Improvement and Evaluation of an Efficient Methodology to Transform a Classroom Based Course into a Web Based Course

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Abstract

This paper describes the improvement, evaluation, and follow ups of a methodology used to transform a classroom based course into an effective web based course which was first presented at the Science, Engineering, & Technology Education Conference on 2003. The course discussed is CS167/467 "C Programming Web Based" offered by the Computer Science department at New Mexico State University with great success since 2002, but the methodology used for the transformation can be easily applied to other courses as well. Even though it does take time to transform a classroom based course into an effective web based course, the benefits for both the instructor and especially the students out weight the initial set up time. In this paper, we describe the steps that were taken to transform the classroom based course into a web based course along with great improvements, evaluations, results, and follow ups. Furthermore, the student performance and course evaluations of the improved web based course are compared against those of the initial web based course, and the classroom based course.

Classroom Based Course

Before describing the methodology used to convert a classroom based course into a web based course, first we will describe the classroom based course which was later converted into a web based course and then was studied, evaluated and successfully improved. The course is CS167/467 "C Programming" offered by the Computer Science Department at New Mexico State University. The objective of this course is to learn the basic knowledge of structured programming in C—control structures; data structures, and functions—along with basic problem solving techniques. The course met for lecture two hours a week and met in the lab for one hour a week. All lectures were given using very clear PowerPoint presentations. The students were provided from the beginning of the semester with all the lecture notes so that they could concentrate on the lecture instead of copying the information from the PowerPoint presentations. The students worked on a new programming assignment every week. The programming assignments for each week covered the lecture material given in that week. Therefore, the students were able to apply the knowledge they got in the lectures every week. There were five closed book exams: Quiz#1, Midterm#1, Quiz#2, Midterm#2, and Final Exam. Quiz#1 and Quiz#2 were basically practice exams for Midterm#1 and Midterm#2 respectively. The Final

Exam was comprehensive. The course grade was computed as follows: Quiz#1 (5%), Midterm#1 (15%), Quiz#2 (5%), Midterm#2 (15%), Final Exam (30%), Lab assignments (20%), Course/Lab participation (10% for undergraduates), project (10% for graduate students).

From Classroom to Web to Improved Web Based Course

The first step in the transformation was to generate web pages that would not only show the lecture slides given in the classroom based course but that would provide a written explanation of each lecture slide as well. The explanation for each lecture slide consisted basically of a detailed description of what the professor said in the classroom. Since in a web based course, the professor does not have immediate feedback from the students to adapt his/her lecturing, the professor must write completely clear and detailed explanations of each lecture slide. The problem we faced is that most students do not like to read. The solution in the improved web based course was to provide different presentation formats of the slides so that we could cover visual, auditory, and kinesthetic stimulus learners. We introduced in addition to the written slides, video slides where an actual professor explained the slides, and audio slides where the students just listed to the professor's explanations. Fig. 1. shows a video slide. In order to make the video and audio interesting, we hired an Art major that pretended to be a British professor and who incorporated lots jokes on her lectures.

