TEACHING BUSINESS STATISTICS COURSES USING AN INTERACTIVE APPROACH BASED ON TECHNOLOGY RESOURCES

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1. Introduction

There is general agreement among college educators that developing statistical skills is essential for business students (Gourgeon, 2009). Teaching Business Statistics courses to undergraduates should focus on understanding the statistical results and its association with business problems. Hence, Business Statistics at this level must emphasize the application of statistical concepts and methods rather than spending time in the specific details of formulae and computations. In this regard, it is widely accepted that the careful use of technological tools will help to achieve that goal.

A committee created by the American Statistical Association (2005) produced the Guidelines for Assessment and Instruction in Statistics Education (GAISE), which recommended the use of technology resources for introductory statistics courses at college level. The appropriate use of technology has been identified as a contributor to the students' motivation and understanding of statistics. Using technology can make college teaching of statistics more effective as it improves the quality of instruction, encourages students' active learning, and provides them with psychological incentives (Garfield, 1995; Higazi, 2002).

Karp (1995) suggested that the use of statistical software provides students with a tool that enhances their learning experience by allowing them to engage the statistical contents actively and analytically. In addition, it is well known that PowerPoint has permeated all aspects of college teaching as a presentation technology resource (Hulsizer & Woolf, 2009). This success has been associated with the appropriate use of text, images and graphics. Handouts or course packs comprised of the PowerPoint slides and distributed prior to lectures have been recommended.

The use of PowerPoint and statistical software in undergraduate statistics courses has been previously described by Lock (2005) as a facilitator of learning statistics. Also, Gomez (2010, 2011) reported the successful integration of PowerPoint and SPSS in statistics courses for various types of settings: from small groups who had daily access to a desktop personal computer in the classroom to large classes of 200 students seating in an auditorium. Scholars learned more quickly and effectively with this technology integration in all cases.

This presentation discusses the benefits of using PowerPoint and statistical software (SPSS) to develop an interactive approach for teaching an introductory statistics course for undergraduate business students. It summarizes the present author's experience with technology resources while teaching the Statistics for Business and Economics course at Florida International University (FIU) during recent years.

2. Method

2.1 Course Description

The Statistics for Business and Economics course (STA-2023) is a requirement for business majors at FIU and prerequisite for the 'Quantitative Methods in Business' course. It is a three credit-hours class covering descriptive statistics, probability and hypothesis testing. The present author taught this course between the fall of 2009 and fall of 2011 using an interactive approach that integrated technology resources such as PowerPoint and SPSS.

The textbook used was "Statistics for Business and Economics" by McClave, Benson and Sincich (2009), which emphasizes inference methods and stresses the development of statistical thinking. It includes many proposed exercises for which real data is utilized to illustrate statistical applications in business. Our course encompassed content from chapter 1 to 8, covering a range of topics: from descriptive statistics to tests of hypotheses based on a single sample. A basic scientific calculator with statistical capabilities such as the TI-30xa was also required for some in class computations.

2.2 Course Design

The traditional approach to teaching Statistics consists of using a board during lectures, a textbook as a reference, a calculator for computations and, more recently, supplementary material posted on a website. Two technology additions were integrated in our course between the fall of 2009 and fall of 2011: the daily use of PowerPoint for lectures as well as statistical software (SPSS) for data computations and analyses. This integration allowed for more class time to discuss statistical concepts and business applications. Thus, a broader conceptual understanding of the material was promoted as well as active learning in the classroom. Consequently, an interactive learning environment was generated where students had the opportunity to develop an increased rank of statistical literacy and reasoning.

At the low level use of technology resources, online material posted on the instructor's website provided valuable information to the students regarding: (a) course content and objectives, (b) syllabus, (c) recommended text book and supplemental exercises, and (d) vocabulary. The vocabulary file, organized by chapter, included a complete list of definitions and concepts for our course. Also, a scientific calculator equipped with statistical capabilities was used for minor computations of descriptive statistics, such as

the mean and standard deviations of quantitative data sets, as well as probabilities for the Binomial and Poisson distributions.

