

## **Technology Integration: Mobile Devices (iPods), Constructivist Pedagogy, and Student Learning**

JARED KEENGWE, DONNA PEARSON AND KATHY SMART

*University of North Dakota, USA*

jared.keengwe@und.edu

donna.pearson@und.edu

kathysmart@mail.und.nodak.edu

Although mobile technology is still evolving with most mobile devices supporting numerous communications and technology standards, there are currently very few applications of these devices to support and enhance teaching and learning activities. Integrated appropriately, mobile devices can help students acquire the skills needed to survive in a complex, highly technological knowledge-based economy. This article reports on a small yet innovative qualitative study where preservice teachers were provided with iPods as part of academic courses in a Midwestern College of Education. Evidence from this study indicates that preservice teachers recognized using iPods and podcasts as an effective tool for differentiated instruction. Further, a majority of the preservice teachers saw podcasting as a vehicle for presenting content to their future students. Finally, the authors recommend that teachers take a constructivist approach in the use of mobile devices to integrate audio seamlessly into the curriculum.

## INTRODUCTION

Technology integration is a process in which computers and other technologies are used as tools to support the tasks of teaching and learning (Eib & Mehlinger, 1998). In other words, technology integration involves establishing the best ways to incorporate education technology into the curriculum as teaching tools. Further, it refers to the different ways that technology tools can be used to support students as they construct their own knowledge through completion of authentic learning activities that enhance meaningful learning (Novak, 1998).

Authentic learning activities involve students in active and interactive complex tasks that require them to use higher level thinking skills (Jonassen, 2000). Technology is a strong tool to support active, inquiry-based learning supported by technology-based tools such as database, analytic software, and composition software (Becker, 2000). Used appropriately, technology can enable students to become: capable information technology users; informative seekers, analyzers, and evaluators; problem solvers and decision makers; creative and effective users of productivity tools; communicators, collaborators, publishers, and producers; and, informed, responsible, and contributing citizens International Society for Technology in Education (ISTE, 2000).

Teaching with technology helps to capture students' attention and engage them in the learning process. However, the result of utilizing these tools ultimately relies on the effectiveness of the instructor's instructional approaches. Gooden (1996) argues that technology is not a substitute for good instruction; effective teachers integrate technology into their lessons to engage multiple learning styles of diverse learners in the classroom. Further, the most effective way to benefit from the use of technology tools is to integrate them into the curriculum as opposed to integrating curriculum into the existing technology.

Meaningful integration of technology into the curriculum requires commitment by school districts to create in-service days for technological workshops. Teachers must be encouraged to attend these workshops. Further, there should be some form of support in each school building so that teachers have assistance and support in the use of technological tools. Support personnel include but are not limited to: a full-time or part-time computer technician, a head technology expert within the building that may be a teacher or an administrator, computer-savvy students, or community volunteers who are knowledgeable about technology (O'Bannon & Puckett, 2007).

## CONSTRUCTIVIST PEDAGOGY AND TECHNOLOGY TOOLS

Constructivist pedagogy is founded on the premise of creating knowledge in learning environments supported by active learning, reflective learning, creation of authentic tasks, contextual learning, and collaborative learning (Novak, 1998). Constructivist teachers view learning as an active, group-oriented process in which learners construct an understanding of knowledge that could be utilized in problem-solving situations. This pedagogical approach requires integration of various technologies with active learning while allowing for teachers to act as guiding partners (Gallant, 2000).

Constructivist learning environments are intended to provide multiple paths for students to learn meaningfully with teachers performing the role of guides, mentors or facilitators. As guides, constructivist teachers incorporate mediation, modeling, and coaching while providing rich environments and experiences for collaborative learning (Sharp, 2006). In practice, constructivist teachers ask questions, oversee activities, and mediate class discussions; constructivist teachers use scaffolding which involves asking questions and providing clues linking previous knowledge to the new experience (Sadker, Sadker, & Zittleman, 2008).