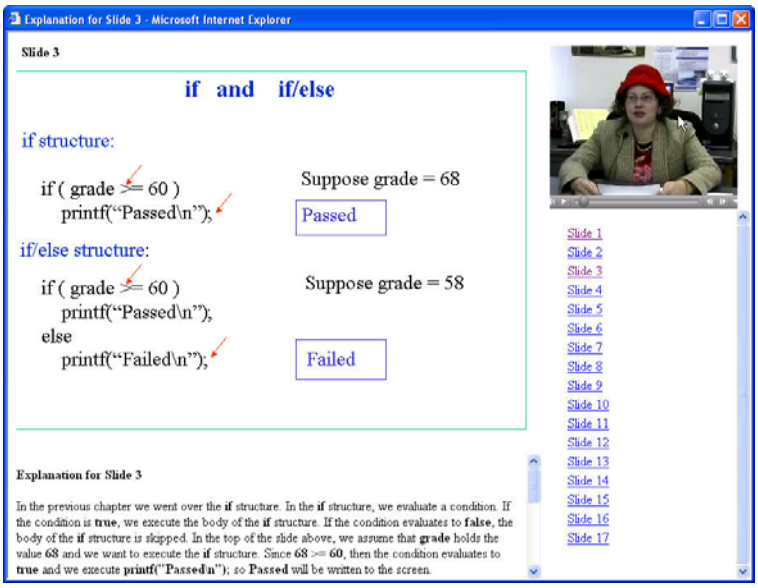

Figure No.1 Video Lecture Slide

In order to help kinesthetic learners understand the execution of the computer programs without the professor explaining it, we introduced step by step animations of the computer programs covered in the slides. The students could control the speed of the program execution; see the computer memory contents, the computer screen, and the flow of execution of the source code at each click of a bottom. Fig. 2. shows a computer program animation. The results were that more and more students started studying.

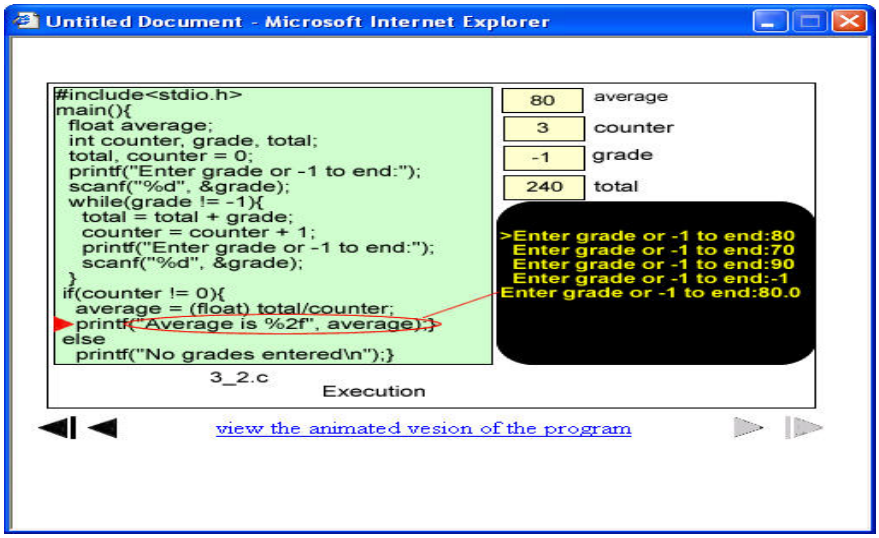

Figure No.2 Animation of Computer Program Execution

In order to make sure that the students understood the class material, we also incorporated a basic concepts Web CT quiz per chapter in the improved web based course. The purpose of the quizzes was for the students to get immediate feedback on their understanding of the chapter, instead of waiting until they took the exams. Although we did not count their quiz grades towards their course grade, the great majority of the students took the quizzes. And since they could take them an unlimited number of times on Web CT, they took them until they got perfect score. It gave them a sense of accomplishment without being penalized.

The second step in the transformation was to generate a detailed plan for the students so that they would know exactly what was going on in the course, what they were supposed to be reading, practicing, studying, etc. However, since the professor can not plan ahead every single detail of what will happen in the course before the course begins, we decided to give to the students a web session three times a week where we explained exactly what they should be doing, reading, practicing, implementing, etc. In each web session there were links to the lecture notes and their explanations, lab assignments, exams, solutions to lab assignments and exams, collection of exercises, grades, announcements, etc. Students were responsible for accessing the web site for the course frequently and reading the web sessions every week so that they could keep up with the work. Figures No. 3 and 4 show a list of web sessions and a sample web session for a particular day.

