DISTANCE LEARNING TECHNOLOGY APPLIED TO PRE-SERVICE TEACHER PREPARATION

Judy Beauford (beau@tenet.edu), Ellen Szecsy (csy@tenet.edu), and D. R. Traylor (traylor@universe.uiw.edu) University of the Incarnate Word 4301 Broadway San Antonio, Texas 78209

University of the Incarnate Word (UIW) has received two National Science Foundation Statewide Systemic Initiative (NSF-SSI) grants to develop and implement a new course for pre-service elementary school teachers. These grants were for the summer of 1996 and for the current calendar year, September 1, 1996, to August 31, 1997. The new course, which is an integrated science/mathematics course, resulted directly from experiences with distance learning technology and those experiences have caused revision of the curriculum and content of mathematics and science courses for pre-service elementary school teachers at the university.

This paper presents the evolution and development of this innovative integrated science/mathematics course for pre-service teachers. It provides an example of how distance learning technology can be used effectively to teach pre-service teachers and how distance learning technology can be used to cause innovative curriculum development.

Groundwork for the development of this course occurred under four Eisenhower grants which were received during 1992 and 1993. As a result of the Eisenhower programs, D. R. Traylor, who then was Professor of Mathematics at UIW, became aware of the deficiencies existing in the preparation of elementary school teachers at most institutions, including UIW. Traditionally, such students are taught mathematics by mathematics faculty and, in totally separate courses, taught science by science faculty. Those faculty from differing academic disciplines do not discuss with each other the subject matter being taught. Moreover, traditionally, those academic disciplinary faculty do not give attention to how the prospective teacher can later translate the learning from college courses to actual teaching of students in grades K-8. It became clear that new approaches needed to be taken to improve the preparation of prospective elementary school teachers. Fortuitously, one of the participants in one of the first Eisenhower grant programs was Julie Roman, who was becoming certified as a secondary mathematics teachers and was graduating as a mathematics major from UIW. The next year, Roman served as Co-Director, with Traylor, for two more Eisenhower grants, and also served as his Administrative Assistant as he became Interim Vice President for Academic Affairs. This background is significant, for the developments at UIW presented in this paper occurred

because the "right" people with the "appropriate" capabilities happened to at the same place at a time when they had access to the authority of high administrative office. That is, because Traylor held the position of Interim Vice President for Academic Affairs, he could encourage development to occur which otherwise would not have happened. Because he and Roman were mathematicians and both were deeply interested in preparation of teachers, and she was technologically knowledgeable, two of the "players" were in place who would be active in the development to occur later.

During the spring semester, 1993, Roman and Traylor were team-teaching a course, "Fundamental Concepts of Mathematics II," which was one of a two semester sequence of courses designed to prepare elementary school teachers to teach mathematics. That semester, one of the UIW prospective teachers was doing her student teaching at Driscoll Middle School, where Ellen Szecsy was her mentor teacher. Driscoll Middle School is a "partner" school to the university for preparation of teachers and, not only were the institutions formally involved, but their sophisticated technological equipment had been placed on site by UIW from a major state grant (CEDE) which provided interactive-video connection between the two campuses. The UIW student teacher mentioned to Szecsy that Roman was team-teaching the mathematics course with Traylor and that Roman had interest in technology. This led to the beginning of an e-mail correspondence between Szecsy and Roman concerning the possibilities of using this new distance learning technology, called interactive-video, to enhance the learning experiences in both the college and middle school classroom.

Roman and Szecsy began planning the first use of interactive-video distance learning technology to connect a K-12 school with a university in San Antonio. At Driscoll Middle School, teams of teachers worked together so that activities in one subject matter area would be integrated to the activities of the others. One of the customary activities which Szecsy employed each year was called "Road Rally." In this activity, her students would construct model cars in a science class and then those cars would be used in Szecsy's class in such a manner that the students would be required to gather data, compile the data, display the data on graphs, apply the concepts of mean, range, median, and mode to make predictions as to the performance of their cars. At the same time that Szecsy was scheduled to teach her sixth-grade students, using the Road-Rally activity, Roman and Traylor were to engage their college students about graphing data, and the concepts of statistics. Plans were made to connect the two classrooms using the distance learning technology, interactive-video. Since this was the first time such technology had been used by educational institutions in San Antonio, television coverage was to occur.