Technology is just a tool that supports learning. Additionally, pedagogy is what determines what tools instructors use in the classroom. For teacher educators, caveats include not being over anxious in using technology and focusing more carefully on crafting sound pedagogy. Jonassen, Peck, and Wilson (1999) argue that teachers need to gain some technology skills but they will be most successful using technology as a learning tool if they do not master the technology and therefore act as an expert. However, teachers should feel comfortable allowing students to “move into domains of knowledge where they themselves lack expertise, and they must be able to model their own learning process when they encounter phenomena they do not understand or questions they cannot answer” (Jonassen, Peck, & Wilson, 1999, p. 22).

Using technology to teach preservice teachers about technology adds a useful dimension to a practical approach that is theoretically based (Clifford, Friesen, and Lock, 2004). Further, thinking about teaching and instruction focuses on meeting specific needs of learners allowing teacher educators to progress from a singular perspective to a multi-faceted perspective in teaching with technology. As a result, preservice teachers must focus on developing thought processes about student learning that enables them to think through the integration process of various technology tools available for them in the classroom.

Technologies have been used traditionally in schools to “teach” students, much the same as teachers “teach” students (tell students what they know and assess their recall and comprehension of what they were told). In the traditional perspective, the assumption of most schools is that students learn from technology or teachers. In the constructivist perspective, learning with technology supports thinking in meaningful ways (Jonassen, 2000). Therefore, teachers need to establish appropriate ways to use technology tools without undermining sound pedagogical practices (Anderson & Becker, 2001).

### PURPOSE OF STUDY

It is estimated that 30 to 57 million American citizens will access and use podcasts by 2010 (Mindlin, 2005). Further, teacher education holds the potential of enhancing learning through mobile devices (iPods) that are becoming less expensive and steadily increasing in popularity. iPods are popular because of their versatility – they double as MP3 players and can play movies downloaded to them from a computer. The iPod isn’t just another distribution approach for learning materials; iPods allows teachers to integrate audio seamlessly into the curriculum. These powerful mobile devices engage individual learners by empowering them to study at their own pace. Additionally, they use audio and video to give multimedia lessons across multiple disciplines. For instance, if students are experiencing difficulty understanding a given science or social studies concept, they can view selected class videos more than once to thoroughly grasp the content being presented.

The 2007 Educause Center for Applied Research (ECAR) Study of Undergraduate Students and Information Technology reported a significant growth in ownership of electronic multimedia devices (iPods, etc). The report collected data from 40 institutions. According to the report, 37% of students owned a mobile device in 2005 as compared to 2006 (60.1%) or 2007 when 74.7% of students owned a mobile device (Caruso & Salaway, 2007). A majority of respondents indicated using mobile devices for leisure, such as music or games.

Today, innovative technologies such as mobile technologies continue to provide unique opportunities for educators to deliver educational materials efficiently and provide a greater flexibility in student learning. Appropriately integrated into the curriculum, mobile technologies can enhance teaching effectiveness as well as promote student learning. Even so, teacher educa-

tion, as an academic discipline, typically does not address or provide individual technology as part of a course component as other disciplines such as engineering, health care, or business. Therefore, the primary purpose of this qualitative study was to explore students' perceptions of the use of iPods for academic or instructional purposes.

Specifically, this article reports on a small yet innovative qualitative study where preservice teachers were provided with iPods (through the Northwest Academic Computing Consortium Proof-of-Concept grant) as part of academic courses in a Midwestern College of Education. Data from this study can provide evidence for adoption and implementation of mobile technologies in schools. Further, results from this study can provide data set to support or dismiss existing assumptions on the potential of mobile devices to support and enhance meaningful student learning.

### **Research Questions**

The following research questions were investigated in this qualitative study:

- (a) Do iPods enhance preservice teachers' pedagogical strategies?
- (b) Does "having" an iPod promote students to develop or author instructional resources?

### **METHODOLOGY**

This study involved three phases: pre-test, peer-assessment, and classroom discussion. Purposeful sampling was used to collect data at a Midwestern College of Education. A total of 43 preservice teachers enrolled in two required undergraduate courses – Technology for Teachers (TT) and Social Studies Secondary Methods and Materials (SSMM) – were part of this study. There were 4 male and 24 female preservice teachers in the TT class and 8 male and 7 female preservice teachers in the SSMM class.

