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Technology and the Changing Face of Teacher Preparation

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"There aren't just three Rs anymore-as in reading, writing and 'rithmetic—there's a fourth: the Internet.' (from *Generations at Work)*

Preservice Teacher Education and Technology

The federal government estimates that, with the increase in student population and the demand for smaller class sizes, the education system will require as many as 2.2 million new teachers in the next 10 years. Many of these new teachers will be graduates of colleges of education (The Milken Foundation, 2001a).

These educators will be charged with preparing children and young people to be successful citizens and members of a society that is increasingly being transformed by technology. The workplace in such fields as medicine, transportation, manufacturing, and entertainment has embraced technology in order to stay current'so must education (The Milken Foundation, 2001b).

However, 'The education industry is the only 'knowledge business' still debating the utility of technology' (The Milken Foundation, 2001b). Reed Hunt, Chairman of the Federal Communications Commission, added 'There are thousands of buildings in this country with millions of people in them who have no telephones, no cable television, and no reasonable prospect of broadband services. They're called schools' (The Milken Foundation, 2001b).

Dr. David Moursund, Executive Officer of the International Society for Technology in Education (ISTE) suggested that preservice teacher education programs have improved preparation of future teachers in information technology, 'but they still have a long way to go' (The Milken Exchange & ISTE, 1999)

A study of teacher education programs initiated by the Milken Exchange on Educational Technology and carried out by ISTE suggested that 'these programs should increase teachers' exposure to appropriate technology if they are to aptly prepare them for today's classrooms'(The Milken Exchange & ISTE, 1999)

Although most programs for teacher education provide some computer education for preservice educators, many do not have up-to-date equipment or faculty with technology expertise, which makes the situation no more promising for those just entering the teaching profession than for inservice teachers (Hasselbring, 1991) who report their technology training as being about computers, not learning with computers. The ISTE study found much the same situation in today's teacher education programs: most faculty-members do not, in fact, practice or model effective technology use in their classrooms

The National Council for the Accreditation of Teacher Education (NCATE) and ISTE have adopted a set of preservice teacher competencies for technology education, standards designed to prepare teachers to use technology (Wetzel, 1993), but colleges and universities must make their own decisions concerning the integration of technology into the teacher education curriculum (Munday, Windham, & Stamper, 1991). The ISTE survey, titled 'Information Technology in Teacher Education,' determined that most preservice faculty believe that future teachers do not receive adequate training or effective modeling. It is important, therefore, that colleges of education widen their offerings to prepare preservice teachers to use technology effectively, and begin modeling proper applications of technology and teaching strategies in the learning process (Fawson & Smellie, 1990).

Integrated Secondary Teacher Education Program (I-STEP)

Historical Context

In an attempt to address these national concerns and the mission of the Center for Excellence in Education (CEE) at Northern Arizona University 'to prepare education professionals to create the schools of tomorrow,' the secondary education faculty began a 2-year reconceptualization of the secondary teacher preparation program in 1993.

The identified need for program revision did not emerge as much from the faculty at this time as it did from the administration. The CEE dean and the Instructional Leadership department chair were urging the faculty to create a program that was unique without sacrificing quality. They were also under some pressure because the elementary school-based teacher preparation programs, even then, were nationally recognized as reformation leaders, while secondary education had changed little over time.

The initial revision efforts centered on a comprehensive evaluation of the secondary education program as it then existed. Each faculty member responsible for teaching the undergraduate and post degree certification courses (High School Teaching Methods, Secondary Curriculum and Principles, Evaluation of Learning, Content Area Reading, and Educational Psychology) presented a thorough synopsis of what content was being covered and how these courses were being taught. A great deal of conversation ensued regarding overlap of content and effort, as well as the more critical insights of existing gaps in the traditional program.

The birth of a felt need within each faculty member for substantive change in the program actually occurred at this stage of acknowledging the deficiencies that existed'most importantly, that we were not adequately preparing our secondary candidates to meet the needs of diverse

student populations, which included differences across gender, ethnicity, culture, mentally/physically challenging conditions, sexual orientation, and varying achievement levels. Furthermore, it was recognized that there was a rapidly increasing need for students to become more skilled in the effective use of technology in classroom instruction.

