Title

Assessment of the Pedagogical Utilization of the Statistics Online Computational Resource in Introductory Probability Courses: a Quasi-Experiment

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Assessment of the Pedagogical Utilization of the Statistics Online Computational Resource in Introductory Probability Courses: A quasi-experiment

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Thank you, Gracias,Obrigado

- We express our thanks to the organizers of ICOTS-7 and IASE for the opportunity to be here.
- Damos las gracias a los organizadores de ICOTS-7 y IASE por la oportunidad de estar aqui.
- Agradecemos os organizadores de ICOTS-7 e IASE da oportunidade de estar aqui.

Outline

1. What is SOCR (Statistics Online Computational Resource)?
2. Background on effectiveness of applets in teaching probability?
3. Quasi-experiment: Effects of SOCR on student learning, satisfaction and use of technology.
4. Conclusions and comments on other experiments we have done.

1. What is SOCR?

- An ongoing, NSF-funded project created and managed by Ivo Dinov.
- A set of portable online aids for probability and statistics education, technology based instruction and statistical computing.
- SOCR contains tools for educators and researchers.

1.1. SOCR Resources

1. Simulation Experiments
2. Distributions to compute probabilities
3. Interactive Analyses
4. Games, 5. Modeler, 6. Charts, 7. More

SOCR is at

http://www.socr.ucla.edu/SOCR.html

1.2. Resources used in this study

- In our study, we used Distributions and Experiments applets
- Some of the games applets are also appropriate to teach Introductory probability.
- Some of the applets lend themselves to very advanced analysis but we used them at introductory level.
- See an example of an activity we used(birthday problem activity handed out)

1.3. The SOCR team

1. Educators who test the material in the class and develop classroom activities and assessment tools to accompany the applets.
2. Software developers who are constantly upgrading the code and the applets and who respond to feedback from the educators.
3. Students who test the material
4. Applied researchers.

2. Background on effectiveness of Applets in teaching probability at college level

- Most knowledge of effectiveness of applets based on introductory statistics classes, not Introductory probability classes.
- Lack of experimental studies with a control group.
- In our study:(a) Introductory probability classes, controlled study

2.1. Agreement on Dimensions in teaching and Intro probability class.

1. Understand what random and chance means
2. Find and interpret probabilities
3. Use probability distributions to answer complex questions.
4. Limit theorems
5. Functions of random variables
6. Marginal, conditional probabilities

3. Our Quasi-Experiment

- Fall 2005. Two Introduction to Probability Classes. Undergraduate upper division.
- One class (treatment group) subject to required SOCR and optional R in homework and optional SOCR in class lectures, exams. Not a very intensive use.
- The other class (control group) could use R, but not exposed to required SOCR.

Table 1. Composition of groups

Group	Major %	Class %
SOCR (n=20) 9:00-9:50am	Math/Ap M 45% Math/Ec 35% Other 20%	Junior 65% Senior 15% Grad 15%
Control(n=39) 11-11:50am	Math/Ap M 13% Math/Ec 24% Biostat 33% Eng,other 30%	Junior 28% Senior 28% Grad 41% *These grads biostats mostly

3.1. Two examples of SOCR activities in treatment group

Handouts 1and 2 with a couple of the activities using SOCR is being distributed. Components of the activities:

(a) They relate to the material covered at the moment. To be turned in with homework.

(b) Taught students how to use the applets

(c) Included homework questions that could be solved using the applets.

(d) The three components followed guidelines given by Roger Woodard and Ginger Rowell in CAUSE workshop 2005.

(e) Exam questions in the final (see handout 3) could be answered using SOCR or R (optional) or using formulas.

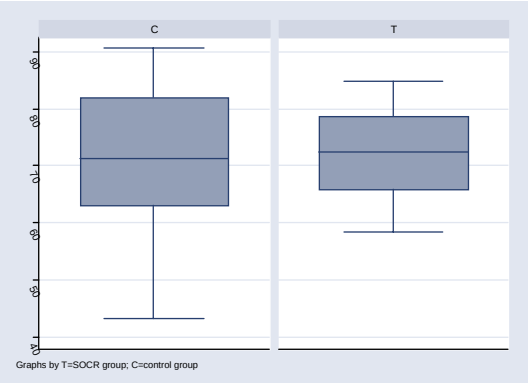
(f) Some applets (like CLT) were also demonstrated in control group but not required in homework)

