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Evolution of teaching and learning through technology

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The profession of education has undergone many changes in teaching approaches, course assessments, roles of teachers and students, mainly through the integration of technology. Programs of Teacher Preparation, therefore, are being challenged to prepare their teacher candidates to use technology effectively. Research shows that technology has become an integral part of the teaching and learning environment making technology a stable part of the teaching and learning experience. Teacher educators must prepare teacher candidates to teach content and to use technology effectively so that all students will benefit in a world that depends on technology.

The evolution of teaching and learning through technology integration is apparent at all levels of education. Technology and education have been brought together, which has changed the classroom as well as the roles of the teachers and students. No longer is the classroom limited to four walls with a teacher using direct instruction.

The roles of teachers and students are not the only roles to change. In colleges and universities, those who teach students (teacher educators) to become effective teachers in today's classroom have roles that have changed as well. Teacher educators who take the responsibility of teaching effectively with technology are sending a clear message to their students (teacher candidates): This is how one teaches effectively and how to do so using technology. Therefore, an important emphasis of many teacher education programs is to prepare teacher candidates to

infuse technology into teaching (Pringle, Dawson, & Adams, 2003).

Roles of Teachers and Students in a Technological World

The integration of technology in education has many advantages. The teacher can provide an individualistic approach to students' work that is quick in submission and response, which gives authentic evidence of learning (Lou, Abrami, & d'Apollonia, 2001). When teachers use technology as a tool in teaching and learning, this should make their role as teachers easier and

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should help learning be more relevant to their students (Firek, 2003).

In classrooms that synergize technology successfully, the teacher is often not the center of learning but a facilitator of the learning activities. This transition of roles is often facilitated by cooperative learning strategies, which involve more complex learning tasks and the development of curriculum materials based on technology (Pasco & Adcock, 2007). In courses that have the use of a digital portfolio, the reciprocal nature of digital learning can help the teacher determine if the students are learning well or if adjustments need to be made to improve the teaching and learning situation. A digital portfolio also allows faculty members to document and record the individual teacher candidate's progress in correlation to standards and/or principles set up for their course (Adcock, 2005). However, a teacher's acquiring technology skills does not mean he or she can unite technology with instruction effectively. In many cases, teachers are learning right along with their students about the opportunities of technology-based learning.

Teachers at all levels need training, sound guidance, and on-site technology support to use technology effectively in the teaching and learning environment. They would benefit a great deal by having an opportunity to observe colleagues who use technology effectively, which would encourage them to experiment with technology as a tool for learning (Windschitl & Sahl, 2002). Studies have shown that teacher candidates' confidence in their technology skills is directly related to how well they feel they were prepared to use technology in their teaching preparation program (Stevenson-Bagnall & Pratt, 2001). It is apparent, therefore, that teacher preparation programs have a responsibility to help all teachers learn to meld technology into the curriculum more effectively. Mehlinger and Powers (2002) state that "not to know what technology is available to assist children educationally, and not to use it thoughtfully, is evidence of instructional malpractice" (p. 26).

Technology Integregation Classroom Examples

The following provides a description of the different ways in which technology is infused in teacher education classes at a local university that is committed to the use of technology as a tool of learning. In the human growth and learning class there are two classroom observations that are conducted using a two-way, audio-video conferencing system. A camera and microphone are set up at the remote location that is viewed and heard from the university setting. Through this form of distance education, the teacher educator and teacher candidates can discuss the observation while it is happening. Teacher candidates then prepare observation reports in a Word document that can be edited and later submitted to the digital portfolio (Adcock, 2005).