Those experienced with technology know that new technology is fickle and sometimes does not work. It was only minutes before the two classes were to begin that the technology became alive on both ends and each classroom was available to the other. After introductions were made, the university students observed the middle school

students. Interestingly, this was the first time that Roman and Szecsy had ever seen each other. All the planning and arrangements for the activity had occurred by the way of e-mail, another component of distance learning technology. The middle school students were not distracted at all by the observers, even when occasionally answering questions from the university students. The university students had the rich opportunity of observing an active classroom, a master teacher who exhibited classroom management skills, used technically correct mathematical language in instruction and explanation, and who was simultaneously engaged with six teams of four students per team who were measuring, discussing, recording, experimenting and cooperating. The university students were in class numbering near thirty and there would have been no way they all could have experienced the classroom other than with interactive-video. Much learning took place that day on both campuses. For instance, one of the university students asked of the middle school students, "Did you make any guesses before you began the activity?" A middle school girl answered, "No, we didn't have any hypotheses!" How better could a pre-service teacher be taught to use correct mathematical language with the students?

The values to this experience were many. Many university students were able to observe a middle school classroom without disturbing it. They saw a master teacher dealing with subject matter that they were simultaneously dealing with. Instead of the experience being abstract and rather meaningless to the students, as normally it is to the university student, all saw how the concept and the manipulation of statistic skill could be meaningful, useful, and fun.

Too often, university mathematics faculty teach subject matter that is presented abstractly and with no effort to make a concrete application or to present an explanation of why it is useful to know or use the mathematical technique or concept. The university faculty, Roman and Traylor, saw that negative habits that are generally practiced in university classrooms could be changed, partly by using distance learning technology.

A paper reporting our experience up to this point appears in the <u>Proceedings of the Eighth</u> <u>Annual International Conference on Technology in Collegiate Mathematics</u>. Written by Julie Roman, Ellen Szecsy and D. R. Traylor, it is entitled "Using Technology to Convert a Middle School Classroom into a College Classroom."

In the fall of 1995, SSI hosted a statewide meeting at a site near Austin, Texas, and Roman and Traylor attended. Resulting from that meeting was opportunity for institutions to apply for grants to develop and implement programs to improve the preparation of prospective elementary teachers of mathematics. During 1995-96, Roman continued to connect with Szecsy's classroom via interactive-video. Indeed, a classroom in the Science Building was converted to an interactive-video room, making it more available and easily accessible to the mathematics and science faculty. Recognizing the opportunity presented, a task force of mathematics, science and education faculty was formed to assess the feasibility of an integrated science/mathematics program to replace the separate offerings that were then in place. The fundamental attempt was to make the teaching of the mathematics concepts and techniques meaningful, useful, and fun, to reduce the prospective elementary school teachers' anxieties that are related to mathematics and science, and to cause the prospective teacher to better understand why the concepts and techniques are being taught. Indeed, it was hoped that these prospective teachers would exit these new courses with a large collection of instructional activities and an understanding and mastery of teaching methods used for those integrated math/science activities. The project was deemed feasible and the university curriculum was revised to accommodate the new courses. The fourteen hours of mathematics and science were replaced with eight hours of integrated science/mathematics and three other hours of science.

During the summer of 1996 four teams of faculty, one mathematician and one scientist per team, worked under the summer SSI grant to develop syllabi for the new courses. The activities varied from one team to the other. Participating in the summer project were two education faculty, four science faculty, four mathematics faculty, including Roman, and one consultant, Szecsy, from Driscoll Middle School. Traylor attempted to offer some guidance to the project across those months. A newly hired faculty member, Judy Beauford, who just received her doctorate in mathematics education, after several years in K-12 teaching, began to meet with the group. Resulting from the efforts of the summer were courses which identified concepts in mathematics that tied directly to the new Texas Essential Knowledge and Skills (TEKS) guidelines, identified science experiments which responded to the Texas Education Agency-adopted Texas Essential Elements, and provided the mathematics to be taught on a concrete basis drawn from the science activity.