3.2 Outcomes of the Study

1. Learning Outcomes: Assessment tools such as required homework, midterm, final exams, identical in both groups, but in SOCR group use of SOCR required for some homework.
2. Technology outcome: Voluntary use of technology in final exam. SOCR group could use SOCR and R, control only R
3. Student satisfaction outcomes

3.3. Learning outcomes

Figure 1. Total Score for the course



T=Treatment (SOCR)

C=Control

Table 2. All Student Learning Outcomes (excluding grad students)

Group	Midterm(35)	Hwk (20)	Final(45)	Total(100)
SOCR (n=17)	Mean=27.08	16.41	29.23	72.73
	Median=28.5	16.41	29.40	72.44
	Min=17.5	13.39	22.5	58.42
	Max=33	19.07	36.9	84.89
	Sd=4.25	1.73	4.3	8.08
Control n=23	Mean=26.19	15.76	28.48	70.45
	Median=26.5	16.92	29.4	71.22
	Min=17.5	4.69	18.4	43.19
	Max=34	19.74	37.2	90.55
	Sd=4.65	4.44	5.31	12.24

3.4. “Use of Technology” outcome

- Final exam conducted in computer lab with centrally monitored terminals
- Treatment group could use SOCR or R; Control group could use R
- Use of technology to answer questions:

  95% in the SOCR group

  65% in the control group

3.5. Satisfaction Outcome

End of quarter questionnaire:

(a) Technology made the class more effective than in other classes not using technology (79% vs. 67%)

(b) Class taught them things more relevant to their lives than other classes (84% vs 62%)

Note: Anonymous survey. No way to remove the grad students.

4. Conclusions

(a) This was a small scale experiment, our first, with moderate use of the SOCR applets in the treatment group.

(b) Not easy to embark in using SOCR in probability classes, but experiment helped us see how to use SOCR and what activities and help files to add to make it easier for instructors to implement it.

More conclusions…

In the treatment group:

(c) Students were more at ease using technology when assessing their learning

(d) Students were more homogeneous in the performance.

(e) Students were, overall, more satisfied.

More information

- More information on this and other experiments conducted by Ivo Dinov's team can be found in the forthcoming publication

Dinov, I. Sanchez, J. and Christou, N. *Pedagogical Utilization and Assessment of the Statistic Online Computational Resource in Introductory Probability and Statistics Courses.* To appear in journal Education and Technology. Elsevier Publishers.

Handouts

- Note: Handouts 1 and 2 with SOCR activities used in the Treatment (SOCR) group distributed separately.
- Note 2: Handout 3 can be found in the next pages.

Handout 3: Examples of questions in Final Exam that could use SOCR or R

Q.12.- What is the probability that in a room with 10 people at least two people share the same birthday? Show work. (Birthday experiment was used in homework-See Birthday activity)

Q.14.- In a large lecture course, the scores on the final examination followed the normal curve closely. The average score was 60 points and three-fourths of the class scored between 50 and 70 points. The SD of the scores was (choose from options): (i) larger than 10 points; (ii) smaller than 10 points; (iii) impossible to say with the information given.

Q.30.- Let X be the random variable representing the gain (in $) from playing a particular game and let Y the random variable representing the gain in satisfaction. It is believed that X and Y are jointly normally distributed with $\mu_x=0$, $\mu_y=0$, $\rho=0.6$, $\sigma_x=4$ and $\sigma_y=2$. (a) What would happen to the expected satisfaction if the gain went from \$5 to \$10 dollars. Provide the exact increase in expected satisfaction.(b) What would be the effect on the joint distribution if ρ decreased to 0.3 and σ_x= became 4?

26.- In deciding how many customer service representatives to hire and in planning their schedules, a firm that markets electronic typewriters studies repair times for the machines. One such study revealed that repair times have an approximately exponential distribution, with a mean of 22 minutes. (a) Find the probability that a randomly selected repair time will be less than 10 minutes. Show work and sketch the density. Is this density more or less skewed than if the random variable had mean 5? Show by comparing a sketch of the density with mean 22 and a sketch of the density with mean 5.

The rest of the problem continues assuming the mean is 22.

(b) The charge for typewriters repairs is $50 for each half hour (or part thereof) for labor. What is the probability that a repair job will result in a charge for labor of $100? Show work. (assume the original mean of 22).