

**A Web-based Foundations of Mathematics Course :
A new approach to prepare freshmen
students for the Math Placement Exams**

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Abstract

During the summer of 2000, a five-week web-based math course was implemented using the BlackBoard CourseInfo™ software. The course was created to improve the math skills of freshmen engineering students, and to prepare them for the math placement exams. The goal of the online course was to make sure that none of the students placed in the Math 106 - Basic Algebra remedial course. The results of the program which had 13 participants were excellent: 7 students placed in Math-241 (Calculus I) and 6 students placed in Math-141, which is one semester Pre-Calculus course. Plans are on the way to expand the program and offer the course to 50-75 students next summer.

I. Introduction

The biggest concern since the implementation of the math placement exams by the university has been the increasing number of engineering students who are being placed in remedial math courses such as Math-106 (basic algebra). Engineering students who are placed in Math 106 will spend an additional 2 to 3 semesters taking remedial math courses before they can take Math-241 (Calculus I). On campus summer enrichment programs such as the Pre-freshmen Accelerated Curriculum for Engineering or PACE, have been successful in increasing the number of freshmen engineering students who place in the correct math course, i.e Calculus I (Math-241). However, the PACE program has some limitations. First, the cost of expanding the PACE program so that all freshmen engineering students (150 to 200) can participate in it will be extremely high. The second limitation has been that even the students that are placed in Calculus I or Pre-Calculus, have been failing the courses at a higher than expected rate.

One possible reason might be that their summer enrichment program improved their test taking skills more than their knowledge of math. Building a good knowledge of math concepts is a time consuming process, which should not be overlooked by concentrating on the preparations of the placement exams. Several universities have started using online courses to offer remedial courses to their prospective students while they are still in high school ^{1,2}. The use of online courses is increasing tremendously because they offer the most flexible and cost-effective way of reaching out to prospective college students.

The goal of the online math course described in this paper was twofold: first, it was created to improve the math skills of freshmen engineering students, and prepare them for the math placement exams. The second goal of the online course was to make sure that none of the students placed in the Math 106 (Basic Algebra) course.

II. Outline of the Web based math Course

All freshmen MSU Science, Engineering and Math (SEM) students have to take four math placement exams. Therefore, the five-week web-based online course was created to cover the following math concepts:

- Arithmetic and basic algebra (Preparation for Placement Tests #1 & #2),
- Intermediate Algebra (Preparation for Placement Test #3),
- Functions and Graphs (Preparation for Placement Test #4).

The course covered some of the basic math concepts, and also gave the students several examples and practice problems. The goal of the web-based course was to prepare the students to place in Calculus I (Math-241) or Pre-Calculus (Math-141). Although the program received 21 applications, 3 students did not participate at all. Half of the students who participated in the program worked full time. Three of the students had engineering internships, while the rest of them worked in non-

engineering related jobs. After the 3rd week, one student left the program because she transferred to another university. Since this was an online course, the most important requirement was that all participants must complete at least 80% of the work to remain in the program. Hence, 4 students were officially dismissed from the program because they only completed less than 50% of the required work after the 3rd week. Only one of the students who worked full time got dismissed from the program. The other three students who were dismissed from the program didn't work at all. Hence, their only reason for not completing the required work was a lack of effort and/or a loss of interest in the program.

Therefore, the online course was delivered over the Internet for 5 weeks to 13 freshmen engineering students. The students were carefully selected to assure that they would benefit from the course. One of the requirements was that all students had access to a computer with a connection to the Internet. All of the participants had a computer either at home or at work. Twelve were from the Baltimore area and one was from California. The twelve students were required to come to MSU campus once a week on Friday or Saturday mornings to take in-class examinations, to go over solutions of the exams and to obtain one-on-one tutoring if necessary. At least 8 to 10 students attended the weekly meetings. They all indicated that the weekly meetings were very helpful because they allowed them to obtain personal tutoring and detailed explanations to some of the more advanced math lessons.

The student from California received help and guidance completely online using the various communication and collaboration tools (Email, Bulletin Board, Chat rooms, etc...) that come with the Blackboard software. The grade point average and SAT scores of the students who enrolled in the online course were similar to the students enrolled in the PACE program, and the rest of the students who were not involved in any summer program.