Two sections of the course are in progress during the fall 1996 semester. One pair of instructors is using Activities Integrating Math and Science (AIMS) materials published by the AIMS Education Foundation (1995) as a major resource in the class. The other pair is using materials from a variety of sources including the Minnesota Mathematics and Science Teaching Project from the University of Minnesota (1967) and many science and mathematics activities developed by the instructors. Instruction concentrates on the mastery of specific mathematical concepts integrated with scientific principles appropriate for grade levels K through 3. Concrete, hands-on laboratory projects in a collaborative setting integrate mathematics and science and provide the prospective teacher the opportunity to construct the learning necessary for success in teaching. In one section, direct instruction in mathematics and science are limited to fifteen minutes with Power Point presentations of lecture material. Interest centers on estimation, graphing and current topics in education are discussed at each session. Student assessment tools include written assignments, in-class experiments, individual and group projects, portfolio

assessment, journals, tests and quizzes. Interactive-video is used with the middle school class at scheduled intervals.

The project is being evaluated across the year with formal evaluation to be accomplished during the summer, 1997. The two education faculty and the mathematics and science faculty not teaching this semester are regularly observing the two sections being taught. Each observer writes an evaluation and shares it with the others involved. Two consultants from Driscoll Middle School, one mathematician, Szecsy, and the other from science meet regularly with the UIW faculty to evaluate what is being accomplished and to offer appropriate recommendations.

Current evaluation operates at two levels--monitoring the integrity of the experiment and assessing the success of the endeavor. A modified subset of the assessment tool used by Texas school administrators in their teacher evaluation is used to record observations. A written journal of observations is often included by the UIW faculty serving as evaluations. Other monitoring tools are taken from Monk and Dillon (1995) Learning to Teach Science: Activities for Student Teachers and Mentors. A written journal is also being kept by the science instructor in one of the sections.

The project is proceeding with four sections of the integrated science and mathematics course being offered in the spring semester, 1997. One of these will be an accelerated eight-week format in a special program designed for adults who are returning to college after an absence of several years of employment. It is possible that another section will be offered to in-service teachers who are participants in an NSF funded Urban Systemic Initiative (USI). The course, if offered, would be up-graded for these USI teachers since their experience will allow more to be accomplished in a shorter time with more depth.

Success of the full program will be measured by how well we meet the goals we have set for the course. As mentioned earlier in this paper, our purpose is that our students exit the course having observed teaching practice as modeled by the variety of learning experiences and assessment tools facilitated by the instructors, experience in collaborative learning, a growth in the mathematics and science knowledge base brought to the classroom, and a decrease in their level of mathematics and science anxiety. The observations of these learning experiences in use in the middle school available by interactive-video demonstrates and reinforced the value of the enterprise.

It is expected that our experiences with the course this year will lead to improvements for the next academic year. Activities, approaches, and assessment tools considered the most successful will be shared among teaching faculty to be used in subsequent offering of the course. We are attempting to learn how to use our in-class activity and out-of-class assignments to best advantage. Improvements will be offered for the strengthening of instructional techniques to maximize learning.

We are learning that the interpersonal relations, and blending and contrasting of instructional styles of team members, serve as strong influence on the outcomes of the course. We are experimenting with whether the course is best organized with the mathematics topic determining the science topic or the science topic determining the mathematics topic. And we are gathering resources and routines which will provide a more efficient use of preparation time for the instructors of the course.

Several factors were important in the development and implementation of this new curriculum. Critical to the project's conception and early development was the availability of distance learning technology in the form of interactive-video and e-mail. Without such technology, these developments simply would not have occurred.

Resources

Monk, M., & Dillon, J. (1995). <u>Learning to teach science: Activities for student teachers</u> and mentors. Washington, DC: The Falmer Press.

Roman, J., Szecsy, E., & Traylor, D. R. (1995). Using technology to convert a middle school classroom into a college classroom. In <u>Proceedings of the Eighth Annual</u> International Conference on Technology in Collegiate Mathematics.