Technology Integration: Connections to Educational Theories

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The Ohio State University at Mansfield (OSU-M), like many institutions, has made technology integration across the curriculum an instructional focus. This article will provide insight into ways in which the education department at OSU-M integrates technology and the educational theories that provide reasons for that integration. As with many new practices, the integration of technology into the elementary education licensure program at OSU-M is a work in progress. The faculty members are constantly revising and adjusting our uses of technology to better meet the needs of the program and our students.

This article consists of a brief description of the campus and student population and an overview of the program, followed by a short description of the typical technological development of an education student at OSU-M. Next is a look into the conceptual foundations of the program, containing descriptions of ways in which we integrate technology to fit the tenets of that particular concept and providing electronic evidence of some of those methods. The article ends with a look at ways in which teacher education programs can use technology to meet the needs of their program and ways in which the perceived necessity for the use of technology is sometimes blurred by the novelty of technological innovations in the field of education.

EDUCATION AT OHIO STATE UNIVERSITY AT MANSFIELD

The Ohio State University at Mansfield is a regional campus of The Ohio State University and serves a large area containing urban, suburban, and rural communities. The university serves both traditional and nontraditional students. The education department at OSU-M is housed within the School of Teaching and Learning and the Integrated Teaching and Learning (ITL) section. The Integrated Teaching and Learning section of the College of Education serves those preservice teachers who are studying to be teachers of children age 3 to Grade 8.

The Ohio State University Master of Education degree, the degree that offers course requirements for licensure in elementary and middle childhood, is a five-quarter, graduate licensure program. Students enter the program with a B.A. in Elementary Education or a similar field. We license approximately 24 teachers per year. Class size ranges from 12 through 24 students. During the bachelor's program, student studies are focused on theories of child development and learning, primary reading and language courses, general liberal arts courses, content courses, and two beginning field courses. At least one field placement during the undergraduate coursework takes place in an urban school. Following admission to the graduate program in education, students begin their coursework in general pedagogy and specific methods: social studies, mathematics, language arts, reading, and science. During this year and a half of studies, students are in the field each week for 4-10 hours and have a 12- to15-day period toward the end of the two methods block quarters when they create and implement lessons in their field classroom. All students complete two separate placements in teams of two. Field placements are primarily in suburban and rural schools. Following these field placements, students have one quarter of student teaching and one quarter for a master's project, including a comprehensive portfolio and a research paper.

Experiences With Technology

During the undergraduate program students take one technology course. This course is intended to provide students with exposure to the basic knowledge of computer hardware and an introduction to traditional educational software. During this course, students are required to complete an

"All About Me," project (see PowerPoint 1) for which students familiarize themselves with tools such as the scanner, digital camera, clipart, and presentation software.

After students are admitted to the master's licensure program, they take one basic technology course that covers other technologies available to elementary education teachers (e.g., Ellison cutters, laminating machines, filmstrip projectors, video projectors, enlargers), and they continue their development of computer knowledge. The two courses, one in the under-graduate program and the other in the graduate program, are the only two stand-alone courses on technology. After students have completed the basic technology course in the graduate program, they begin their methods courses.

Throughout the methods coursework, students are asked to use technology when appropriate to enhance their teaching. In addition to this expectation, instructors of the methods courses integrate technology into their teaching to serve as a model of ways in which technology can enhance learning in the particular subject areas. During the two methods course quarters, students attend a lab course entitled the Technology Teaching Lab (TTL). The goal for this course is to increase the use of technology in students' lessons in ways that will enhance their teaching.

The TTL is a series of 2-hour labs that runs concurrently with our methods blocks. The purpose of this lab is to provide the preservice teachers in our elementary education program opportunities to create, with assistance, technology-enhanced lessons for their field placements. The lab course provides the students with instruction, opportunities, and equipment to take their technology-enhanced lessons directly to the field.

Much of the equipment for the technology teaching lab was funded through a Technology Education Learning and Research (TELR) grant. The TTL lab classroom (Figure 1) has 12 desktop, computers, a scanner, three digital video cameras, three digital cameras, three flex cams, and three laptop computer and projector sets. Each of the field placement schools used in any particular quarter will house a technology set to be used by the students. The set contains one each of the technologies mentioned above. There is also one digital microscope, one portable white board, and one classroom set of TI-73 calculators with an overhead calculator, which students can check out to use in their field placements. By providing the students with

the portable equipment, students can create and deliver their lessons in the field without concern for lack of hardware or software A side benefit of the onsite technology sets has been that practicing teachers have been able to see what technologies are available for teaching and how to use them.

