San Francisco, CA: Dellen Publishing.

Tamhane, A. C. & Dunlop, D. D. (2000). *Statistics and data analysis: From elementary to intermediate*. Upper Saddler river, NJ: Prentice Hall.

Triola, M. F. & Franklin, L. A. (1994). *Business statistics.* Reading, MA: Addison-Wesley Publishing Company.

Webster, A. (1998). *Applied statistics for business and economics: An essentials version*. Boston, MA: Irwin/McGraw Hill Publishing.

Weirs, R. M. (1998). *Introduction to business statistics.* Chicago, IL: Duxbury Press.