

ENHANCING STATISTICS COURSES FOR PSYCHOLOGY STUDENTS USING TECHNOLOGY RESOURCES

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1. Introduction

Educational researchers believe that advanced Statistics topics are now essential for Psychology graduates. Most psychologists recognize that the minimum requirements for a quality undergraduate education in Psychology include teaching students how to develop hypotheses, collect and analyze data using statistical methods, as well as write reports summarizing the results (Dunn, Smith, Beins, 2007). Rather than streamline an existing one-semester course with additional topics the current trend consists of teaching a second-semester class (Brakke, Wilson, Bradley, 2007). To address this issue many statistics departments offer a second undergraduate course including hypothesis testing, analysis of variance (ANOVA) models, regression, categorical data analysis and nonparametric methods.

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). In 2004, a committee created by the American Statistical Association produced the Guidelines for Assessment and Instruction in Statistics Education (GAISE), which recommended the use of technology for introductory statistics courses at college level.

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. The undergraduate statistics courses for psychology majors emphasize the development of statistical literacy and competence. To this end, learning statistical techniques constitutes an essential element and statistical software the technology tool to achieve this objective (Beins & Lynn, 2007). The goal of integrating statistical software into statistics courses for psychology majors is to insure that students can understand the analyses and explain the results. Perhaps most importantly, the use of computers in statistics and research classes helps to shape the behavior of psychologists in their professional activity (Beins & Lynn, 2007).

Professional statistical software has recently become more accessible to academic institutions and students as its cost has dropped during recent years. The choice of statistical software depends on: a) the context where students are expected to use their

statistical skills, and b) resources available. Research on statistics courses for psychology students has identified SPSS as the most commonly used statistical software.

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. The use of Power Point where text is presented in conjunction with graphs and other pictorial representations helps students, particularly those with a more visually oriented learning style. Handouts or course packs comprised of PowerPoint slides and distributed prior to lectures have been recommended for helping students to focus on class discussions.

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) reported the successful integration of PowerPoint and SPSS in statistics courses for large classes (200 students), as well as for small groups (less than 25 students) who had daily access to a desktop personal computer in class. Students learned more quickly and effectively with this technology integration in both cases.

This presentation discusses the benefits of using PowerPoint and statistical software (SPSS) in a second statistics course for undergraduate Psychology students at university level. It summarizes the present author's experience with technology resources while teaching the Introduction to Statistics II course at Florida International University (FIU) during recent years.

2. Method

2.1 Course Description

The Introduction to Statistics II course (STA-3123) is a requirement for Psychology majors at FIU and prerequisite for the Research Methods course. It has been a four credit-hours class and covers five logical units: hypothesis testing based on one and two samples, analysis of variance models, regression analysis, chi-square tests for categorical data, and non-parametric statistics. The present author taught this course each summer term of years 2008 and 2009 integrating PowerPoint and SPSS. The author had also taught the same course using traditional resources in 2006 and 2007.

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 for the years 2008 and 2009: the daily use of PowerPoint for lectures as well as statistical software (SPSS) for data computations and analyses. The interactive lecture approach used for this STA-3123 course in these years was intended to promote active learning in the classroom as well as conceptual understanding.

2.2.1 Traditional Resources

The textbook used was “Statistics” by McClave and Sincich, which emphasizes inference methods and stresses the development of statistical thinking. It includes real data in applications for many proposed exercises. Our course encompassed content from chapter 8 to 14, covering from hypothesis testing to non-parametric methods. A basic scientific calculator with statistical capabilities such as the TI-30xa was also required for minor computations.

Material posted on the instructor’s website provided valuable information to the students. The following list describes the online content: a) course description and objectives, b) syllabus, c) recommended text exercises, d) vocabulary, and e) SPSS assignments. The vocabulary file, organized by chapter, included a complete list of definitions and concepts involved in our course.

2.2.2 Technology Resources

Use of PowerPoint

The PowerPoint presentations for all lectures, developed by the instructor for this course, included: a) text for definitions, concepts, formulas, examples and exercises; b) tables, figures, and graphs; c) SPSS output; and d) SPSS instructions. Use of burdening slides was avoided. These presentations were structured with the goal of maximizing the students’ engagement and active learning in class, resulting in a more dynamic lecture. The experience obtained with PowerPoint along the two year period 2008-09 allowed the present author to create course packs with the PP slides for all lectures that are now available at the university bookstore. The coursepack reduces the notes taken by the students during lecture time and allows them to focus on the discussion of statistical concepts, solution of exercises and use of the statistical software.