Figure 1. The technology teaching lab.

As an evaluation piece, each student completes a technology template aligned with the International Society for Technology in Education (ISTE, 2000) professional profile. Each of our students downloads this template, the competencies in table form, onto a CDWR disc. Our students write a short narrative addressing how they met each of the competencies and include with their narratives hyperlinks to electronic evidence of their work. The TTL template (Appendix A, http://education.mansfield.ohio-state.edu/iste/ RebeccaHays/TechTemplate.doc) has proven to be a beneficial tool for our department to see whether or not the program provides opportunities for our students to meet the profile set by ISTE. The template also gives our students an opportunity to collect electronic evidence of their teaching that can later be used in an electronic portfolio, which is an option for their capstone course.

The lab course meets for a 2-hour period once every week during the same quarters as our methods block. In addition, the lab space is available for walk-ins throughout the week. The students work during this time to create

technology-enhanced lessons that they will take directly to their field placement. There is little direct instruction; instead, time is spent on the uses of instructional technologies, demonstrations of those uses, and experimentation with the equipment. The primary structure of the lab course is one of open discovery and experience. Students are to play and create lessons, again, to take directly to the field.

CONCEPTUAL FOUNDATIONS

The ITL department at The Ohio State University at Mansfield has six primary themes: (a) developmentally appropriate practice, (b) integrated curriculum, (c) literature-based instruction, (d) classroom-based inquiry, (e) diversity and equity issues, and (f) technology integration. The goal for technology integration, like the other themes in the program, is to integrate the theme into each course of the program, when appropriate. For example, instructors find ways to integrate children's literature into each of the methods courses, whether it is a mathematics, science, or social studies methods course. The goal is to integrate the common themes of the program throughout the methods courses and the other graduate courses leading up to student teaching.

While this writing provides insight into each of the primary themes upon which our program is based, technology integration at OSU-M is viewed as more of a tool for instructional methods than a theory. As we continue to grow as technology users and instructors, we are beginning to question and seek out primary theories of technology integration for the education program. For now, technology is integrated into the courses through the primary program theories. Because of this, the theme of technology integration will be addressed at the end of the discussions following each of the other conceptual frames in this writing.

Developmentally Appropriate Practice

Developmentally appropriate practice (DAP) is a basic underlying principle of our teacher education program and should be a general tenet of instruction at all levels. "Developmentally appropriate" means that the learning

activities children are involved in consider their age and are related to individual children's interests, abilities, and cultures (Hendrick, 2001). For educational decisions to be developmentally appropriate, teachers must regard at least three key sources of knowledge: how children learn and develop physically, cognitively, socially, and emotionally; the characteristics of individual children and their families; and the social and cultural contexts within which children live (Bredekamp & Copple, 1997). These sources of knowledge are introduced, examined, and applied throughout our teacher education program in introductory child development and pedagogy courses, and later in subject matter methodology courses.

This knowledge helps teachers plan curriculum in multiple ways. It offers ideas about how and why children learn and behave, gives guidelines for what children should be able to do at certain ages and stages, suggests sequential benchmarks for physical, cognitive, social, and emotional development, and provides background about individual children and cultural diversity (Bredekamp & Rosegrant, 1992).

We help and encourage our teacher education students to use various strategies to apply their DAP knowledge during supervised field-based experiences. Our students develop educational activities that reflect children's natural learning and interests across subject areas and developmental domains. These activities are based on their observations and diagnoses of individual children's abilities and needs, as well as general age appropriateness. Our students prepare learning environments that motivate active involvement with relevant, concrete, and real materials, as well as interactions with peers and adults. We ask our students to tier their learning activities so that the wide range of abilities and interests found in every classroom are considered. We also encourage our students to observe and reflect on the progress of their children frequently in order to modify the learning activities they have planned.