At a higher level, the PowerPoint presentations, developed by the present author for this course, included: (a) text for definitions, formulae, examples and exercises; (b) tables, graphs and other pictorial representations; and (c) SPSS output. These presentations were structured with the goal of increasing student participation during lectures in addition to satisfying the needs of scholars with a more visual oriented learning style. A course pack comprising the PowerPoint slides for all lectures was made available to the students at the beginning of the course, eliminating the hassle of frantic note-taking in class.

The incorporation of SPSS involved the use of computer output to illustrate a variety of topics including frequency graphs, box plots, control charts, display of areas under normal curves, sampling distributions, confidence intervals, and tests of significance, allowing a more effective discussion of the statistical concepts and business applications.

2.3 Course Organization

The Statistics for Business and Economics (STA-2023) course, is a three credit-hours class that meets two times (75 minutes each) or three times (50 minutes each) per week. Typical enrollment for this course was 40-60 students seated in a regular classroom. A computer projection system was used for the PowerPoint presentations during the fall 2009 to the fall 2011 period. No desktop or laptop computers were accessible in the classroom. A dry erase board was also available as a supplement for class discussions.

The Instructor's style for lectures consisted of projecting slides from a presenter device and discussing their content with the students while moving around the classroom. This approach allowed a more direct interaction with learners. Homework from the text book and online supplemental exercises was assigned at the end of lectures, and their solution discussed during the next class. The bulk of the evaluation system comprised of two/three midterms and a cumulative final exam, all designed using the "show all work" format.

3. Results

Before using the interactive teaching approach described here, the present author had also taught the same course using traditional resources and a more teacher centered approach several times. The Table 1 below shows relevant data of the students' motivation and performance for all groups taking the STA-2023 course between the fall of 2007 and fall of 2011. The indicators used to measure motivation and performance were the retention and passing rates, calculated as the number of non-dropped and passing students relative to enrollment, respectively. The table is divided according to the time periods of fall 2007-spring 2009 and fall 2009-fall 2011

Table 1

Method	*Students Enrolled*	*Students Dropped*	*% Retention*	*Students Passing*	*% Passing*
Traditional Fall 07- Spring 09	188	11	94.1%	112	59.6
Interactive with Tech. Fall 09- Fall 11	163	2	98.8%	114	69.9

4. Discussion and Conclusions

The use of Power Point where text was presented in conjunction with graphs and other pictorial representations assisted students, particularly those with a more visually oriented learning style. The course pack comprised of PowerPoint slides helped students to focus on class discussions by minimizing the note-taking process. Furthermore, the integration of computational technology provided an effective teaching tool for this type of course by generating more time for data analysis and conceptual understanding. The scientific calculator expedited the computation of sample means and standard deviations as well as binomial and Poisson probabilities; whereas the presentation of SPSS output for statistical graphs and procedures led to a deeper problem understanding. Instructor's mobility in the classroom, granted by the use of a presenter device, also facilitated interaction with the students.

To assess the effectiveness of this interactive approach based on technology resources, data from Table 1 was used to compare the performance and motivation of students taking the STA-2023 course between fall 2009 and fall 2011 to four groups of the same course taught with a more traditional approach that excluded Power Point and SPSS (fall 2007- spring 2009). The present author was the instructor for all groups involved in the comparison.

Despite possible limitations, the statistical comparisons provide useful information about the effectiveness of this technology based interactive approach. The passing rate was 10 points of percentage higher and the retention rate increased from 94% to 99% while using the interactive approach. A data analysis from Table 1 indicates that the higher retention and passing rates for groups with the technology additions are statistically significant, using a conventional $\alpha = 0.05$ (p-values equal to 0.0110 and 0.0215 respectively). Moreover, students' satisfaction with the interactive method was high, demonstrated by the 90% of excellent/very good opinions about the overall quality of instruction, as assessed by the official university surveys.

These results indicate that the integration of technology resources into an interactive approach provided a highly effective teaching-learning method for undergraduate

business students taking an introductory statistics course. The following conclusions substantiate the improvements related to the quality of instruction and students' understanding:

- Students learned more effectively as demonstrated by the 10% higher passing rate when compared to groups with a more traditional teaching method.
- Students' motivation was outstanding as evidenced by the 99% retention rate.
- Students' satisfaction was high as indicated by the 90% of excellent/very good opinions about the quality of instruction.

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