Use of SPSS

Students were taught how to enter the data into SPSS, and instructions about the statistical procedures, previously posted in the instructor website, were discussed in class. The integration of SPSS comprised three different activities: a) use of computer output in the form of statistical tables and graphs as part of the PowerPoint presentations for lectures, b) discussion of SPSS instructions in class for software procedures, and c) execution of take-home assignments by the students. A list of SPSS modules and procedures used for lectures and take-home assignments follows:

- Compare Means
 - One sample t-test
 - Two independent samples t-test
 - Paired samples t-test

- General Linear Model
 - One-way ANOVA for the completely randomized design
 - Two-way ANOVA without interaction for the randomized block design
 - Two-way ANOVA with interaction for the two factor factorial design
- Regression and Correlation
 - Linear regression with one independent variable
 - Bivariate linear correlation
- Chi-Square tests for categorical data
 - Non-parametric tests for multinomial probabilities: One Way classification
 - Crosstabs for testing independence/dependence: Two Way classification

2.3 Course Organization

The Introduction to Statistics II course, which has been a four credit-hours class, usually comprises twenty eight class meetings, one hundred minutes each. Typical enrollment for this course is 40-50 students seating in a classroom with a computer projection system used for the PowerPoint presentations. No desktop or laptop computers are accessible in the classroom. A dry erase board is also available as a supplement for class discussions.

Student evaluations included two midterms and a cumulative final exam in which software computer output was involved. The exams were designed using the “show all work” format. In addition, three SPSS take-home assignments were scheduled along the course accounting for 25% of the total class score. The inclusion of statistical software in the evaluation system was expected to contribute to the success of this technology based teaching-learning model.

The SPSS assignments were performed by teams, integrated by 4-5 students, with the purpose of promoting cooperative learning. A team report, including a questions and answers section about the software output, was required. The SPSS execution was conducted at the university computer labs. Florida International University has a site license for SPSS and many on campus computer labs are loaded with the software.

3. Results

The table below shows the comparison of relevant indicators of the students’ motivation and performance between groups taking the same course with and without the integration of PowerPoint and SPSS. The indicators used for these comparisons were the retention and passing rates, calculated as the number of non-dropped and passing students relative to enrollment, respectively. Table 1 shows data from the last four times the Introduction to Statistics II course was taught.

Table 1

<i>Method</i>	<i>Students Enrolled</i>	<i>Students Dropped</i>	<i>% Retention</i>	<i>Students Passing</i>	<i>% Passing</i>
Traditional Summer 2006-07	102	20	80%	60	59%
Technology Summer 2008-09	94	6	94%	78	83%

4. Discussion and Conclusions

Despite possible limitations, these comparisons provide useful information about the effectiveness of the PowerPoint and SPSS integration in teaching a second statistics course for undergraduate Psychology majors. A data analysis from Table 1 indicates that the higher retention rate for classes with the two technology additions is statistically significant ($p\text{-value} < .0001$). The passing rate with the technology integration is 24 points of percentage higher than the non-technology classes resulting in a highly significant statistical difference ($p\text{-value} < .0001$).

The use of Power Point where text was presented in conjunction with graphs and other pictorial representations helped students with a more visually oriented learning style. The use of SPSS results for complex statistical procedures provided more time for analyses and helped students to focus on class discussions. Consequently more than 80% of them rated the overall quality of instruction as very good/excellent at the end of the course. The Psychology students also became familiar with the SPSS data entry and procedures, facilitating their transition to the Research Methods class where this statistical software is used.

The results indicate that the integration of these two technology tools into other traditional resources provided a highly effective teaching-learning method in a second statistics course for undergraduate Psychology students. The quality of instruction as well as students' understanding and motivation improved as pointed out by the following conclusions:

- Students learned more quickly and effectively.
- Students developed SPSS skills.
- Students' retention and performance with this technology-based teaching method compared favorably to students with a more traditional teaching approach.
- Students' satisfaction was high.

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