The preservice teachers were grouped based on their individual courses with each preservice teacher receiving an iPod for the first half of the semester. The preservice teachers completed the Computer Self-Efficacy Scale (CSES) by Murphy, Coover, & Owen, (1989) as a pre-test that examined computer self-efficacy. The survey was on a five point Likert Scale with items rated on the following levels of self-efficacy: quite a lot of confidence, high confidence, some confidence, little confidence, and very little confidence.

For a required class assignment, SSMM preservice students created topical podcasts of interest from economics, geography, history, or political science. During the last week of the semester SSMM course, preservice teachers engaged in a class discussion (reflective practice) to examine: (a) increased pedagogical skills, (b) expanded access to and use of subject matter area material (c) increased use and understanding of a (portable media device) for instructional purposes and (d) reflective practice. Learning experiences supporting the preservice students' expertise in pedagogy included the flexible delivery of course related materials (podcasts), critical information from lectures/readings, collaboration, and subject matter information.

### **Creating Podcasts**

During the semester, the researchers collaborated with the Apple computer regional educational representatives in delivering two presentations. The first presentation focused on the use of podcasts and video podcasts in education and was conducted early in the semester. The second presentation was made later when students finalized their projects in preparation to publish. A portion of the class time was devoted to iTunes U. This was in conjunction with the institution recently launching the iTunes U. The preservice teachers enrolled in the TT course evaluated the podcasts published by the SSMM preservice teachers. This review activity was also part of the assignments in the TT course.

In the SSMM course, preservice teachers created social studies content with technology resulting in the creation of a podcast. Preservice teachers were free to choose any topic relative to the disciplines in the social studies (i.e., economics, geography, history, political science, anthropology, psychology, and sociology). However, they were encouraged to choose a topic from the core content of their social studies program namely economics, geography, history, and political science. For preservice teachers working on this project, supplementary class time provided assistance and instruction in creating podcasts. Additionally, the use of rubrics provided them with guidelines on podcast preparation and development.

#### **Podcast Evaluation**

The researchers reviewed multiple podcast rubrics. Upon identifying one (Bell, 2007), the researchers requested for and received permission to modify and incorporate the rubric into the courses as well as this study. The rubric was organized into four categories that included: (a) introduction; (b) content; (c) delivery; and (d) graphic and music enhancement. Under each

category were articulated gradations of quality for each criterion: exemplary, proficient, partially proficient, and incomplete. Total available points ranged from nine at the exemplary benchmark to zero points at the incomplete benchmark.

### **Classroom Discussion**

At the conclusion of the semester, students participating in the class discussion explored the following three questions: (a) What did you like/dislike about the iPod incorporation into the classroom instruction and would you like to learn this way again (why/why not); (b) How will you incorporate this teaching strategy into your teaching, and (c) How could I as the instructor better facilitate your learning of this technology as an instructional strategy

Discourse began with discussions centering on student responsibility and the importance of technology integration in instruction. Discussions were geared toward generating specific responses to key questions such as, (a) How can mobile devices (iPods) enhance your (individual) learning, and (b) What specific ways can ipods be integrated in your subject area to support student learning.

## **RESULTS**

### **Pre-Tests**

Students in the TT and SSMM courses participated in the pre-test aimed at providing the researchers with a baseline to determine student efficacy in using computers. In analyzing the data, the TT and SSMM pre-service students shared similarities and differences. Based upon a five point Likert Scale, students selected (1) quite a lot of confidence, (2) high confidence, (3) some confidence, (4) little confidence, and (5) very little confidence when asked questions directly relating to their comfort levels with mobile technologies. Figure 1 depicts students' self-reported efficacy in using mobile technologies.

