

Project Report

Enhancing Statistics Learning with Online Modules and eLearning System

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In the summer of 2008, I was awarded the CELT Instructional Grant for my project entitled “ Enhancing statistics learning with online modules and eLearning system”. The purpose of this report is to summarize my accomplishments in the project during the summer and the outcomes after I made the changes to the course.

Project Review

Communicating with statistics (STAT 125) is an elementary statistics course offered every semester including summer with multiple sections. This course teaches basic methods and skills about data analysis, probability and statistical inference. Many students find this course very useful, but they have difficulty in learning and the success rate is low. Even though instructors and the tutoring service have made every effort in helping them, the situation did not improve very much.

After thinking about the problems in this course, I proposed to develop online learning modules to help the students with their learning. As supplementary materials, these modules allow students to go over the key concepts and skills at their own

convenience. If they happen to miss a class or do not understand some of the lectures, they can find related module(s) that will guide them through. The step-by-step animation gives detailed explanations and instructions, which makes the modules more interesting than the conventional lectures, and motivates students in their learning. By incorporating these modules into the eLearning system available from IPFW, students can get easy access to these modules and use them to help with their understanding of the statistics concepts. The eLearning system also helps them to self-evaluate their learning effectiveness using the assessment sets I have developed.

Project Implementation

I started my project by first carefully choosing the topics to be covered. According to my past teaching experience, these topics are the ones that the students usually had difficulty in understanding and using in problem solving. I also tried to keep them well distributed over all the eight chapters and make sure all the key topics are covered. Below is a table showing the number of modules in each chapter.

Chapter	1	2	3	4	5	6	7	8
Number of modules	4	1	4	0	3	2	3	3

After identifying them, I began using Adobe Flash to develop the step-by-step modules. My goal was to develop concise, clear yet fully functioning modules that will interest students. In order to make these modules “attractive”, I carefully designed each of them and used plenty of images and graphs to demonstrate the course materials rather than just presenting the “manipulation” of numbers. This turned out to be a correct decision since my students seemed to be more interested when I showed them in my class. To add more interactivities between students and the modules, I did some programming in each module so that students can get involved in it and control each step of the module. Having in mind that students may get bored if the modules took too long, I tried to keep the length of the modules within one minute. Totally, I had finished 20 such modules by the end of the summer.

After all the modules were developed, I tested them for errors before posting

them on the eLearning system. Fortunately, I was able to correct some minor errors before the modules worked seamlessly on the eLearning system. When the new semester started, I told my students that they can always go to eLearning to check for these modules if they have any question. In addition to asking students to use these modules by themselves, I also demonstrated them as we progressed in class so that students knew how to use them. For some difficult topics in the later chapters (6, 7, 8, for instance), I extensively used the animated modules to enhance students' understanding. By using the assessment set designed for each chapter, students can do a self-evaluation about their learning effectiveness and then spend some more time on what they did not master.

I was also open to students' opinions about these modules. For example, when some students complained that they could hardly see the color (sky blue, the default setting of Adobe Flash) in the modules, I immediately changed the color. In this way, I improved the modules little by little as the class moved on.

Project Evaluation

To evaluate the successfulness of my project, I used multiple methods, namely peer review, student evaluation and pre- and post-score comparison.

1. **Peer review approach.** Unfortunately, I do not have enough data to finish this evaluation. But this approach helps me to evaluate my project from the instructor's point of view. Since STAT 125 is a multi-section course, many of my colleagues have taught or are teaching this course. Their precious experiences and insights into the teaching of the class will definitely help to generate a valuable assessment of the project and to improve the modules in the future. When I invite them to review the learning modules, I focus on collecting their opinions from the following aspects:

- Whether the learning modules give clear explanation and/or instructions
- Whether enough topics are covered by the learning modules

- Whether they think students can generate interests from these modules
- How to improve these modules in the future

2. **Students evaluation approach.** Students, as the recipients of knowledge and the changes I made to the course, have the right to evaluate the modules in the first place. At the end of the semester, I asked my students to voluntarily complete a survey (please see the appendix) and collect their opinions about those modules. Out of 22 students enrolled in my class this fall semester, I have 15 responses (or 68% response rate) and the statistics are summarized below.

Proportion of favorable response

The following table gives the proportion of favorable responses (positive scores) for each question in the survey.

Question	1	2	3	4	5	6
Proportion	67%	93%	80%	47%	67%	53%

From these proportions, we see that a majority of the students (question 1) used the modules by themselves after I showed them the functions and most of them (question 2, 3) thought that the modules were interesting and showed clearly the details of the statistical concepts and methods. Although not many of them used these modules to teach themselves (question 4), those modules did help them to answer their questions (question 5) if they had any difficulty in learning. Since about half of the students believed that these modules have covered enough topics (question 6) in the class, probability I do not need to develop any more modules and should concentrate on improving the existing ones, making them more effective and helpful to students.