Growing out of the now clearly recognized content duplication and gaps within the education courses, the arduous task of conceptualizing a program that would correct these deficiencies was begun. The secondary certification program, as it then existed, was based on students' completing 16 credit hours of professional pedagogy that could be taken any time during the sophomore, junior, and senior years and in conjunction with their major content area coursework. This meant that students were in varying stages of their certification process, carrying varying course loads at any given time. One of the earliest questions in program design centered around this idea of time and timing. When should students begin and end the professional coursework, and how should the courses be blocked or sequenced?

At this time the faculty realized that, if they were to move beyond just tinkering with the existing program to radical redesign, they needed to have total control over the students' schedule for the professional pedagogical semester, and that this semester should come immediately before student teaching. This meant that students must have completed their content major/minor coursework, all liberal studies requirements, and the prerequisite of an educational foundations course prior to their I-STEP semester. With this decision made, it truly freed the faculty to think about the program in nontraditional ways.

Framing the Curriculum

Even then, however, the first thinking was that some of the curriculum gaps could probably be addressed by simply reconceptualizing curriculum within existing courses or reallocating hours to a new course that more specifically addressed diversity and context issues. But the critical question that kept emerging was this: What should the graduates know, be able to do, and be like, when they leave the program? By framing the discussions around the issue of student outcomes, it became clear that, before the form of the program could be decided on, it must first be decided what would drive the design. Thus an extensive investigation into what the faculty believed was begun, and the literature indicated comprised the characteristics of effective teachers, including novices.

The NCATE Knowledge Base Standards and the Council of Chief State School Officers' Standards for Licensing Beginning Teachers were used as springboards for multiple discussions that eventually lead to the identification of the knowledge, skills, and dispositions that were wanted for candidates upon completion of our program to meet the needs of the classrooms of tomorrow.

Once these were identified, the form of instruction that would best accomplish these objectives must be determined. The faculty broke totally out of looking at the program in old ways, as a series of isolated courses taken in sequence, and began to imagine the program as student experiences that would lead to an integrated understanding of learning theory, curriculum, instructional methods, assessment/evaluation, and the contexts in which all of these come together.

Through this focus on learning experiences, the program was reconceived as an integrated

16-hour block of professional study that would be team-taught by faculty members from the secondary department. Three mornings a week, the 20- to 30-student cohort met on campus. One morning each week for 4 weeks (with a 3-day intensive 5th week), the students met at one of two school sites (a high school and a middle school) and then rotated to the other school for an additional 5 weeks. At least one faculty member was also present at the school sites to coordinate activities and debrief with students at the end of each day's experiences.

The integrated semester guarantees alignment of course material through the team-teaching and planning. Formerly fragmented topics are united around experiences and themes/issues designed by the faculty team. Duplication of material is eliminated by planned and coordinated coverage of important concepts. Placing inquiry rather than response in the foreground, the curriculum is experiential and project-based. Five habits of mind, adapted from the Coalition of Essential Skills model (Sizer, 1992) form a guiding framework for this inquiry.

Student work is directed toward a capstone experience, which is a final exhibition that offers students the opportunity to integrate their learning from all the areas of study into a meaningful whole. This exhibition calls on students to present their beliefs and plans for teaching as they would to a hiring committee, incorporating the production of teaching documents and professional presentations.

Technology Integration

Since the implementation of I-STEP in 1995, the faculty teams have rotated and changed each year/semester, and program continuity has become an ever-increasing challenge. Even with the commitment of the university, the professional college, and the department of technology, the major question continues to be how to meaningfully integrate technology into classroom instruction with the varying levels of expertise of the many faculty members who teach in I-STEP.

From 1995-1997, members of the educational technology faculty did guest presentations/instruction on what was available to classroom teachers in the name of technology and some direct instruction in one of the heavily used and under equipped computer labs, with regular I-STEP faculty following along. Over time, one of the secondary education professors became quite technologically proficient, and if he was teaching in I-STEP, the infusion of technology increased. He designed an I-STEP Web page complete with assignments, additional resources, and so forth. However, few required assignments within the course curriculum necessitated student development of technology artifacts. And when he rotated out of the I-STEP faculty, much of the technology integration was lost.

