Minitab and Pizza: A Workshop Experiment

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ABSTRACT

Laboratory/workshop and cooperative learning approaches are methods that raise student interest and involvement in their coursework. The present paper presents an experience in applying such methods to teaching a general statistics course to non-mathematics majors. A voluntary, one-hour weekly lab was offered to our students. How it was developed, using email and Minitab, the Lab Assistant and the results of a student survey, with their reactions, comments and suggestions for improvements, is described. Finally, preliminary statistical analyses, comparing grade results of students who attended the workshop vs those who did not, is presented and some general conclusions regarding the workshop effectiveness, its recruitment/retention results and future work are 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 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 the first author developed a (Minitab) statistics workshop for the general introductory course. Through the aid of a SUNY Central Grant ($1200) 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, the second author, 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 Jack Narayan, of SUNY-Oswego. It provided support for 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 email and met weekly to (i) study (do exercises with data collected from the class) and (ii) 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/unequal work in 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 (i) distribution of (data input) work and (ii) sharing of partial individual knowledge to build a greater collective one.

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

LAB DESCRIPTION

Attendance to Lab was voluntary (participation in groups was mandatory). Labs were started the third week and ran for ten weeks, paralleling 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 email to the class, so everyone could do them anyway.

The Lab Assistant was a Biology senior that had taken both our general and the second stats courses and had done well in them. Also, the TA had some experience in the use of Minitab and we met weekly to jointly run over the Lab work before class. I would usually start the Lab with him and let him continue after 10 or 15 minutes, on his own. Lab work always reinforced/paralleled weekly lecture.

The 10 Lab Sessions were:

1) Introduction (input/edit/save/retrieve/describe univar 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 experiment. Since Labs started in 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 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 email to ALL students (attending or not the Lab) and a one pager essay was requested, responding to the 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 opted not to attend?
2) What can we do next time to make it 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 the survey to provide useful information that helped us to make changes in the semester remaining five Labs.

The second data collection stage was a completely anonymous survey, distributed during the last week of class when 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) particip. (0/never ..3/weekly)
4) Perceived benefit from CLG participation (1/neg .. 3/positive)
5) Email use for communication (0/never .. 2/often)
6) Email use for tutorials/Lab info (1/seldom .. 3/always)
7) Perceived benefit from email info (1/neg .. 3/positive)

8) Minitab use in homework or CLG work (0/never .. 2/often)
9) Perceived benefit from Minitab (1/neg .. 3/positive)
10) Attendance to Minitab Pizza Lab (0/never .. 3/5 or more)
11) Individual Study (non during 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 quizes (same as above)
15) Student Expected (perceived) Course Grade (same as above)

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

QUANTITATIVE ASSESSMENT RESULTS

At present, we have barely started the data analyses and have only preliminary results. We have submitted a Research Proposal to our Campus for support to complete and present the analyses to the International Statistical Institute meeting, this summer. However, we include here the following preliminary results:

From the essay, the most frequent and useful comments were: (our reaction/explanation to them, between parentheses)

1) Best Features: Minitab software practice, understanding class material, connect theory with applications, able to ask more questions, someone to answer more questions (both these addressed the TA's work in the Lab), reinforced material, hands on experience.
2) Worse Features: Lab time collided with other class/activity time and student couldn't attend (Lab was not prescheduled, it was not a part of the course but voluntary), lack of TA's expertise to answer some questions, extra student effort without extra credit, no instructor teaching the Lab (all our Lab work was above our teaching load), no interest in computers, pizza was not the issue.
3) Solutions Offered: develop a Minitab handbook (which exists but was not available since Lab was not required for course), more sections offered (no administrative support for this operation), extra credit (requires curriculum revision by College), add second assistant (which was done this semester), have the instructor teach the Lab (overload, but I am teaching this semester).

From this anonymous survey (32 responses) variables x1 (particip. in Pizza Lab), x2 (use of Minitab), x3 (particip. in CLG), x4 (Grade in test #1), x5 (in test #2) and x6 (weekly quiz aver.) were correlated using the Spearman Rank. The Table below has the Spearman Coefficient and significance level:

x2	.41				
	(.02)				
x3	.31	.29			
	(.09)	(.10)			
x4	.09	-.11	.00		
	(.64)	(.54)	(.99)		
x5	.08	.17	-.23	.42	
	(.63)	(.36)	(.19)	(.01)	
x6	.55	.01	-.08	.60	.50
	(.00)	(.93)	(.62)	(.00)	(.00)
	x1	x2	x3	x4	x5

We observe how grades in tests and weekly quiz's are strongly correlated, as expected. And we observe how participation in the Minitab Lab, in the CLG work and use of Minitab are also strongly associated. This may mean that they affect each other or that good students enjoy/participate in these activities.

CONCLUSIONS AND FUTURE WORK

The current (Spring 97) semester, the first author is, again, developing the Pizza-Minitab Lab for his General Statistics course at SUNY-Cortland. This time he is personally teaching the Lab while the TWO Lab Assistants are helping by going around answering student questions and helping them with the Minitab commands. Lab is running much more smoothly.

Finally, the two authors of this paper have collaborated for several years now. We are looking forward to (i) obtaining the grant to perform, this summer, in-depth statistical analyses of the present data, to submit the complete work to the ISI meeting or a journal and (ii) implementing the Lab approach in the second author's university, San Sebastian, Basque Country, Spain, to compare results obtained and to assess any possible cross-cultural influence in this teaching approach (since our other big interest lies in international education).

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