Item	Quite a lot	High	Some	Little	Very Little
Using User's Guide	SS 0.0% (0) TT 0.0% (0)	SS 7.7% (1) TT 14.3% (2)	SS 46.2% (6) TT 28.6% (4)	SS 30.8% (4) TT 57.1% (8)	SS 15.4% (2) TT 0.0% (0)
Terms Hardware	SS 0.0% (0) TT 0.0% (0)	SS 23.1 (3) TT 28.6 % (4)	SS 38.5% (5) TT 50.0% (7)	SS 30.8% (4) TT 21.4% (3)	SS 7.7% (1) TT 0.0% (0)
Terms Software	SS 0.0% (0) TT 0.0% (0)	SS 23.1% (3) TT 35.7% (5)	SS 38.5% (5) TT 35.7% (5)	SS 30.8% (4) TT 28.6% (4)	SS 7.7% (1) TT 0.0% (0)
Troubleshooting	SS 0.0% (0) TT 0.0% (0)	SS 30.8% (4) TT 42.9% (6)	SS 38.5% (5) TT 35.7% (5)	SS 15.4 % (2) TT 7.1% (1)	SS 15.4 % (2) TT 14.3% (2)

**Figure 1.** Students' self-reported efficacy in using computers

## **Professor Assessment**

Preservice SSMM teachers submitted podcasts for both peer and professor evaluation based upon the rubric provided that categorized the content of the podcast (a) introduction; (b) content; (c) delivery; and (d) graphic and music enhancement. Each category contained various degrees of achievement (e.g., exemplary, proficient, partially proficient, and incomplete).

Scoring by the professors graded and feedback provided to students. Additionally, the preservice teachers completed an assignment that had employ the rubric and evaluate peer work as an exercise in assessment.

### **Classroom Discussion**

The SSMM classroom discussion revealed that all students enjoyed the experience of creating and publishing content. Students were positively surprised how simple the mechanics of creating a podcast were and majority of students reported the experience of working with another course as somewhat novel. The SSMM preservice teachers reflected that they believed that classroom students would be excited to use and create podcasts. Majority of preservice teachers recognized that using iPods and podcasts could be an effective tool for differentiated instruction. Further, many saw podcasts as a vehicle for their future students seeing content as more relevant given the richness and variety of media.

Integrating iPods and podcasts into lesson plans were identified as an additional tool for teaching social studies. For the preservice teachers, critical reflection was not perceived as part of the project at the onset, but became integral during the planning and preparation of the podcasts. Finally, preservice teachers experienced a sense of a learning community in working across the disciplines, some even receiving recognition as the authors of particular podcasts. Working together, both in their individual courses and outside the normal boundary spurred enthusiasm. The preservice teachers suggested finding additional time to complete podcasts.

## **DISCUSSION**

### **Computer Self-Efficacy, Assessment, and Class Discussions**

Overall, findings from this study indicated that students felt confident using the computers. About 54% of the preservice teachers expressed quite a lot of confidence and high confidence in many areas, but specifically un-

derstanding words and terms associated with hardware and software were notable with TT preservice teachers scoring slightly higher than the SSMM preservice teachers. There were specific instances where more questions regarding use and assistance arose that indicated existing gaps in several preservice students' learning. Unexpected outcomes of this study included the TT students gaining exposure to Social Studies content. Over 60% of SSMM students owned an iPod and felt comfortable using this device.

While researchers expected the students to be more technologically savvy, this was not the case in some instances. As indicated in this study and the ECAR report (Carousa & Salaway, 2007), instructors overestimate student comfort with technology and resources. There exists barriers to learning and as cited in the ECAR report, overestimating student technology comfort was a particular barrier. Additionally, the literature review indicated that although issues with planning and technology awareness are common, more often than, preservice teachers moved the technology responsibility to the teacher educators rather than accepting responsibility for not being technologically aware themselves.

For teacher educators, evidence from this study is of importance when planning and structuring technology integration. The teacher educators wanted the focus of this task to be on teaching and for preservice teachers to develop a sense of decision-making about integrating mobile technology tools into their future classroom instruction.

## RECOMMENDATIONS

The teacher educators learned multiple lessons from this study. Some of the recommendations for future study include: (a) designing a new pre-test to include a specific instructional focus on podcasting; (b) designing a post-test to address instructional issues of the podcasts created; (c) identifying and providing podcasts for participating students early in the semester; (d) taking class time to complete pre- and post-tests; (e) identifying particular trends emerging from a similar study; (f) assigning podcasts blindly to technology preservice students; (g) formalizing the learning communities between the SSMM methods class and the TT class; (h) organizing a college podcast showcase initiating outreach efforts within the local communities, and (i) identifying funding sources to secure more iPods.