Another example is an ethics assignment for teacher candidates, which includes a basic definition of their personal ethics. Later students visit a list of websites on ethics to expand their definition of ethics, and they must also find an ethical clash in education. After finding the ethical clash in the media, students apply their revised statement of ethics to the ethical clash in a reflection. This ethics activity allows teacher candidates to discover the connections between teaching and learning, the role of the teacher, and their own ethical commitment (Hartley & Bendixen, 2001; Windschitl & Sahl, 2002). By placing the ethics activity in the digital portfolio, the teacher candidates can archive their work to be used as a reflective measure of their ethical beliefs in future education classes or in marketing their competencies for future employers (Kilbane & Milman, 2003).

Blackboard is another commonly used program that has many different approaches to teaching, such as in electronic quizzes and discussion boards. Quizzes that are taken electronically on each chapter help students and teacher to determine if the most important information is comprehended. A comparison of the scores of students who completed midterm and final tests electronically with those students who completed their midterm and final tests using traditional paper and pencil was conducted to determine if there would be a difference in the students' scores. Results of this study are found later in this article when addressing assessments.

Discussion Board is example of an electronic tool on Blackboard that also can be used. This program is designed as an interactive

chat room in which students share journal articles they have found by placing a summary on the Discussion Board. Not only do these students submit a summary of their article, but they are also required to reflect and respond to other students' articles they have read. This activity broadens the learning environment beyond the regular classroom through technology in which anytime-anyplace learning occurs (Adcock, 2005).

Another approach of learning with technology is through concept mapping with the use of the Inspiration software package. To help students gain an orientation to special education, student groups developed a concept map from research at various websites. Then student groups constructed a concept map that defined special education concepts and outlined characteristics of children with this speciality and, challenges for teaching these children. Each group presented their concept map to the class and submitted it to the Eportfolio where each teacher candidate completes a reflection on this activity.

Assessments and Technology

Dan Carnevale, in his article titled "Online Students Don't Fare as Well as Classroom Counterparts, Study Finds" (2002), hoped to shed more light on this subject. A study was completed using two on-line sections and two face-to-face sections. Initially when looking at the raw data, the students in the traditional face-to-face classes did better than the students in the on-line classes. However, it was found that contributing factors needed to be taken into account, which included a) The face-to-face students attended class regularly and performed better due to the close guidance and supervision of deadlines by the faculty. b) The on-line students were older; they spent less time on their studies than the face-to-face students. c) It was also noted that on-line students had jobs and other responsibilities as well as their studies and did not take advantage of the videos of lectures on-line.

Therefore, even though it initially appeared as if the traditional students did better than the on-line students, when taking into account all of the factors mentioned above for each group, both groups performed about the same. Therefore, it is important that studies are conducted that examine claims that technology

integration does indeed benefit the learning experience (Wepner & Ziomek, 2003).

At a local university a preliminary study of the use of technology as an assessment tool was conducted from 2002-2004. In this study, midterm and final tests were examined from four classes that were completed through the campus-wide electronic system called Blackboard. In the preliminary study when analyzing past students' grades, researchers noted that the electronic test grades appeared to be lower than those of students who completed the hardcopy version of the test. Therefore, a statistical analysis was completed to determine if there was a significant difference in the midterm and final test grades of those students who took both types of tests. In several of the classes that were compared, a significant difference in the means and the two-tailed t-test for equality of means did exist. Therefore, this study indicated that the means of the hardcopy test grades of those semesters were significantly higher than the means of the electronic test grades (see Table 1 – Preliminary Study).

After examination of this preliminary study, a decision needed to be made concerning the use of technology for assessment. If students' test scores were lower for those who took their midterm and final tests using technology, was that because there was a flaw in the initial study, or was there truly a significant difference in these two forms of assessment? It was decided to do a follow-up study to determine if there was a significant difference in test grades of students using hardcopy and electronic versions of the tests under carefully controlled conditions: a) both classes took the test in the same classroom each semester; b) the test was taken during the regularly scheduled class time periods for each class; and c) the test was exactly the same, whether the student took the hardcopy or electronic version of the test.

