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Jorge Luis Romeu and Vicente Gascon Gascon

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MINITAB AND PIZZA: A WORKSHOP EXPERIMENT

JORGE LUIS ROMEU
State University of New York at Cortland

VICENTE GASCON GASCON
University of the Basque Country, Spain

ABSTRACT

Laboratory, workshop, and cooperative learning approaches are some pedagogical methods that raise student interest and involvement in their course work. The present article describes an experiment in applying such methods to teaching a general statistics course to non-mathematics majors, and its statistical assessment. A voluntary, one-hour weekly lab was offered to the general statistics course students. It was developed using computers, e-mail, and Minitab, in conjunction with learning groups, and with the utilization of a Lab Assistant. The results of such experience was then assessed through several instruments, including a student survey that collected their reactions, comments, and suggestions for improvements. Then, a preliminary statistical analysis of some of the course data collected, comparing grade results of students who attended the workshop with those who did not, is presented. Finally, some general conclusions regarding this workshop's effectiveness, its recruitment and retention efforts and directions for future work, are also discussed.

INTRODUCTION

Getting non-mathematics majors to become involved in a general statistics course is not easy. Giving and analyzing interesting real life examples helps. But the corresponding statistical data analyses are time consuming and turn many students off. One way to overcome this problem is by using some statistical software (e.g., Minitab). But learning to use it effectively also takes time and effort, which we cannot afford to take away from class time.

To deal with such problems, Romeu, who has worked in this area for some time now, developed a (Minitab) statistics workshop for the general introductory course [1, 2]. Through the aid of a SUNY Central ($1200) Grant, a Lab Assistant (TA) was hired to teach it. Pizza and refreshments were provided in every Lab session to "lure" students and foster attendance. Then, Gascon, a colleague in Spain, became interested in applying such techniques with his students (which will allow cross cultural comparisons). He also became involved in the data analysis. The SUNY Central grant was obtained through a SUNY Coalition for Mathematics Workshop headed by Dr. Jack Narayan of SUNY-Oswego. This provided support for the incentives (pizzas) and TA salary. Our overload work, developing and implementing the labs, did the rest.

The philosophy behind the Minitab workshop solution worked as follows. Students were divided into cooperative learning groups of four to six, with a group coordinator. They interacted via e-mail and met weekly to 1) study (do exercises with data collected from the class), and 2) discover (perform experiments via Minitab and its simulation and data analysis capabilities). Group participation was not directly evaluated for credit, but provided the right to take the exams. This removed the problems of uneven or unequal work when grading them. On the other hand, weaker students benefited from the knowledge of the stronger ones. And these latter benefited from the tutoring they gave to the weaker group members. Finally, all benefited from 1) smaller distribution of (data input) work and 2) sharing of partial or individual knowledge, to build a greater collective one.

The use of e-mail and Minitab software was essential for this experience. Students as well as the instructor were in constant e-mail communication. Also, information (data, instructions, tutorials) could be sent, or questions asked, at any time. Minitab allowed 1) real data analysis and graphical description and 2) the generation of additional data for students to perform more analyses as needed. Also, the capability for collecting an entire session into an output file gave both instructor and students the possibility to share the work done as Tutorials, as questions, or as problem sessions.

LAB DESCRIPTION

Attendance to Lab was voluntary (participation in groups was mandatory). Labs were started the third week of class and ran for ten weeks, paralleling the course work. There were two sections, in two different weekdays, to provide students from our two statistics classes (40 in total) a greater opportunity to attend it. Pizza and sodas were provided before starting each Lab. Also, a special effort was done to have at least one member of each Cooperative Learning Group attend the weekly labs. Additionally, Lab tutorials and instructions were sent via e-mail to the class, so everyone could do them, even if they were unable to attend.

The Lab Assistant (TA) was a Biology senior that had taken both our general and second statistics courses, and had done well in them. Also, the TA had some experience in the use of Minitab. We met weekly to jointly run over the Lab work before classes. I would usually start the Lab with him and then let him continue after ten or fifteen minutes, on his own. Lab work always reinforced and paralleled our weekly lectures.

The ten Lab Sessions were:

1. Introduction (input/edit/save/retrieve/describe univariate data).
2. Follow-up (sending/receiving/processing files of gathered data).
3. Analysis of bivariate Qualitative data: contingency tables.
4. Analysis of bivariate Quantitative data: correlation/regression.
5. Probability: expected values/variances, distribution simulation.
6. Normal and binomial distributions; generation and data analysis.
7. Central Limit Theorem and its effects in data analysis.
8. Confidence Intervals for (small/large sample) mean/proportion.
9. Hypothesis Testing for one sample Mean/Proportion (z and t).
10. Hypothesis Testing and c.i. for the two-sample case.

DATA COLLECTION FOR ASSESSMENT

Lab attendance was carefully monitored with the objective of collecting data for assessing the Lab experiments. Since Labs started during the third week and our Midterm was in the sixth, we did not expect a large effect in this test. But we did hope to see an effect in the second test (11th week) and in the final exam, as well as in the weekly quizzes.

Three stages of data collection were defined for assessment. In the eighth week of the course (fifth of the Lab) a questionnaire was sent by e-mail to ALL students (attending the Lab or not) and a one-page essay was requested, responding to the following questions:

For those who have, at any point, attended the Lab:

1. Why did you decide to attend? The Pizza?
2. What was the most useful feature? Why?
3. What was the least useful? Why?
4. How can we improve in this, next time?
5. For those who stopped attending; why did you?
6. What can we do to prevent attrition?