Our program stresses the need to consider children's holistic development and variety of interests. Doing so makes children's education inherently meaningful rather than adult-defined (Krogh, 1997). The skills, knowledge, and attitudes needed for such teaching are explored and discussed in on-campus coursework, then applied, evaluated, and reflected upon during supervised field experiences and capstone assignments.

One way that we integrate technology into the theme of DAP is by modeling the importance of the students' world in our courses. As an example, the "All About Me" hypermedia project in the undergraduate technology course shows students one way that they can get to know their students to improve their connection to the students' lives (Figure 2). In addition, students complete a Math, Science, and Technology (MST) project (see PowerPoint 2) in which they import digital video into a hypermedia presentation that highlights the strengths and concerns of their teaching. This has proven to be a beneficial means of reflection and a great learning experience for our students in terms of uses of digital video and editing (Figure 3).

Figure 2. Students watching an "All About Me" PowerPoint presentation.

**Figure 3.** Preservice teachers using digital video camera.

Integrated Curriculum

Integration is a vital piece of teacher education because it is only when the relationships between ideas are recognized that they become meaningful (Sunal, Powell, McClelland, Rule, Rovegno, Smith, & Sunal, 2000). Otherwise, ideas become static and are not meaningful. Learning which is not meaningful is not retained.

One clear objective of the elementary education program at OSU-M is to connect instruction/learning to real-life situations so that students learn and appreciate how different subjects are used together to solve an authentic problem (Pang & Good, 2000). In its simplest form, integration is the melding of content area concepts when real-life situations provide for such melding. However, the motive for integrating in the teacher preparation program at OSU-M is not simply a sharing of the common goals of the four general content areas and their respective curricula. Rather, best practice in teacher education involves working with preservice teachers in field-based, university-based, and community-based settings— in other words, integrating the worlds of the preservice teacher.

To be effective, teachers must not only demonstrate a knowledge of how to integrate content or concepts within a particular discipline, but they must justify that this method is having a positive effect in their classroom as evidenced through student learning. Integration can only be justified when students' understanding of the content is enhanced (Lonning, 1997).

This is also true with the issue of technology integration. Our students are expected to use technology to enhance their students' learning. At times, we discover they use technology simply because it is available. Sometimes our students find that a particular lesson actually could have been more effective without the use of technology. When students experience these insights, they are provided with opportunities to assess the appropriateness of particular technology uses within their instruction (see Appendix B). Many times, however, students find that the use of technology enhances their lessons (Appendix C) and improves their students' learning. For example, they find that when they create Microsoft Excel charts (Figure 4) to demon-strate mathematical graphs that students can see immediate differences between the values of a particular criteria. Some teacher education students have also used technology to give their students a different look at con-cepts or material in their curricula, as one teacher education student did using a flex cam (Figure 5).
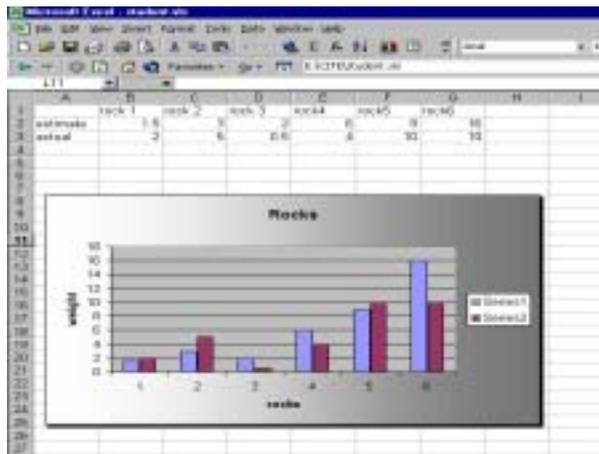
Figure 4. Sample mathematical graph in Excel.

Figure 5. A preservice teacher uses a flex-cam to give her students a different perspective.

Literature-Based Instruction

Eminent scholars, such as Charlotte Huck (1977), Margaret Meek (1991), and Jeannette Veatch (1958), long have advocated the use of children's literature as a basis for instruction in elementary classrooms. They note that the need for basal readers and textbooks that grew out of a lack of available books during earlier periods in the United States no longer holds merit in an age of abundant, readily accessible, high quality trade books that now are published every year. In addition, psycholinguists, such as Frank Smith (1976) and Ken Goodman (1986), strongly argue that learning to read best happens with whole, interesting, well-written texts like many children's books, rather than the contrived, dry material found in many textbooks and basal programs.