III. Benefits of Web based Math Course

Using Blackboard CourseInfo™ to develop the web-based “foundations of mathematics” course has two advantages. First, the online course will allow students to learn the math concepts at their own pace from anywhere at anytime 24 hours a day, 7 days a week. They will have access to the course materials at home, or any other location, which has access to the Internet such as a public library. Second, it provides the means for upcoming freshmen students to take the course without being present on Morgan State University's campus on a day to day basis.

Since the university didn't have a license for CourseInfo™, the web-based math course was created for free on Blackboard's server, at www.blackboard.com. CourseInfo™ provides a large set of tools and an authoring interface that allows for the creation of sophisticated WWW-based courses. The course designer requires little or no technical expertise. Initial experiences of giving WWW-based courses with no facility for student participation or progress tracking led the developers of

CourseInfo™ to develop a set of student-tracking tools for use with CourseInfo™ developed courses. These tools automatically form a part of every course developed using CourseInfo™ and can be called upon at any time by the course instructor or facilitator. CourseInfo™ is a tool that facilitates the creation of sophisticated World Wide Web-based educational environments. It can be used to create entire on-line courses, or to simply publish materials that supplement existing courses. The course designer provides the content of a course. Interactivity, structure and educational tools are provided by CourseInfo™ .

Several institutions have developed and implemented online math courses. They range from high school³ to graduate level courses⁴. Regardless of the complexity of the content, research has shown that online courses can have the same learning outcomes as traditional lecture based courses. Since online courses require a greater commitment and participation from the students, it might not be attractive to all students. However, a big advantage of online courses is that it forces students to become proactive learners by giving them control over the content and the pace at which they can learn.

IV. Results of Web based course

The math placement exam results for the students who were enrolled in the online course were excellent. Our goal was to make sure that none of the students placed in the Math-106 Basic Algebra course. Seven students placed in Math-241 (Calculus I) and the remaining 6 students all placed in Math-141 which is a one semester Pre-Calculus course. Based on the results, the goals of the online course were accomplished. The students were very proud of their accomplishments since they are the ones who took the initiative to study and prepare for the math placement exams. The online course also gave them a chance to review their math concepts and prepare them for math course they will be enrolled in during the Fall 2000 semester.

At the end of the program, the students were given an evaluation form. The evaluation form was used to assess three things: the Blackboard CourseInfo software, the overall program, and to get comments, and recommendations for the online course. Here is a summary of the results: 90% felt that the blackboard.com web-site and the CourseInfo software were easy to access and were very user-friendly. 90% of the students felt that the summer program and the foundations of mathematics online course were excellent.

They felt that the lessons were very thorough and concise, the assignments were challenging. They all felt that the staff was very supportive and helpful, and that they were better prepared to take the placement exams after completing the online course. The comments and recommendations for the program were also very encouraging. Here are some sample comments:

- “This a great program for students who must work or travel frequently over the summer”.**
- “Accomplished my goal. It’s a great alternative to the PACE program.”**

- **“Without the program, I wouldn’t have passed the placement exam because I would not have known what was going to be on it.”**

All of the students agreed that the foundations of mathematics online course and the overall program were excellent. The most important impact of the foundations of mathematics online course was summarized by the following comment from one of the participants: “It saved me at least one year of school”.

V. Conclusion

It is extremely hard to expect a student who has only taken basic algebra in high school to come to MSU and be able to place in Calculus I even if they go through a summer enrichment program such as PACE. Unlike other summer enrichment programs, which can only be implemented during the summer time, an online course can help alleviate some of that problem, because it can be offered to all prospective engineering students while they are still in high school. This will allow MSU School of Engineering to recruit students who have the right math skills before they start taking courses on campus.

It should be noted that the 4 students who were dismissed from the online course failed their math placement exams and placed in Math-106. Compared to the students who placed in Math-241, this puts them behind by at least one year. Hence, the results prove that if web-based online courses are designed carefully, they can become the most efficient and cost effective medium of instruction. Plans are on the way to expand the online course and offer it to more freshmen engineering students next summer.

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