THE CHALLENGES OF TEACHING WITH TECHNOLOGY: FROM COMPUTER IDIOCY TO COMPUTER COMPETENCE

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ABSTRACT

Teacher education programs often focus on how to use technology rather than on how to teach with technology. Further, teachers with more exposure to technology do not always use technology tools to help their students learn. This study investigated an educational technology course that provided hands-on activities in a collaborative, non-threatening environment to determine if it would improve the perceived technology competence of the teachers and also to determine if teachers' classroom technology use would increase after the course ended. The findings suggest that the perceived technology competence of participant teachers improved and teachers were moving toward increasing their technology use in the classroom even though technology is still unavailable or inaccessible in some schools.

"I am no longer a computer idiot. I can actually do tasks on my own now." This was a response to a questionnaire at the end of Spring 2002 semester regarding graduate student technology use. Another graduate student, in a more detailed response, explained:

You were the first to expose me to the Virtual Field Trip phenomenon. My students have carried out the actual lesson plan that I wrote for the course. I am in the process of compiling more trip information from the Internet to complement my social studies curriculum/lessons for next year! This course put that twinkle back in my eyes and made me revisit PowerPoint! It made me reteach and assign PowerPoint projects with my class. They're presently working on a six slide presentation about themselves. It must include custom animation, sound and pictures of them (Spring 2002).

The use of technology in the classroom has many benefits for students such as finding current and easy to access information through Internet resources, being motivated and empowered by technology tools, assisting and enhancing the learning process with the use of specific software and web sites, and opening a global perspective by talking with others around the world through e-mail.

Although computers and other technologies may be available in a school, the necessary training to implement technology tools may be lacking. It should be noted that there are some technologically more adept teachers who use these tools with their students without any training, but this is the exception rather than the norm. When students are mandated by state standards to use technology in their classrooms, this lack of teacher training causes problems.
This article describes an action research study to enable graduate students, educators themselves, work toward a course goal to use technology tools with their own PK-12 students. It is the purpose of this study to consider the components in a technology course that enable teachers to be competent classroom technology users and also to determine the nature of classroom technology use after the course ended.

There are many challenges to teachers who want to integrate technology into their classrooms. Russell, Bebell, O'Dwyer, and O'Connor (2003) report that schools have not incorporated technology into regular instruction. Clouse and Alexander (1997-98) echo this statement when they assert that technology continues to be a supplement in the classroom teaching and learning environment. Teachers do not use technology for many reasons: they feel unprepared, are unwilling to learn new technical skills, resent having to spend more time in preparation, and believe they are required to change their teaching role. Although the current generation of teachers has had more exposure to technology and may be more confident and comfortable working with it, the research of Russell, Bebell, O'Dwyer, and O'Connor (2003) found that this does not translate into higher levels of technology use in the classroom. Teaching models new teachers recalled from their own student experiences did not include the integration of technology into instruction. Many teacher education programs that include technology components focus on how to use technology rather than on how to teach with technology. New teachers need further training on the instructional value and uses of technology and how to integrate it into everyday teaching.

There are further challenges to those teachers who would like to gain competence in the use of classroom technology tools. Teachers need time to spend learning and exploring with technology (Clouse & Alexander, 1997-98; Harris, 2000; Khamis, 1987; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Clouse and Alexander propose that it might take as long as six years to learn to integrate technology into the classroom environment. Gooler, Kautzer, and Knuth (2000) suggest that teachers need time to reflect on their learning to integrate new knowledge into practice. They need to experiment, to reflect on the outcomes of these experiments, and to make adjustments as needed.