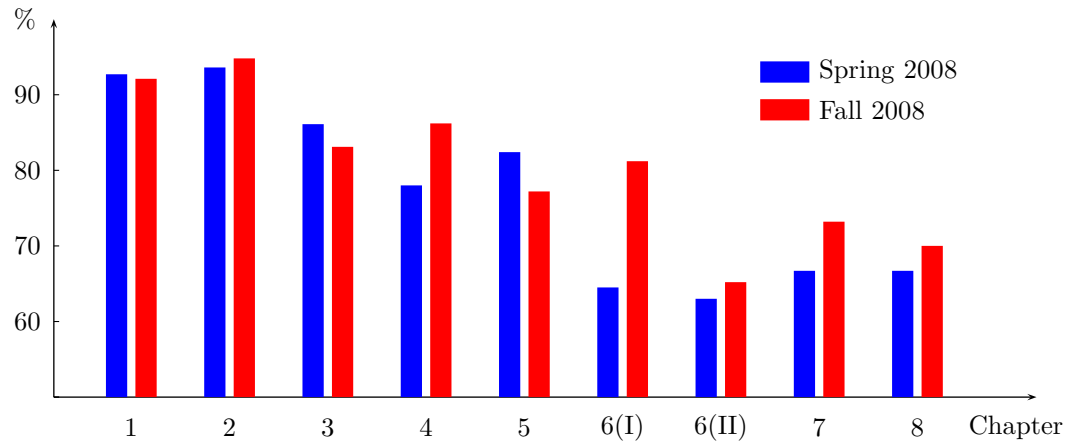
Mean score

Another analysis of the mean score of each question comes to similar conclusions: Students tended to use the modules at their own convenience and these modules somewhat help them generate interests in learning and explain the concepts and methods very well.

3. **Pre- and post-score comparison.** By comparing the average scores of my students before and after the proposed changes, I can determine whether my project leads to better performance and higher success rate. As I developed various modules for various chapters, this comparison will allow me to evaluate not only the overall effect of the whole project but also the effect of modules within each chapter. I have been teaching STAT 125 for the past two years and the comparison was conducted using my classes in spring and fall 2008.

Chapter comparison

The following chart and table show the average percentage grades for each chapter for the two classes – one before the proposed changes (13 students) and the other after those changes (22 students). In these two classes, same topics were covered in each chapter and same assessment set was given after students finished the chapter.



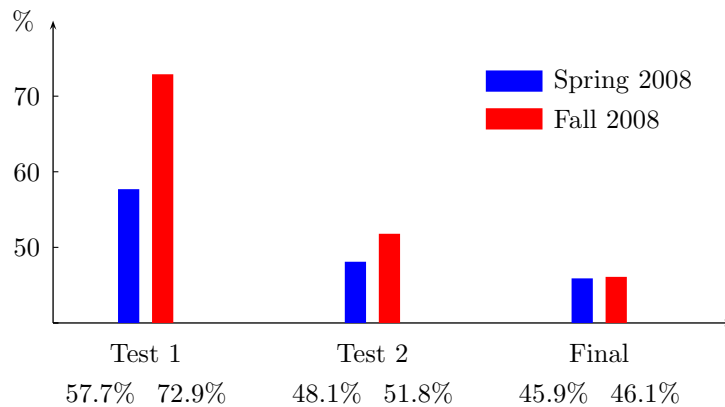
Chapter	1	2	3	4	5	6(I)	6(II)	7	8
Spring 2008 (%)	92.7	93.6	86.1	78.0	82.4	64.5	63.0	66.7	66.7
Fall 2008 (%)	92.1	94.8	83.1	86.2	77.2	81.2	65.2	73.2	70.0

As we can see, the average percentage grade tends to decrease as students move to later chapters of the course. When comparing the average grades of the two classes for the same chapter, it is obvious that there are significant improvements except for a couple of chapters (for example, chapter 3 and 5).

I was not sure why this happen, but for small sample sizes (13 and 22) it is possible that the post-scores are not unanimously higher than the pre-scores.

Overall comparison

The overall comparison is studied using test scores. I gave two midterm tests and one final for this course and these tests for the two classes were identical except that the order of the questions and the numbers in some of the problems were slightly different. The chart below gives the test results.



It is easy to see that the overall performance was improved although improvement in the average percentage grade of final is only a small positive change. Once again, the small sample sizes may have certain impact here.

Success rate comparison

When it comes to the comparison of success rates, it is interesting to note that there is a tiny decrease from 38.5% in spring 2008 to 36.4% in fall 2008. Small sample sizes may lead to this unfavorable result, other factors such as imperfection of the online modules, the way of delivering these materials to students may contribute to the decrease as well.

Generally speaking, these modules have helped students in provoking their interests in learning and getting better performances in statistics class. In the future when larger sample sizes can be obtained, the effectiveness of the proposed changes will be more accurate and convincing.

Acknowledgement

I would like express my deepest gratitude to Dr. Chand K. Chauhan and Dr. Gail A. Rathbun for their great help during the writing of my proposal. This project would never be accomplished had it not been for their constructive comments and suggestions. I would also like to thank all the members of the CELT Advisory Board. The sharing of their expertise in teaching students from different backgrounds had greatly improved my design and implementation of these online modules and helped put this project on the track to a success. Thanks also go to Department of Mathematical Sciences and IPFW community for cultivating and supporting ideas like mine in this project.

Appendix

Student Evaluation

Please mark the circle that best describe your opinion using the scales below:

Disagree (-2), Somewhat disagree (-1), Neutral (0), Somewhat agree (1), Agree (2)

- | | -2 | -1 | 0 | 1 | 2 | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|
| 1 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I had a chance to use the module(s) by myself. |
| 2 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | It was interesting watching the animation(s). |
| 3 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | The modules gave clear explanations and detailed instructions. |
| 4 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | I used modules to teach myself. |
| 5 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | The modules helped in answering my question(s). |
| 6 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | The online system has enough modules for my study. |

What do you like most about the online modules and eLearning system?

What do you like least about the online modules and eLearning system?

Participation and completion of this evaluation is absolutely voluntary and anonymously. In no manner will the result affect your final grade.