For those who did not attend the Lab:

1. Why did you decide not to attend?
2. What can we do next time to make attendance possible for you?
3. What do you think you missed, because you did not attend?
4. What have you done to compensate for this difference?

All students responded this required, signed essay. Even when not anonymous, our open student rapport allowed this survey to provide very useful information that helped us make changes in the semester's remaining five Labs and in the Lab for the following semester.

The second data collection stage was a completely anonymous survey, distributed during the last week of class, after Labs were completed.

From these, we obtained the following data analysis variables:

1. Student year (1/freshman, 2/sophomore, 3/junior, etc.)
2. Student gender (0/male, 1/female)
3. Cooperative Learning Group (CLG) participation (0/never . . . 3/weekly)
4. Perceived benefit from CLG participation (1/negative . . . 3/positive)
5. E-mail use for communication (0/never . . . 2/often)
6. E-mail use for tutorials/Lab info (1/seldom . . . 3/always)
7. Perceived benefit from e-mail info (1/negative . . . 3/positive)
8. Minitab use in homework or CLG work (0/never . . . 2/often)
9. Perceived benefit from Minitab (1/negative . . . 3/positive)
10. Attendance to Minitab Pizza Lab (0/never . . . 3/5 or more)
11. Individual Study (outside of CLG) (1/never . . . 4/every day)
12. Student Grade in Test #1 (0/E . . . 4/A)
13. Student Grade in Test #2 (same as above)
14. Student Average in weekly quizzes (same as above)
15. Student Expected (perceived) Course Grade (same as above)

The last data collection consisted in the first, second and final grades, course grade and weekly test average. Notice how the students submitted anonymously their expected course grade and how we assessed their real grades. We compared each grade with student participation in Lab, as per the Lab attendance sheet.

QUANTITATIVE ASSESSMENT RESULTS

At present, we have only completed the initial data analyses and hence have only preliminary results. We have submitted a Research Proposal for support to complete the pending data analyses and have presented some additional results to the 51st Session of the ISI (International Statistical Institute) meeting in Istanbul this summer. We include here some of these preliminary results:

First and from the student essays, the most frequent and useful comments were (our reaction/explanation to them, in parentheses):

1. Best Features: more Minitab software practice, better understanding of class material, connection between theory and applications, being more able to ask questions, someone else to answer more questions (both these addressed the TA's work in the Lab), reinforced material, hands-on data analysis experience.

2. Worse Features: Lab time collided with other class/activity time and students couldn't attend (Lab was not previously scheduled, it was not a part of the course, but voluntary), lack of TA's expertise to answer some questions, extra student effort (Lab attendance) without extra credit, no instructor teaching the Lab (all this Lab work was above our normal teaching load), lack of student interest in computers, pizza was not a favorite dish.

3. Solutions Offered by Students: develop a Minitab handbook (which exists on-line, a hard copy was not required since Lab was not required for course), more Lab sections offered (but no administrative support was provided for this experiment), extra credit hour (but requires curriculum revision by College), add second assistant (which was done in the following semester), have the instructor teach the Lab (overload, but was done in the following semester).

From this anonymous survey (32 responses) the following variables: X1 (participation in Pizza Lab), X2 (use of Minitab), X3 (participation in CLG), X4 (Grade in Test #1), X5 (grade in Test #2), and X6 (weekly quiz average) were analyzed using the Spearman Correlation. Table 1 shows the Spearman Coefficient and significance level, respectively.

We can observe, how student grades in tests and weekly quizzes are strongly correlated, as would be expected (this provides validation for the data). And we observe how student participation in the Minitab Lab, in the CLG work and the use of Minitab are also strongly associated. This may either mean that they affect each other or that good students, who always get good grades anyway, enjoy and participate in these activities, too.

Table 1. Spearman Correlation (p-Value)

X2:	0.41 (0.02)				
X3:	0.31 (0.09)	0.29 (0.1)			
X4:	0.09 (0.64)	–0.11 (0.54)	0.00 (0.99)		
X5:	0.08 (0.63)	0.17 (0.36)	–0.23) (0.19)	0.42 (0.01)	
X6:	0.55 (0.00)	0.01 (0.93)	–0.08 (0.62)	0.60 (0.00)	0.50 (0.00)
	X1	X2	X3	X4	X5

CONCLUSIONS AND FUTURE WORK

During the spring 1997 semester, the first author again developed the Pizza-Minitab Lab for his General Statistics course at SUNY-Cortland. This time he personally taught the Lab, while TWO Lab Assistants went around the class answering student questions and helping them with the use of the Minitab commands. This second time Lab ran much more smoothly.

Finally, the two authors of this article have collaborated for several years now. We are preparing conditions to 1) get the grant to perform, this summer, in-depth statistical analyses of the experimental data, to submit the complete work to a journal, and 2) to implement this Lab approach in the second author's university, San Sebastian, Basque Country, Spain. We then intend to compare results obtained in order to assess any possible cross-cultural influence in this teaching approach (since our other big interest lies in international education).

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Direct reprint requests to:

Jorge L. Romeu
P.O. Box 6134
Syracuse, NY 13217