Most educators would agree that training should be offered to develop teacher competence in classroom technology use (Clouse & Alexander, 1997-98; Gooler, Kautzer, & Knuth, 2000; Khamis, 1987; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Russell, Bebell, O'Dwyer, and O'Connor advise that teacher-training programs do not generally provide future teachers with the necessary experiences that prepare them to effectively use technology in their classrooms. This underscores the need for inservice training for all teachers. Researchers generally agree on several components that should be included or addressed in technology training: modeling, a hands-on component to allow practice, collaboration, a match between the level of instruction and the ability/needs of the students, continuing support, and easy access to the technology.
COMPONENTS OF TECHNOLOGY TRAINING

Several researchers discussed the need for modeling as a component of the learning process (Clouse & Alexander, 1997-98; Dunne & Harvard, 1992; Harris, 2000; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Russell, Bebell, O'Dwyer, and O'Connor suggest that modeling products used to support instructional objectives may result in stronger beliefs about the value of technology in education.

Training should also have a hands-on component to allow teachers opportunities to practice with the technology (Clouse, & Alexander, 1997-98; Gooler, Kautzer, & Knuth, 2000; Khamis, 1987; Russell, Bebell, O'Dwyer, & O'Connor, 2003; Zhang & Espinoza, 1998). Teachers cannot be expected to learn to use technology effectively only by observing others; teachers need the chance to try it out themselves. However, sometimes teachers in professional development situations become anxious about working with technology. They recognize and worry about the disparity in skills and knowledge between themselves and their colleagues. Gooler, Kautzer, and Knuth (2000) recommend that thoughtfully designed workshops be structured to provide opportunities for participants to interact, collaborate, learn together and from each other. Zhang and Espinoza (1998) recommend the creation of a non-threatening environment for students so that they can feel more comfortable about their computer use and can thereby reduce their anxiety. A collaborative environment may lessen anxiety.

When training is offered, it is important to match the level of instruction to the ability and needs of the teachers. Harris (2000) suggests that teachers choose appropriate topics and training for themselves. Gooler, Kautzer, and Knuth (2000) purport that professional development is most effective when it addresses authentic problems with classroom integration of technology and when technology is linked to broader reform goals of the school or district. Professional development should be relevant to teachers’ subject matter and/or grade level.

Another component that is needed if teachers are to integrate technology in their classes is continuing support. Initial training will help teachers get started, but will not guarantee continued use (Gooler, Kautzer, & Knuth, 2000). If technology support is difficult to access, this can cause frustrating situations (Clouse & Alexander, 1997-98). Harris (2000) concurs that easily available technical support is a key ingredient for successful technology use.

Easy access to technology is another necessary component to enable teachers to use these tools with their students. If computers are in a lab rather than in a classroom setting, access may be more difficult and teachers may be less likely to use the technology. Further, increased practice will lead to better computing skills (Khamis, 1987). Russell, Bebell, O’Dwyer, & O’Connor (2003) report that teachers who have access and more exposure to specific technology value that technology more strongly than those who do not have access. Russell, Bebell, O’Dwyer, and O’Connor therefore suggest that professional development programs may be able to shift teachers’ beliefs about the value of particular technologies by providing them with opportunities to work with these technologies.

Teachers who use technology in the classroom must practice with it. They need to be able to manipulate the technology with ease so that they can function
without constantly seeking help. Eventually, these users will be competent in what they are doing. The present study, which drew from research recommendations, focused on helping graduate inservice teachers implement technology tools with their own classes to help their teaching and to facilitate student learning.

METHODOLOGY

This study included 42 graduate education students enrolled in two beginning educational technology courses taught by the same instructor. Most of these graduate students were employed as teachers in an urban school district. For purposes of this paper, to differentiate between the teachers/graduate students and their own students, the graduate students are referred to as “teachers” whereas their students, in PK-12 settings, are referred to as “students”. Teacher technology expertise ranged from almost no technology background to those who were facilitating students’ classroom use of technology. The availability of school technological resources for teachers ranged from no technology resources to several computers in each classroom. One course goal was to help all teachers become competent in their use of technology and enable them to become more proficient in their classroom technology use. Another course goal was for teachers to try new technology-infused activities and projects in their own classrooms, enabling their students to be technology users. The course was designed to help the teachers to reach these goals in an environment that addressed the components found to be of importance in prior research.