Approximately 60 students were asssessed in a follow-up study, in which only midterm and final exam test grades were used in the data analysis to determine whether there was a significant difference in the comparison of the two methods of the tests. In the follow-up study, the comparison of both methods of the midterm and final tests grades, there appeared to be no significant difference in the means and the two-

tailed t-test for equality of means, which was different from the results of the initial study (see Table 2 – Follow-up Study).

The difference in the results of the preliminary and follow-up studies could be based on several factors. The initial study was of past students' test grades only, with no opportunity to insure carefully controlled conditions. Another factor could be based on the design of the tests. Both tests utilized multiple-choice questions; however, in the preliminary study the hard copy version had a few short essay questions, which the electronic version did not. Even though the material presented in class and the material covered in the test were exactly the same, it is possible that grades were higher for the hardcopy version of the test due to students doing better with the short-essay-answer questions in the preliminary study. When it came to the follow-up study, however, only multiple choice and matching questions were used for both testing methods.

Because the follow up study proved that under carefully controlled conditions, the grades of students taking their test by either testing method showed no significant difference, it is appropriate to use either method of assessment. A teacher would not want to use a method of assessment that would hinder students' grades; therefore, teachers can feel reassured that the convenience of using electronic assessment methods is as suitable for students as are traditional hard copy tests (Adcock, 2004).

Future Trends

Aust, Newberry, O'Brien and Thomas (2005) discussed how John Dewey's approach to child-centered learning began with an assessment of the child to determine what he or she knew, then proceeded with the development and delivery of a progressive plan for learning. Using this approach when integrating technology into education would help ensure that teacher educators are technology-literate and passing this technology literacy on to teacher candidates as they become teachers in the PK-12 educational system. Aust, et al. (2005) described a systemic model that looks at the individual skills and experiences of the students, then adapts the learning and technology skill development to

meet those needs. Therefore, their model is not using the mentality of "one program fits all" approach in using technology in education but adapting the learning to the teacher candidates' needs to benefit future students.

The key of technology-assisted pedagogy depends on the teacher educator's understanding of the value technology can contribute to the learning environment (Hughes, 2005). Technology resources that are available to assist all teachers who take the initiative and are innovative will give students new ways of learning with technology that others without this approach cannot appreciate. Who are these teachers? Who are the innovators who are more likely to use technology effectively when they teach? Studies show that teachers who learn about technology while they are learning how to teach the content area seem to be more likely to use technology in the classroom more effectively. However, those who were taught technology in a separate class of technology skills did not seem to be as successful in using technology (Hughes, 2005).

When teacher candidates have real or authentic classroom experience in which they can apply the use of technology as a tool of learning, these teacher candidates fill their role as teachers who use technology to benefit themselves and their students. It is these same teachers then who are willing to learn more about how to use technology successfully in a teaching situation and are more innovative (Bird & Rosaen, 2005) when it comes to the union of technology and education.

Conclusions

In the electronic age when a number of teaching and learning strategies are based on technology as a tool of learning, researchers question whether the use of said technology is a convenience for learning or a distraction from the academic attainment of students (Adcock, 2004). Although the confluence of technology into the pedagogical aspects of teaching can be a positive step, technology use needs to be routinely assessed to determine if changes in students' skills and grades are due to the use of technology or if there are contributors that improve skills and grades other than technology. Therefore, close monitoring and assessment of technology activities must be conducted on an ongoing basis to determine if technology does

contribute to and, at the very least, does not detract from the teaching and learning situation (Wepner & Ziomek, 2003).

The evidence is clear that technology integration is a stable part of the educational system. Research shows that when technology is taught in unison with how to teach content, teacher candidates learn to use technology more effectively. Research also shows that the use of technology in teaching and learning does not detract from the learning and, if used effectively, can support the learning in a number of different ways. The challenge that remains is for teacher educators to become more technology-savvy like their students and to model the use of technology in their teaching more effectively so that all students will benefit in a world that depends on technology.

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