28th Annual AMATYC Conference Presentation

Excellence in Mathematics through Communication and Collaboration ($E=mc^2$)

1. Summary of presentation

Ten video-based team projects are incorporated into College Algebra and are used to develop *soft skills* for learning math. Topics include effective homework and testing practices, college resources, relating to the instructor, learning styles, mathematical thought and communication. Student accountability and minimal intrusion into classroom instruction are emphasized.

2. Description of presentation

The objectives of this presentation are a) to report on an on-going study being undertaken at Tri-County Technical College in which ten video-based team projects are incorporated into College Algebra and are used to develop *soft skills* for learning mathematics and b) to offer to the educational community a potential plan for helping students to be more successful with their initial college mathematics experiences. These soft skills include forming effective homework and testing practices, making good use of college resources, relating to the instructor in a more useful manner, understanding learning styles, and developing good patterns of mathematical thought and communication.

The description will include comments on the motivations for this NSF funded study, on the insights gained and struggles encountered during the development and initiation of this work, and on the potential benefits to students, teachers, and educational institutions. Anecdotal reports from students who found this approach to be beneficial will be shared.

A preliminary analysis indicates that students in the classes who use the project materials discuss course content with more students, that they get more out of the homework time, and that they use extra resources more often than those who do not use these materials. Results from a fall 2001 pilot study have noted a significantly higher retention rate among our College Algebra students (based on a statistical z-test at the 5% level of significance).

This report affirms the fact that new college students need to develop certain ancillary *soft skills* in order to be successful in college mathematics. It promotes the development of key study skills and critical thinking.

$E=mc^2$ Project Summary
CCLI Grant Number 0089404

Excellence through Mathematics Communication and Collaboration

During the early part of the year 2000, Dr. Herbert H.J. Riedel, who was later designated as the Principal Investigator (PI), began to disseminate information about a potential research idea. The project's name was "Excellence through Mathematics Communication and Collaboration," a.k.a. $\mathbf{E = mc^2}$. Dr. Riedel envisioned an out-of-classroom, video-based, student responsible program in which students could develop the "soft skills" needed for learning mathematics. These skills included working in teams and the ability to speak and write mathematics well. He believed that these skills, when developed, would increase students' success rates in college-entry-level mathematics courses such as Tri-County Technical College's (TCTC's) MAT 110, College Algebra, course. Over the years 1994 to 1999, only 34% of the students enrolling in this course achieved a grade of "C" or higher.

In the summer, a formal proposal for a Course, Curriculum, and Laboratory Improvement (CCLI) grant was electronically filed with the National Science Foundation (NSF). In January 2001, NSF approved this proposal in the amount of $58,682. In the interim, Dr. Riedel had been promoted to Arts and Sciences Division Chair and Dr. Gerald L. Marshall was hired as the new mathematics department head. Dr. Marshall was made a member of the project's Senior Personnel and given release time for two courses during the spring so he could focus on the project. Dr. Riedel remained Principal Investigator and maintained oversight of the project.

Work on the project during spring 2001 centered around the production of ten (10) video teleprompter scripts, ten (10) accompanying PowerPoint presentations, and a Student Guidebook, which contains ten (10) project worksheets developed around twenty-three (23) group activities. The taping of these video-based lessons was begun in the spring and completed during the summer. An eleventh tape was produced that was used to introduce the TCTC mathematics faculty to the project group members.

In the summer, Ms. Susan Smith was hired as Project Assistant. With her help, a Faculty Handbook and the project's online Web components consisting of 14 pages were completed. These pages contain the transcript for the ten (10) projects and links to other Internet resources on communication in mathematics, learning styles, and mathematics anxiety. The project homepage may be located via the Internet at http://www.sctechsystem.com/TCTC/Math110/index.htm.

The videotapes were professionally edited, reproduced, and prepared for distribution to project students. A Group Activity Evaluation sheet was developed using a rigorous accountability rubric. To serve as tools for assessment and evaluation, a Student Survey form and a Note Taking Grading Rubric were finalized.

A fall 2001 pilot study at TCTC involved 210 students, which were divided among four (4) mathematics instructors, who each taught two (2) project MAT 110 courses: one class, a treatment group, in which the video-based lessons were used and the other, a comparison group, in which they were not used. The classes in which the project materials were used consistently retained a higher percent of their students and consistently maintained a lower dropout rate than the comparison classes. At the end of the term the treatment classes had roughly 60% of their students still enrolled while the comparison classes had only about 50% of their students still enrolled.

Tangentially this project has led to the creation of several other products. They include posters showing the way to the Project Assistant's office and presentation boards for tabletop displays. An e-mail list of 135 high school mathematics teachers in Anderson, Oconee, and Pickens counties has been set up and used to inform local teachers of the project's web pages. One teacher remarked, "I like the $\mathbf{E = mc^2}$ project website. (It) looks great. (I) will definitely tell my students (about it)."

Plans have been made to present the results at state and national conferences. Dr. Riedel administered a poster session on January 8, 2002 at the Joint Mathematics Meetings of the Mathematical Association of America (MAA) and the American Mathematical Society (AMS) in San Diego, CA. During March 2002, Dr. Marshall shared at the Joint NCMATYC/SOCAMATYC meeting in Greensboro, NC. On May 29, 2002 Dr. Riedel and Dr. Marshall presented a report at the Austin Convention Center during the 2002 National Institute for Staff and Organization Development (NISOD) International Conference on Teaching and Leadership Excellence in Austin, TX. Presentations will be made at the 28th Annual AMATYC Conference in Phoenix, AZ, at the Joint Mathematics Meeting in Baltimore, MD on January 17, 2003 and at the NCTM Southern Regional Meeting in Charleston, SC on November 6-8, 2003.

The results of performance on course tests and final exams were analyzed. A mini-study of students' note-taking abilities was administered. Preliminary results from these data indicate that students in the classes who used the project materials have discussed course content with more students, that they got more out of class time, and that they used extra resources more often than those who did not use these materials. Furthermore, of the project students earning a grade of A, B, or C, a greater percentage of the treatment students went on to enroll in at least one math class the following term. In the spring of 2002, 71% of the treatment group compared to 57% of the comparison group took more advanced classes and had a higher GPA (2.72 versus 2.56). During that semester, the project was expanded to include all MAT 110 classes taught at TCTC and one MAT 110 class taught by Patty Monroe at Greenville Technical College. A Student Review Panel was established and began to function in the spring. The PI will visit project classrooms, examine submitted material, and discuss progress with the faculty. A study was made of project students' progress in subsequent mathematics courses such as MAT 111, College Trigonometry. Finally, an article describing the project and its results has been written and submitted to a professional journal.

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Links

Link to the website: http://www.sctechsystem.com/TCTC/Math110/index.htm.

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