Teachers were assigned a variety of activities that were intended to give them hands-on technology experiences, as recommended in the research. Teachers had to find information on web sites and navigate electronic library resources. They became proficient using e-mail and learned how to send file attachments. They researched a topic and developed a PowerPoint presentation. Teachers also chose topics suitable for their own students and prepared and shared virtual field trip lessons.

Collaboration was encouraged on many activities, recognizing a preference to work with a partner when learning something new (Rosenfeld, 1992). The PowerPoint assignments were completed in small groups; the presentations were developed and later presented to the rest of the class. It was hoped that being a part of a group would be less threatening than developing and making a solo presentation, particularly since the PowerPoint program was new to many teachers. The virtual field trip lessons were presented individually, although teachers were advised that they could collaborate on the development of the plans if they wished. These lessons were presented to small groups, again with the hope that this would be a less threatening environment for those who had just learned about this technology-driven activity. The presentations allowed teachers the opportunity to try out the technology with an audience (practice), and also gave teachers several models to emulate, as recommended in the research.

Blackboard (a distance learning management program) was used to continue discussion outside class on the discussion board or through small group discussion forums. Announcements were posted weekly so that teachers had information about the class prior to meeting. Grades were posted, as were course
documents (e.g., syllabus and class handouts). Blackboard gave teachers another opportunity to build competence in technology use within an asynchronous classroom community.

At the beginning of the semester, teachers identified course expectations and completed a survey about their technology use on a four point Likert scale. Questions included their level of competence with the use of automated library resources, computer software, virtual field trips, videocameras, PowerPoint, and Blackboard. At the end of the course, the same survey was administered and teachers were also asked to respond to a questionnaire about their classroom use of technology activities.

RESULTS

Course Expectations

At the first class meeting, teachers were asked about their course expectations. Responses were clustered as follows: 1. Learning about technology to help oneself (10 responses), 2. Learning about technology to help one be a better teacher (13 responses), and 3. Learning about technology for the class or for the students (18 responses).

Examples of Cluster 1 responses included gaining more computer knowledge, learning basic fundamentals of computer use, and becoming more computer savvy. Examples of Cluster 2 responses included learning to incorporate technology into their teaching and gaining technology information to help them become better teachers. Examples of Cluster 3 responses included learning how to use technology to enhance their classes, helping students to learn and research math topics, and learning how to teach with the computers in their classrooms. Some teachers’ responses were in two categories, whereas other teachers’ responses did not fit any categories or they gave no response.

Survey of Computer Use

Teachers’ responses to the survey indicated that at the beginning of the course in January their perceived competence with all the technologies listed was lower than at the end of the course in May. Most teachers felt somewhat competent or very competent in all areas by May.

<table>
<thead>
<tr>
<th>What is your level of competence with the use of:</th>
<th>January A and B</th>
<th>January C and D</th>
<th>May A and B</th>
<th>May C and D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automated library resources</td>
<td>31</td>
<td>11</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>Computer software</td>
<td>21</td>
<td>6</td>
<td>21</td>
<td>36</td>
</tr>
<tr>
<td>Internet virtual field trips*</td>
<td>37</td>
<td>1</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>Videocameras*</td>
<td>24</td>
<td>5</td>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>PowerPoint</td>
<td>32</td>
<td>3</td>
<td>10</td>
<td>39</td>
</tr>
<tr>
<td>Blackboard or WebCT*</td>
<td>39</td>
<td>1</td>
<td>2</td>
<td>41</td>
</tr>
</tbody>
</table>

n=42
A = Don't know anything B = Know a little C = Somewhat competent D = Very competent *One January response unanswered
Virtual Field Trips

At the end of the course, teachers were asked some questions about their computer use. (Thirty-three teachers returned this questionnaire.) Only one teacher had attempted a virtual field trip (VFT) prior to the course. Eight teachers tried a VFT with their students after the class discussion and eleven others planned a VFT. One teacher reported that she was using the VFT as an extra assignment for failing children. She added that if she had had access to a lab, it would have been an end-term project for all her students. Two teachers had no online access, another teacher was trying to persuade the assistant principal to let her try a VFT with her special education children, and one teacher was working with the computer teacher to get a time slot.