These tenets, combined with a child-centered focus that recognizes the importance of learners' interest and motivation and the important role that children's literature can play in integrating curriculum, provide a solid

theoretical foundation for our teacher preparation program. Education students are first exposed to children's literature in a required course at the undergraduate level. Then in the graduate licensure program, literature is incorporated extensively into reading and language arts methods courses and woven throughout content methods courses in mathematics, social studies, and science. We do this through team-teaching by literature and content specialist instructors, distribution of children's book bibliographies related to content area topics, and integration of assignments that require the use of children's literature across the curriculum.

Increasingly, we have discovered ways that technology enhances our use of children's literature for teaching and learning in elementary classrooms. For example, in the children's literature survey course, pre-education students can use technology to make projects, such as creating videotape or compact disc versions of favorite children's picture books. They learn about and use electronic databases and CD-ROMs to locate children's books. They search author websites, contact authors and illustrators by e-mail, and, in turn, have children do this in their student teaching experiences. In methods courses, education students learn to use digital and video cameras to record children's creative drama reenactments of favorite books. They have children use programs, such as Hyper Studio, to create literature response projects. Finally, to enhance our students' learning of authors, students create electronic posters (PowerPoint 3). Using technology to enhance their learning models ways that education students can use technology to enhance their students' learning.

Classroom-Based Inquiry

The combined research of Piaget, Vygotsky, Dewey, and Bruner supports learning environments and activities that are developed to allow for whole-to-part learning with big ideas, pursuit of student questions, use of manipulative materials, and the viewing of students as thinkers who are emerging at different rates (Brooks & Brooks, 1993). A great deal of research exists connecting instructional design to positions on constructivist learning (Ertmer & Newby, 1993 & Cooper, 1993). If instructors hold the constructivist orientation of learning, they are more likely to create learning environments that provide opportunities for students to create or construct knowledge. Best practice calls for teacher development to "be built around

experiential activities rather than theoretical lectures" (Zemelman, Daniels, & Hyde, 1998, p. 228). The elementary and middle childhood education program at OSU-M honors this advice by designing coursework that is authentic, reflective, and constructivist. As Zemelman, Daniels, and Hyde (1998) wrote, "Teachers need these ingredients just like kids do" (p. 228). Because of this, the natural starting point for instruction in a constructivist classroom is not the material to be taught, but student interests, prior experiences, and current understandings (Ravitz, Becker, & Wong, 2000).

Our teacher education program provides opportunities for our students to explore issues of constructivist-based instruction with respect to the four basic content areas. Each content area provides methodologies that represent the primary tenets of a constructivist classroom. Students are encouraged to experiment with multiple instructional methods to provide them with experiences upon which they can draw to best meet the needs of their students. Another primary goal has been to provide preservice teachers with course experiences that model those they would find in a constructivist-based classroom. The methods and general pedagogy courses use constructivist practices, such as cooperative learning, discovery learning, emergent curriculum development, and using student interests.

This modeling continues through the format of the TTL course. A tconstructivist form of a TTL has to accommodate a variety of levels of student technology abilities and provide for their varying interests. We designed the TTL course to be one of discovery and experience. The teacher's role, in a constructivist setting is to facilitate student-designed efforts. Therefore, the instructor's responsibility is to help the students develop educationally sound applications of technology in their field placement—applications in close connection to the education department philosophies and the needs and requirements of the methods courses. The instructor's job is to facilitate the lab course. The major focus of this time is on experimentation and on emergent needs of particular lesson as they develop. The hope is that students will feel comfortable enough with technology to use it, when appropriate, in their own classrooms (PowerPoint 4).