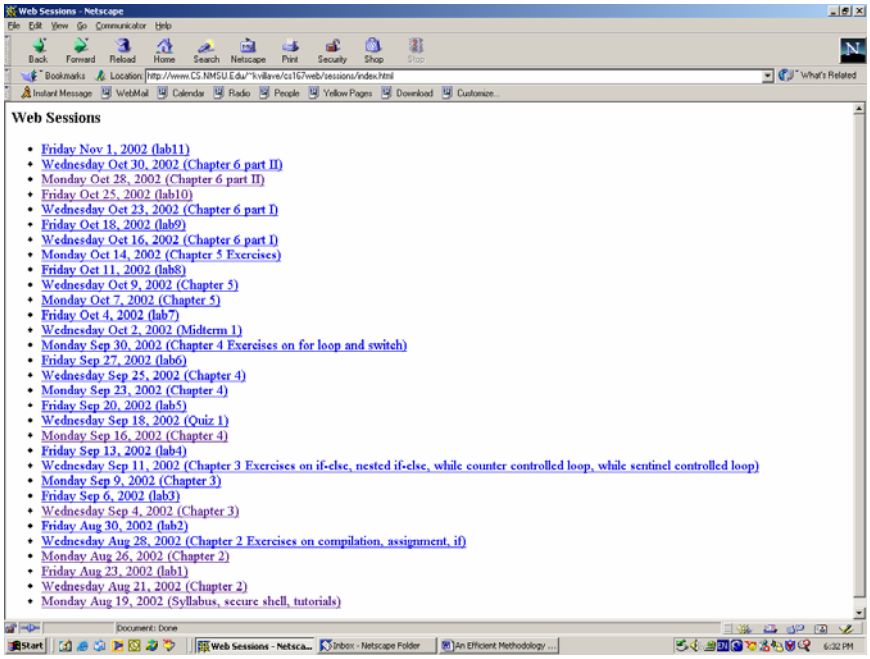

Figure No.3 List of Web Sessions

The problem that we faced was that most students were not keeping up with the web sessions and were behind. The solution was to put the entire course on Web CT and count their Web CT logins as 10% of their course grade. The students immediately started keeping up with the web sessions as soon as they understood that the professor/TA would find out their level of activity.

The third step in the transformation was to decide how to give the exams to the students. Since we wanted the course to be completely web based, we decided to give the exams online, open book, and open notes, and the students were told to work on their own. However, in order to compensate for the open book policy, the students were given only 24 hours to complete the exams, and for each problem on the exam—actually a C program per problem—they received either full credit or zero. Having a quiz (practice midterm) worth only 5% before each midterm was very effective in reminding the students that the midterm was coming.