PowerPoint

A total of 10 teachers had worked with PowerPoint prior to the course; 23 had not. Five teachers reported using PowerPoint with their students since the class activity; two planned to use it in the future. Additionally, one teacher had helped a friend prepare a PowerPoint presentation, and one teacher used it in another graduate course where he reportedly "wowed" his classmates. Five teachers stated that the program was unavailable to them at their schools.

Other Technology Activities

Teachers were asked what other technology activities they had tried since the class discussions. The responses can be divided into three categories: technology used to help oneself, technology used with children in the classroom, and plans for the future.

Several teachers reported using technology to help themselves. Six teachers reported using a spreadsheet program, mostly for grading and record keeping. I spent my entire Saturday working on report cards yesterday. Because of this course, I was able to use spreadsheet to calculate the grades. I also used it for the third quarter grades. Since all the information was already on Excel, all I needed to do was enter new grades, thus cutting my time in half (Questionnaire response from graduate student, Spring 2002).

One teacher used ideas for web sites in other classes, and another used web sites to assist with content and teaching methods. One teacher practiced using PowerPoint so that she would be able to use it in the future. One teacher surprised her family by using a videocamera at home. They didn't know she knew how to operate it.

There were many responses signifying technology use with children in the classroom. Three teachers reported that their children researched topics online, a fourth teacher had children go on the Internet to retrieve information and evaluate a web site. One teacher showed her children how to identify if a web site is useful and how to check for the accuracy of the posted information. Three teach-
ers used software with their classes; another teacher showed her children how to evaluate software for purchase; and another started a reading club and used software during club meetings. A couple of teachers reported that they started to look for useable software in their school. A teacher taught Excel for project presentations, and another used the spreadsheet program to teach volume and show linear relationships. An elementary teacher typed poems in PowerPoint and printed them. Because she did not have access to the PowerPoint program at school, her children made presentations holding the printouts that were mounted on posters. A couple of teachers typed work for bulletin boards and created banners. One teacher asked her children to use the computer to answer the question of the day. A kindergarten teacher took digital pictures of her students, printed them, and created a bulletin board.

Teachers reported that they planned to use what they learned in class in the future. One wants to chart student accomplishments in fitness using Excel. Another plans to videotape a scene from Othello. Others want to create a class web page, a class e-mail list, and integrate technology into the curriculum. A number of teachers were unable to use technology with their classes because they didn’t have computers in their classrooms or they didn’t have lab access.

**DISCUSSION**

The survey of computer use asked about teachers’ perceived competence with different technologies. The survey indicates that teacher competence at the end of the semester was higher than at the beginning of the semester in all areas. Providing a relevant course that includes modeling, a hands-on component to allow practice, collaboration, a match between the level of instruction and the ability/needs of the teachers, continuing support, and easy access to the technology resulted in increased competence for the teachers involved. Teachers were also increasing the use of technology tools with their own classes.

Providing teachers with a collaborative environment was useful for one who wrote, I really like that it was a sort of a close knit group and I was able to make some good friends like N. We hope to keep in touch and give feedback on our teaching methods since we both teach chemistry....Overall it was a really good course and I learned a lot. It has inspired me to try out new methods on teaching (Questionnaire response from graduate student, Spring 2002).

Another student related, “One part I especially enjoyed was the PowerPoint presentations that my group and I presented. I had never been exposed to this program and now I feel confident in using it for my class in the years to come” (Questionnaire response from a graduate student, Spring 2002).

Providing hands-on practice was crucial for giving teachers an opportunity to try out different technologies. A teacher related that

My only experience with PowerPoint prior to this class was a brief introduction to it during a staff development day. The presentation allowed me to really become more adept at using it. I haven’t used it in class but I would now feel comfortable using it when my class is responsible for school technology projects.... I learned a lot and more importantly I plan to use what I learned in the classroom (Questionnaire response from a graduate student, Spring 2002).