Diversity and Equity

Teacher educators have increasingly embraced a commitment to preparing teachers for socially diverse classroom environments. In the OSU-M M.Ed.

program, we espouse beliefs about teaching and learning that demonstrate a critical pedagogical stance and that reflect consistency with social reconstructivist approaches to multicultural education. Social reconstructionist teaching is most often evidenced by critical talk about social issues, a student-centered curriculum, and social activism for equity. As Geneva Gay (1995) explained, the goals of multicultural education are

> to make education more equitable for and representative of the social, ethnic, and cultural pluralism which characterizes U.S. society; to make high quality learning more accessible to a wider variety of students; and to contribute to the creation of a society in which the democratic principles of equality, freedom, justice, and human respect are realized for culturally diverse people. (p. 161)

Furthermore, like Gay, we believe that multicultural education (MCE) and critical pedagogy are compatible and that we have an obligation to prepare future teachers for the increasing social diversity they will encounter upon entering today's schools. Such preparation is less about teaching "methods" and more about developing attitudes, promoting self-analysis, fostering inquiry orientations, and perceiving sociocultural issues with an inclination toward change for equity (Bartolome, 1994).

The approach of our teacher education program has been to infuse many of our courses with readings, experiences, and assignments that draw upon sociological research—to explore the social construction of reality (e.g., Schutz, Goffman, Shipler)—as well as writings that explicitly address the relationships between critical theory and school practices (e.g., Freire, hooks, McLaren). A primary goal has been to promote critical inquiry through reflection in order to enable students to see "reality in process, in transformation" (Freire, 1970, p.64) and then feel empowered to transform.

Although all courses include some consideration of equity issues, the social studies and mathematics methods courses (before student teaching) and the Multicultural Education and Equity course (after student teaching) that most explicit consideration of these issues takes place. We ask our students to question practices, materials, and school organizational structures, and we invite them to discuss topics that are often initially uncomfortable for them. Students engage in critical evaluation of schools' orientations toward MCE by charting characteristics consistent with the different perceptions of MCE

as defined by Sleeter and Grant (1994) and then casting a similar critical eye toward their own teaching philosophies and practices as they complete fieldwork. Students also engage in reflective journaling, inquiry projects in the community, and passionate (but respectful) discussion about sensitive issues, in which all points of view are heard and given thoughtful consideration.

Students discuss technology integration as it relates to issues of equity and access. We ask our students to evaluate the fit between the "haves" and "have-nots" and their access to technological innovations, and we have them ponder their roles in creating better access for students who are not being kept current. We have students evaluate programs and websites (a) for critical examination of the cultural sensitivity/accuracy of those programs and websites but also for (b) learning more about issues of social diversity of which the students themselves are unaware. For instance, students who are very shy about inquiring about gay/lesbian-related issues will frequently find it much safer to explore questions online than they would in a more public forum. Finally, we compel students to use computer technology (as well as laser discs and other media) to seek out curricular materials and resources (see Appendix D) that both supplement and transform the curriculum—to promote more well-rounded, socially-sensitive and transformational curricula.

CONCLUSION

Although there are common theoretical threads in contemporary teacher education programs, each program is unique. It is because of this individuality that technology integration must also be unique. Some programs can have content courses in which the technology used is used in the process of learning the content. This would be an excellent example of modeling. The technology connection must fit the resources, program demands, and theoretical frame. If the use of technology does not fit within the theoretical tenets of a program, it does not help to meet the programs' goals.

Even so, it is also not beneficial to a program to include technology simply because it is available. This trap catches even the best-intended programs. As we began to infuse technology into our program, the driving force was the ISTE standards (ISTE, 2000). While the standards are a good structure

for technology infusion, it is a superficial reason for infusing technology. Technology, like any teaching tool, must be integrated to improve learning. Every time we use technology, whether in our instruction or related to a classroom assignment, we must question its use. Does it enhance the learning of a particular content or concept? Sometimes it takes a non-example to show us that a more traditional method of delivery is more effective..

In any event, appropriate use of technology does show promise. It provides organizational tools for teachers through databases and document software and aids in professional development through websites and electronic communications. Technology gives students opportunities to observe and reflect upon things that otherwise would be missed. Technology gives students an opportunity to put more of themselves into the lesson through presentation software and group authoring. Technology, when used appropriately, provides many opportunities for students and classroom teachers.

Still, the most important aspect of technology use in teacher education programs is the fit with the program's theoretical frame. When looking through the lens of the theoretical frame, the picture must be clear. If the use of technology causes a blur, it needs to be removed. A blurry picture can be frustrating and it interferes with the true subject.

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