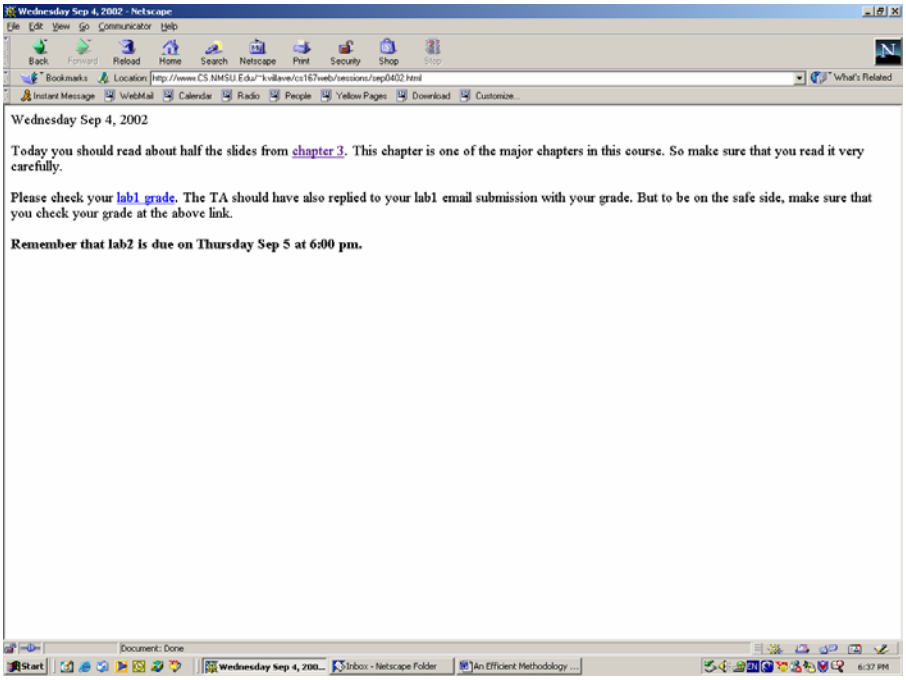

Figure No.4 Web Session

However, once the entire course was moved to Web CT, and students were keeping up with their web sessions, we decided to have only three exams and one comprehensive final. This improvement allowed us to cover more material in the course. Also, since some students complained about unfair grading when they got very close to solve a problem perfectly but were given zero credit, we decided to give partial credit per problem on the exams. The students response to these improvements was very satisfactory, and their grades starting to improve as well.

The fourth step in the transformation was to decide how the students would submit their lab assignments and exams. We decided that students would submit everything by email instead of creating special submission programs, to make it easy for the students, the TA, and professor. This method proved to be simple and effective and also provided the professor and the TA with a straightforward daily report of the class progress.

Student Performance Comparison

The same lecture materials, collections of exercises, exams topics, and lab assignments that were given in the classroom based course were given in the web based course, and the improved web based course. This was done with the purpose of comparing the performance of the students in the three courses. Table 1 shows the percentage of As, Bs, Cs, Ds, and Fs grades from the three courses. The classroom based course had 23 students, the web based course had 29 students, and the improved web based course had 43 students. We can see that the student performance in the first two courses was very similar, and that the number of As increased and the number of Fs decrease in the improved web based course which had the most number of students.

Letter Grade	Classroom based course	Web based course	Improved Web Based Course
As	*39 %*	*48 %*	*58%*
Bs	*22 %*	*21 %*	*21%*
Cs	*13 %*	*7 %*	*9%*
Ds	*9 %*	*7 %*	*7%*
Fs	*17 %*	*17 %*	*5%*

Table 1. Student Performance

Course Evaluation Comparison

The same course evaluation form that was given in the classroom based course was given to the students in the web based course. Table 2 shows the percentage of As and Bs given to a selected set of topics from the course evaluation form. The students on the improved web based course were given a different evaluation that reflected better the nature of the course being a web based course. For example, the rating for attitude of the instructor was changed to ability to teach at a fair pace; the rating of the enthusiasm of the instructor was changed to ability to present material in a nice format; the rating of office hours was changed to quick response to email; the usefulness of the syllabus was changed to usefulness of the web sessions. Although the students from the classroom based course gave better evaluations than the students from the web based course, the evaluations from the web based course were not at all bad considering the fact that the course was given in web based format for the first time and that the course evaluation form was not rewritten or adapted for web based courses. We can see a big improvement in the evaluations from the improved web based course versus the old web based course. The ability to convey information, fair grading, fair exams, organization, and usefulness of web sessions increased significantly. This shows that the improvements made to the web based course were very much appreciated and useful to the students.

Topic	*Classroom based course*	*Web based course*	*Improved web based course*
Ability	*100 %*	*69 %*	*88%*
Attitude	*100 %*	*85 %*	*75%*
Enthusiasm	*94 %*	*92 %*	*75%*
Objectives	*100 %*	*92 %*	*100%*
Content	*100 %*	*92 %*	*75%*
Fair tests	*100 %*	*77 %*	*88%*
Fair grading	*100 %*	*54 %*	*100%*
Exams/points	*94 %*	*85 %*	*100%*
Organization	*100 %*	*69 %*	*88%*
Office hours	*100 %*	*85 %*	*75%*
Syllabus	*81 %*	*54 %*	*88%*

Table 2. Percentage of As and Bs Given in Course Evaluation Forms