Therefore, in 1999, it was decided to restructure one of the existing 3-hour required courses into a new course entitled Diversity, Technology, and Literacy in Secondary Education. Based upon the belief that schools should represent a force for social justice in our society, this course demanded that students critically reflect on their personal and collective identities and on the many faces of diversity and equity in today's schools and communities.

Focusing on major sociocultural and political issues related to schooling, students are asked to examine their own notions of why schools are the way they are and to re-imagine the possibilities for the way they should/could be. Beginning with a focus on self, students progress through a series of self-assessments that help them understand the influence of their family of

origin on their current identities, beliefs, and behaviors. Dispositional reflections are completed each week to monitor personal growth in developing an ethic of caring, valuing diversity, efficacy, and so forth. Shifting the focus to learners, classroom diversity and equity issues are investigated and experienced. Finally shifting the focus to teachers/teaching, students are challenged to re-imagine current teaching practices that disenfranchise and marginalize many students.

In addition, the course includes the following technology objectives: understanding the uses of technology on changing teacher roles and diverse learning environments, understanding the ethical implications of technology, and using a variety of computer applications in developing class projects. Every secondary education preservice teacher now takes this course, whether they are in the innovative I-STEP section or any of the traditional program sections.

For the 1999-2000 school year, two graduate assistants, skilled in technology, who were also former classroom teachers, taught the technology strand in both the I-STEP and traditional programs. However, in each case, the regular secondary education faculty members were also present at the time of laboratory instruction, so that in the future they would be able to teach these technology components themselves; thus professional development of university faculty as well as preservice training is taking place simultaneously.

The technology direct instruction takes place in either a Mac lab or a PC lab for a block of time no less than 1 hour and 15 minutes per session. This technology integration includes direct instruction and the production of student artifacts in the areas of multimedia presentations, Internet/WWW investigations, spreadsheets, and desktop publishing.

During the course of the semester, each student is a member of two interdisciplinary teams charged with solving authentic school-related problems. These teams do research on the Internet, as well as in appropriate books and journals, to formulate possible solutions to each problem. The final projects are presentations to mock school boards and special education evaluation teams. A required component of these presentations is electronic supporting documentation using MS PowerPoint, a multimedia presentation software that allows the inclusion of graphics, sound, movies, and animation, in addition to text. Click here to see a student presentation, Afro-Centric Curriculum.

Additionally, each student is required to create a WebQuest that they would use with their high school/middle school students in each of their respective content areas. The preservice students design these WebQuests as authentic problem-based assignments in which some or all of the information that learners interact with comes from resources on the Internet. Examples include such titles as, 'When Will I Ever Use This: An Exploration in the Topics of Algebra,' 'The Importance of Physical Education: Developing Your Own Workout Plan,' and 'Where No Musician Has Gone Before.'

Students also become familiar enough with spreadsheets to understand their multiple uses for everything from setting up a worksheet to calculate grades to keeping athletic team statistics or club accounting records. Students can keep budget information for a school store, enter hours of work, or set up "what if" situations for solving math and statistical problems. Spreadsheet worksheets are tools of practical value that require minimal math skills to accomplish tedious calculations and gain understanding of mathematical concepts. Students in this course learn how to design a gradebook using a spreadsheet. (Brownell, Youngs, & Metzger, 1999).

A final technological artifact produced by each student is a newsletter they might send home to parents or that their own students might be taught to create. Using word processing for desktop publishing allows students and teachers to create newsletters for their classrooms, clubs, or for parents. They learn appropriate formatting and uses of graphics and text for communicating ideas and issues, or just reporting on current activities. Throughout the semester, students are investigating and reading articles about the ethical implications of technology in classrooms, pondering such troubling issues as gender equity, equity of access, students with special needs, copyright, and responsible use of the WWW.

Clearly, it is recognized that technology in preservice teacher education, as well as in society at large, is a powerful vehicle for change. It has become a catalyst for challenging attitudes, long held beliefs about the way things have always been done, classroom practices, and the way students learn. Future teachers will be in classrooms full of the 'N-Gen' (Internet Generation) who have grown up digital (Tapscott, 1998). Therefore, beginning teachers no longer have a choice about using technology in their classrooms of tomorrow if they hope to understand and reach this generation of students who have learned technology as a second language.

