

Title (See page 2!)

## Design and Evaluation of Undergraduate Probability and Statistics Courses using SOCR Tools

### Abstract

Technology-based instruction represents a new recent pedagogical paradigm that is rooted in the realization that new generations are much more comfortable with, and excited about, new technologies. The NSF-funded Statistics Online Computational Resource (SOCR) provides a number of educational materials and interactive tools for enhancing instruction in various undergraduate and graduate courses in probability and statistics. SOCR includes class notes, practice activities, statistical calculators, interactive graphical user interfaces, computational and simulation applets, tools for data analysis and visualization. These tools are based on novel technologies and are designed to bridge between the introductory and the more advanced computational and applied probability and statistics courses. We have designed a study involving 300 over students to assess the effectiveness of SOCR. In this study, we will try to explore how SOCR affects the performance of students in relation to their learning style. We will also use the same design for two different courses (an introductory course and a more advance course in probability). For each course, SOCR-based and non SOCR-based activities or homework will be assigned and analyze relative to their performance. Our goal is to assess the relationship between SOCR and students' achievement in the Statistics courses through their homework and activities.

Key Words: education research, teaching with technology, Java applets, online course materials, probability and statistics.

Comments: I'd recommend the following structure for the abstract:

Background: (1 sentence on IT-based instruction + 2 sentences on SOCR resources)

Methods & Design: (of our 2005 pilot study + design of the 2006-2007 larger study\_

Results (from the 2005 study)

Conclusions (impact of SOCR, effectiveness, why should others try it?)

**Background:** Technology-based instruction represents a new recent pedagogical paradigm that is rooted in the realization that new generations are much more comfortable with, and excited about, new technologies. The NSF-funded Statistics Online Computational Resource ([www.SOCR.ucla.edu](http://www.SOCR.ucla.edu)) provides a number of materials for enhancing instruction in various undergraduate and graduate courses in probability and statistics. The SOCR resources include educational materials, practice activities, tutorials, statistical calculators, interactive graphical user interfaces, computational and simulation applets, tools for data analysis and visualization.

### **Design & Methods:**

In 2005-2006 we used the SOCR resources in an experiment designed to assess the efficacy of using IT-based blended instruction and compare it to traditional pedagogical methods. Over 300 UCLA students from several classes were involved in this pilot study. In a larger study in 2006-2007, we used the Felder-Silverman-Solomon index as a measure of individual students learning style to study the relation between the quantitative examination measures in the experimental (SOCR) and control (traditional) groups. Within each class, we used randomization in utilizing the SOCR resource for different topics in the instruction and assessment.

### **Results:**

We saw a consistent trend of improvement in the SOCR treatment group compared to the control group, in terms of quantitative examination measures. Taking in account all homework assignments and examination scores for all courses in this study, we saw no quantitative category where the measures was higher for the control group compared to the SOCR-treatment group. This consistency was indicative of a very strong treatment effect in this study, sign-test  $p\text{-value} < 10^{-3}$ . Furthermore, the variability in the quantitative measurements in the treatment group was consistently smaller, which suggests that SOCR may benefit the majority of the students not only the top students.

**Conclusions:** The SOCR resource provides a number of interactive tools and materials that may be used by the instructors, during lecture and/or discussion, and by the students for self-learning and to complete assignments. These tools bridge between the introductory and the more advanced computational and applied probability and statistics courses. Our findings indicate that the utilization of novel information technologies in modern pedagogical approaches is a worthwhile endeavor.