It is also recommended that good assessment techniques be in place to support learning activities. For instance, grades should be associated with peer evaluation activities in that students can analyze other students' podcasts. This will promote critical thinking skill development and encourage

collaborative learning. Another approach would be incorporating blogging on podcasts and having students listen to different podcasts and provide feedback on the blogs.

Providing opportunities for a seamless integration of mobile technologies into instruction requires schools to ensure that technology implementation and vision supports the overall educational goals for their students. As a result, schools have an important duty to develop clear set of goals, expectations, and criteria for student learning based on national and state educational technology standards, a profile of the student population, and community concerns. Additionally, schools must determine the types of technology tools that will support their goals. In other words, the learning goals should drive technology implementation and use in schools. Technology is not an end in itself. Further, school leaders should assure teachers that the goal of technology is to improve teaching and learning, not to intimidate or replace teachers.

In summary, there is need for commitment on the part of educators and teachers to transform traditional pedagogies to benefit their students. Educational leaders must support teachers who are innovative in the use of technology so that they could help their peers to do so. Although infrastructure is important, leadership is critical in establishing technology as part of the school culture (Becker, 2000). Additionally, teachers are willing to spend a reasonable amount of time, for instance, learning effective strategies to use and integrate technology into their courses, when they realize the value of technology to enhance student learning (Kent & McNergney, 1999).

## CONCLUSION

The iPod may not only be a flexible tool for teaching, learning, and self reflection, but also given its ubiquitous nature, it is timely to have a meaningful exploration of the array of preservice teacher program related experiences it may augment or enhance. Use of iPods will increase student access to existing resources for teaching and other course related materials. Additionally, it will provide an opportunity for preservice teachers to construct their own instructional materials using media related technologies for integration into their teaching. Consequently, new technologies require teacher educators to rethink the pedagogical framework and its influence on preservice teachers as well as their future students.

Technology integration is a complex phenomenon that involves understanding teachers' motivations, perceptions, and beliefs about learning and

technology (Woodbridge, 2004). To experience successful integration of technology into instruction, educators must have a strong conviction that the use of technology is more efficient and effective than the use of other tools available to them in teaching and learning (Simonson & Thompson, 1997). While factors such as technology hardware and software, technical support, technology training, and time are key to integrating technology in the classroom, it is usually the factors that are personal and deeply ingrained, such as teachers' beliefs about the instruction process (Ertmer, 1999) that can play a more influential role in the way teachers integrate technology into instruction.

Educational reform efforts should focus on establishing a model that teachers can use to guide them through the necessary changes they will need to make to be successful in integrating new technology into their classroom (Johnson & Liu, 2000). As a result, it is important for education leaders to provide leadership with a model of technology integration that can produce feasible results. School leaders should also strive to support teachers to model projects that offer opportunities that link learning theories to real-life situations. Providing teachers with easy to work templates could help them to better model what is expected of their students. This could help to increase teacher's understanding and use of available technology.

Promoting technology for technology sake is a recipe for failure. Technology integration constitutes a major change in people's lives. Schools should, therefore, first assess the technological needs of their teachers in order to provide relevant workshops that can help them successfully integrate technology into their classroom instruction. Additionally, teachers need to be self-motivated, interested and willing to integrate technology in their courses. While mobile technology opens vast opportunities to support instruction, the teacher's role remains central. To achieve the full benefits of technology requires prudent use of these devices and sense making that only a skilled teacher can provide.

Teachers must also develop a pedagogical model that potentially creates stronger link between theory and practice (Kelly, 2003). This recognition will help teachers to prepare themselves for their role of shaping the intellectual depth of their community of learners. Technology needs to be a pervasive part of how teachers teach. As teachers get knowledgeable and more comfortable in the use of innovative classroom technologies, it is hoped that their instructional practices will also improve, change or be transformed, and that the integration of technology into instruction will become an integral part of all their school curricula.

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