Conclusions

To gain insight from the stakeholders (professors, graduate assistants, and students) into the new course, 'Diversity, Technology, and Literacy,' a study to examine changes in attitudes of preservice secondary education majors toward technology and perceptions about technology in the classroom was initiated. Further investigation into the perceptions of the professors and graduate assistants about the technology activities taught in the course to revise and improve the presentation in succeeding semesters was conducted.

Findings provided new directions and implications for the course and the secondary teacher education program at the university. In fact, the findings about changes in students' attitudes and self-efficacy using technology have already impacted the course delivery and have provided faculty with information about the usefulness of this model of technology integration for the program of teacher education (Willis, Raines, Sujo de Montes, Kotcho, & Garcia, 2000).

Students reported positive changes in attitude and self-efficacy using various computer technologies, which supports past findings that 'the confidence and expertise...were seen to grow through relevant practical experience' (Oliver, 1994, p. 75). The student improvement came not necessarily from using the specific tools and applications, but from participation in technology-centered activities and, perhaps, from the value put upon the use of technology by the course designers and instructors. This provides evidence that this course, which integrates technology activities into the curriculum in a systematic way, is necessary and important to our teacher preparation program (Willis, E., et. al., 2000).

The investigation further revealed useful insights into the specific technology offered in the course. Students clearly noted that they thought learning presentation software such as MS PowerPoint was the most relevant technology activity. They also pointed out that learning about a strategy, such as a WebQuest, is most useful when they had to do it themselves and produce a tangible artifact. Students also suggested that more effort be directed toward Web-based teaching and learning. Their comments about the lack of access to technology are important ones, too, for us as a teacher preparation institution. We must find ways to provide computer technology

education that does not deter or limit student participation (Willis et al., 2000).

Student input was utilized by the instructors in the spring 2000 semester to revise and enhance the technology component of 'Diversity, Technology, and Literacy,' one of the goals for conducting the study. For instance, all classes are now conducted in a lab, which 'has made practical use a lot easier' (Mark Kotcho, e-mail communication, April 2000). Also, graduate assistants have assumed that the students know more and, therefore, are not focused on the applications themselves, 'but the practical (hands-on) instruction so they (the students) can see it in action' (Kotcho, 2000).

> We also gave them examples of problems during our first year teaching and connected them to the technology and how it could have made things easier. We concentrated much more on the relevance of the technology to the classroom, as opposed to concentrating on the instructions of all the functions of each program' (Dulce Garcia, e-mail communication, April, 2000).

The use of graduate assistants to teach the technology component in a course is convenient and adds to the synergy of the class. However, this same convenience may bring unexpected consequences. For instance, faculty may so heavily rely on the graduate assistant(s) to teach the technology component that they delay the development of their own technology skills. From the graduate assistants' point of view, the professor retains control of the course design and activities. They must abide by the faculty requests for technology activities, even when they do not represent the full utilization of the technology skills and expertise that the graduate assistant may bring to the course.

This finding underscored the need for providing opportunities for university professors to update their technology skills, as well as giving teaching assistants some leverage in the course design and management. By combining these resources, the students win by getting both perspectives and expertise, resulting in a much richer technology experience.

Direction for the Future

In keeping with the findings and a recent Technology in Arizona study, the authors continued to revisit and revise the technology integration in the teacher education program; specifically addressing the following recommendations to the Arizona Board of Regents:

- University educational technology courses should further focus on and emphasize the ISTE Foundation Standard category Application of Technology in Instruction.
- All the university teacher education programs should ensure that all the ISTE standards are addressed through any combination of courses offered.
- All course content offered in the Regent's universities' educational technology courses should be assessed using performance-based measures rather than just content knowledge assessment.
- University faculty working with preservice teachers should have the necessary skills to teach and model the integration of technology in diverse K-12 classroom settings and do so in their own instruction.
- University faculty teaching educational technology courses should be provided opportunities for ongoing professional development. (Willis, Tucker, Rowland, Wong, & LeCrone, 2001).

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