Course expectations for the graduate students indicated that they were inter-
ested in learning more about all facets of technology, both for personal and professional use. This is in line with Kellenberger's (1996) suggestion that pre-service teacher programs highlight the value of computers for both personal needs and careers of the pre-service teachers. This study would support Kellenberger's suggestion for inservice teachers as well.

**LIMITATIONS**

Teachers who are expected to use technology tools appropriately in a classroom need to have technology competence. However, confidence and a feeling of comfort may also have an effect on classroom technology use. A teacher reported that "the course made me feel more comfortable using the computer and other sources of technology" and another exclaimed, "I feel so confident now when using technology" (Questionnaire responses from graduate students, Spring 2002). It is the author’s belief that with practice (especially in a collaborative, non-threatening environment) competency as well as comfort and confidence increase. However, this study only examined perceived technology competence. A future study might examine the relationship of confidence, competence, and comfort.

This study was conducted in an urban university where most of the participants taught in a large urban school district. The findings of this study may not be generalizable to other situations.

The questionnaires that asked about technology use were distributed at the end of the spring semester. The results indicated that there were constraints that might have interfered with the introduction of technology in the classroom at that time. For example, some teachers were involved in end of year testing and some did not have access to the technology. However, the results of the questionnaires indicate that these teachers were beginning to use technology to help themselves, to help children in the classroom, and to plan for the future.

Although pupil access to instructional computers has improved since 1998 (Ansell & Park, 2003), how the technology is distributed and used varies among schools. Teachers in the present study were asked about computer accessibility in their schools. In spite of the No Child Left Behind legislation and state standards that mandate classroom technology use, many teachers reported that the only computer access they had was in a computer lab or in the library; the Internet is not available in every school. Sometimes computer access is limited in other ways, such as the case of the secondary English teacher who reported that the state-of-the-art computer lab is only accessible to the math department, and the only time her English students can use the two Internet computers located in the library is during lunch. Another teacher reported that she gave an extra assignment using technology only to her failing students because she lacked computer access for the whole class. A teacher of special education students had to beg her assistant principal to be allowed to use computer technology with her students. Other teachers reported that they had computers in their rooms, but these computers were broken and could not be used. Broken equipment ought to be repaired or replaced, otherwise they become expensive dust collectors.
IMPLICATIONS

Administrators who are interested in having their PK-12 students benefit from the use of technology resources are crucial in assuring that these tools are not only accessible, but kept in working order. Administrators must provide the funding for technical support personnel who can maintain the technology and quickly fix malfunctioning computers. Until all classes have sufficient available computers with Internet access, there will be students and teachers who are missing out on valuable resources and learning opportunities. It should be noted that all students can benefit from the appropriate use of technology tools, including those with special needs.

Administrators also can be pivotal by demanding that new teachers possess classroom technology skills and Schools of Education should require teacher candidates to take an educational technology course prior to graduation. Further, administrators should hire educational technology personnel to provide teachers with continuous technology support to assure that teachers have ongoing in-service technology training, and to provide them with current information on classroom uses of technologies.

Technology changes the way that people teach and learn. It is no longer necessary for teachers to be the source of all knowledge in the classroom. Students can find answers to their questions from myriad online resources, empowering students to take more responsibility for their own learning, and permitting teachers to take on roles as facilitators and coaches. Enabling students to take control of their learning will encourage them to become lifelong learners.

The ability to use technology appropriately in a classroom requires time to learn. The modeling of technology applications for teachers is not sufficient to ensure classroom technology use. Hands-on activities designed to provide practice in a non-threatening, collaborative environment help participants to gain competence. Teacher education programs are responsible for training to enable teachers to learn not only how to use technology, but how to teach with it. School districts should continue to train and support their faculties. The educational implications are clear: if children are to gain technology expertise, teachers need to have the competence to facilitate technology use.

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