



Web-Based Implementation of the Personalized System of Instruction (PSI) in a Mechanical Engineering Required Freshman Computer Course

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DESCRIPTION OF INNOVATION

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PSI is mastery oriented, self-paced, teaching strategy that emphasizes direct interaction between student, proctor, and professor. Course material is divided into units that are studied sequentially and asynchronously by individual students. When a student feels that he or she has mastered a unit to 100% , he takes a readiness test to see if he is allowed to proceed to the next unit. No matter how many times a student retakes the unit tests, the grade is not affected. All students who complete the course receive an A. In this web implementation, proctoring is done over the web using chat sessions and multiple web cams, in a special proctoring room, over the telephone or by email—at the student's choice. The professor is present for most chat sessions in what could be called virtual office hours. Interaction between student, proctor, and professor is maximized, not minimized as in most web-based courses used in distance learning. This course has been offered for four semesters to regular engineering freshmen students. In one instance, the

professor managed the course and interacted with the students in the class from Japan. *This experiment shows that, using PSI, a professor who has access to a laptop and a telephone line anywhere in the world can teach a successful course.*

Rather than design a web-based course that is a pale imitation of a live course, this course blurs the boundary between a live classroom lecture and the web course by using specialized techniques. There is a fundamental difference in watching the live performance of a play or a drama on television. The technical difference is the feeling of “presence” felt by the audience in the live performance. This course was specifically constructed to maximize the feeling of presence. For example, students see their professor once the first day of class, on the web in chat sessions, in very short video clips sprinkled throughout the units, and in longer streaming segments. Not only the professor in charge, but also other professors who teach courses that depend on the material being learned appear in short video segments explaining the relevance of the material. Efforts have been made in these clips to bring forth the unique personalities of the professors the students will meet in later courses. This was achieved by tight cropping of the various images, the use of a steady cam (a special camera that promotes and records movement instead of a fixed point of view), and emulating the “professor metaphor” instead of the “talking heads of the nightly news metaphor” as is so common in the standard web based course.



This course is consistent with best educational practice. It provides hands-on learning since the students use the computer and the Internet to learn about programming and the Internet instead of simply talking about programming and the Internet. When students solve a problem involving the weight of a bridge, a clip of the Tacoma Narrows Bridge failure is included. Its state-of-the-art unit construction manages reinforcement contingencies to maintain student progress by putting small, highly reinforcing units at strategic places along the learning curve. For example, a standard problem with self-paced courses is getting the students to begin the course, the so-called procrastination problem. In this course, small highly rewarding units are designed for the first units and unit difficulty is systematically increased thereafter. As a second example of using unit construction to encourage student progress, consider the last few units in the course. Typically, students feel that they can complete more units over the last few weeks of the course than they can. We have all met the student that takes two laboratory units home for the Christmas holidays convinced he or she can complete them. Seldom is any work done. In this course, the last units are actually easier than the earlier ones. We have taught the student how much work is required to complete a unit, and by lessening this near the end of the course, made the students expectations conform to reality. He can finish the last units in the last few weeks. One co-worker has labeled this an acceptable implementation of the unacceptable merchandising technique called "bait and switch."

The course is "designed for revision" using student performance as the criterion for successive improvement. (This is consistent with the ABET 2000 criteria.) Data is collected on individual progress in what are called progress charts. The unit a student has completed is plotted against the class day. This step chart allows the professor to analyze the unique study habits of each student. Some students begin early; others wait until the end of the course and make steady progress finishing near the last day of class. In a self-paced course no prejudice is given to a student's management of his time. In several cases where a student did not complete the course on time, he commented that he learned a lot about his own ability to schedule his time that would be valuable in the future. An additional bar graph plotting the number of students working on a unit against the unit number is also constructed. This graph is invaluable for improving the course the next offering by highlighting the units that are too difficult or too easy. It also allows a rather simple solution to the perennial question as to whether students are cheating or doing their own work in a web-based course. Three times during the course (units 6, 10, and 17) the student is required to complete a review unit under the watchful eye of the proctor. These are the only times the student must come to campus. Careful examination of this chart helps ensure the integrity of the course. If the students are not doing their own work, the bars for the review units will grow in relationship to their

neighbors as students have difficulty and have to be recycled because they do not know the material. Ideally, a review unit should be very easy for a student and not impede her progress. Finally, we keep careful statistics on web usage. When students access the web site, where they access the web site from, and which pages are accessed more frequently furnish invaluable data for course revision. This data also allows the proctor hours to be scheduled to be the most beneficial to the students.

TARGET POPULATIONS

The primary population of students is the incoming freshmen, but other populations will be investigated in the future. Advanced high school students in computer clubs, students on co-op assignment, or international students planning to come to an American university could participate in this learning environment. If a student can connect to the Internet, in principle, she could participate in this course. This should help in recruitment and retention in engineering.

OBJECTIVES OF COURSE

Student Retention. Many colleges have a problem with freshmen retention. Required freshman courses are often some of the principal reasons for this problem. The results show that the present implementation can bring essentially everyone to the required level of proficiency.

Student Integration into Department. Typically freshman do not meet the professors who will be teaching advanced courses. Through the web and with the small vignettes of professors, the students meet and, at times, talk with their future professors.

Student Motivation. Engineering computer courses are well known for student dissatisfaction in part due to the diverse levels of computer competency of entering students. The PSI method allows each student to progress at his or her own pace making the output level of competency the constant and the time to achieve that level the variable.

RESULTS OF INNOVATION:

First beta test in Summer, 2000 to 5 students Three completed the course and received an A. The two remaining students achieved course objectives the next semester and received an A.

Second offering Fall, 2000 to 15 students Thirteen completed the course within the semester and were awarded an A. One of the remaining students dropped out of the university and the other enrolled this spring and completed the course.



Third offering Spring, 2001 to 60 students In this offering, 80% of the students completed the course using course objectives determined by the freshman committee in the mechanical engineering department. This is an extraordinary achievement in a freshman course.

Fourth offering Summer, 2001 to 15 The course was offered to a limited number of students (and one professor from another department on campus). The professor in charge began the course while on campus, and then completed the course over the Internet from Japan. This use of an internal control allowed a direct comparison of the operation of the course when the staff is local or truly at a distance. Such variables as latency, flexibility, and student satisfaction from this offering are currently under analysis.

Fall and Spring of 2001-2002 all ME freshman (approx. 120/semester) This experiment is currently under way.

ACCESS TO SITE

For a minimum of two years, access to the web site will be maintained to allow inspection of the course and its content. The URL is <http://me205serv.me.utexas.edu/> A back door has been created to allow access to the individual units. Please use "koen" as a login name and "billy" as a password without the quotes and in lower case.

CONCLUSIONS

This experiment in educational design conclusively demonstrates that a properly constructed web based PSI course can equal or exceed the results of a standard lecture-recitation course with some student populations and course content. More research is needed to evaluate the extent to which these results can be replicated in other educational settings. This course is also successful from the point of view of The University of Texas at Austin. It recently received a \$3500 award from the Center for Instructional Technology.

