

Pedagogical Applications and Social Effects of Mobile Technology Integration

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Chapter 14

The Changing Roles of Faculty and Students when Mobile Devices Enter the Higher Education Classroom

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ABSTRACT

Mobile devices pose a challenge for most faculty members in higher education as they view the device as disruptive and in competition with the work to be completed in the classroom. The goal of this chapter is to examine the implementation of HTC tablet devices and the changing roles of the faculty instructor and learners when using this device in an undergraduate business management course in a business college and a graduate course in early childhood in a college of education in a large Midwestern university. The chapter describes the classroom setting, instructor and student perspectives of the implementation, and the use of the tablet both in class and out of class as well as the barriers associated with tablet use when embedded in a higher education course.

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INTRODUCTION

Mobile learning seems like such an easy term to understand and logically it seems that mobile access to content should enhance learning. What educator does not want 24/7 access to content for learners? After all, isn't this the age of the digital learner—the independent learner that has technology at his/her fingertips?

While we often speak of today's learner as a digital native, the faculty member in higher education is most often referred to as a digital immigrant (Prensky, 2001). The role of the faculty member in the classroom as *teacher* is expected but the roles of 'IT specialist' and 'content developer' for a mobile learning is a new wrinkle in the duties of a faculty member in higher education. When mobile devices enter the higher education classroom a unique change in how the faculty and students approach learning is required. Can the learner become the teacher?

The goal of this chapter is to examine the changing role of faculty instructors and learners when a mobile device (HTC tablets) is introduced into an undergraduate business management course in a college of business and a graduate course in early childhood in a college of education to provide opportunities for mobile learning. The chapter describes the classroom setting, instructor, and student perspectives of the implementation and the use of the tablet during in class and out of class activities. Barriers associated with tablet use are provided along with student and faculty perspectives on overcoming these barriers.

BACKGROUND

The use of e-readers has in a sense lead the way in the use of mobile devices (McCarthy, 2011). Duke University recently replaced standard textbooks and course materials with online open source multimedia content, recorded lectures, ePub texts, captured whiteboard instruction and PDF files as

a means of providing access to course content that can be easily distributed across the Web under the creative commons designation. Students working during course sessions are able to collaborate as teams in solving problems while accessing course resources as needed through their laptops, tablets, and smartphones. Faculty facilitate the work of the course by moving from group to group answering questions, noting progress and guiding the work of the teams. In this sense the faculty member is better able to maximize class time for problem-solving, synthesis and evaluation of problems and build critical thinking, communication and collaboration skills among the students (Fusch, 2010).

One question that typically appears as universities begin to examine the adoption of a technology is 'What is the availability of the technology to the largest group of students and how well will that technology serve the largest group of students.' In January 2012, the Pearson Foundation Survey on Students and Tablets "...was conducted to gauge the opinions of college students and college-bound high school seniors regarding digital device ownership and purchase intent; perceptions toward tablets; tablet usage and features of interest; and preferences between digital or print formats when reading, studying, and doing other school-related activities. The survey identified interesting trends pertaining to students' use of tablets and mobile technology, including:

- Tablet ownership among college students and college-bound high school seniors has more than tripled from a year ago. Further, a large number of students plan to purchase a tablet within the next six months.
- College students and high school seniors believe that tablets are just as valuable for educational purposes as they are for personal entertainment.
- Students agree that tablets will transform the way college students learn in the future.
- More students are reading digital books, and a majority of college students now pre-

fer to read digital books rather than print” (Pearson Foundation Survey on Students and Tablets, 2012, p. 1).

Add to this report the use of mobile devices with a multi-touch user interface (Donato, Sanna, & Lamberti, 2010) and the tablet now has the ability to provide enhanced human-machine interactions that can be exploited in a large number of applications and immersive learning scenarios (Fiorella, Sanna, & Lamberti, 2010). The potential for mobile devices to deliver information to students’ fingertips no matter where they are has many educators intrigued—as this could help students learn to take ownership of their education (STAR Report, 2011).

Mobile Learning

The use of mobile devices (cell phones, smartphones, laptops, tablets, etc.) in education is a growing area of research. Literature has focused on a variety of themes including distance education, in-class usage, and field learning (Hwang & Chang, 2011; Park, 2011; Rogers & Price, 2008). Increased access and student motivation are arguments put forth to support the use of mobile devices for learning (Hwang & Chang, 2011). Beckman (2010) found that mobile technologies are crucial for providing on-demand education; but constant and reliable Internet access is vital. Mobile tools are being heralded for their ability to teach students how to find information rather than rely on rote memorization (Devaney, 2008). Proper instructional design and learning support are essential for these tools to make a marked difference in education (Hwang & Chang, 2011; Winnips, Heutink, & Beldhuis, 2011; Brooks-Young, 2010).

In-class usage of mobile devices is varied and educators have differing views of their effectiveness as certain pedagogical approaches have shown greater gains in learning and motivation. Hwang and Chang (2011) created a formative approach

to mobile instruction which forces students to obtain a correct answer before being able to move forward in a guided mobile learning environment. Participants in this study demonstrated increased interest and learning achievements.

Winnips, Heutink, and Beldhuis (2011) demonstrated that students can communicate with an instructor during lectures by using their phones to relay questions regarding the content of the lecture. Students demonstrated an added interest as the lecture could be better tailored to suit their actual knowledge needs. Beckman (2010) states that while new technologies can certainly add to a learning experience, the focus of education should never stray from the pedagogy to the delivery method.

Constructivist Pedagogy

Constructivism is a broadly defined learning theory, which suggests that learners construct knowledge and create meaning by building on the knowledge that they already possess. It is not a pedagogical tool or set of instructions for educators (Robinson, Molenda, & Rezabek, 2008). Rather, it is simply a theory of learning with varying interpretations that can influence pedagogy. Although it is difficult to briefly and thoroughly define constructivism because of the diversity of interpretations and views, von Glasersfeld (1995) and Phillips (1995) state that constructivism and the knowledge a learner constructs is based on his or her world experiences.

The main tenets of constructivist pedagogy are interaction, collaboration, and authenticity (Huang, 2002). When used effectively, technology has been shown to promote and enhance these practices. A 2011 study by Sultan, Woods, and Koo found that younger (ages 8-13) learners were able to interact, negotiate meaning, and participate in authentic learning activities through the use of technology in a constructivist classroom. Students also report higher perceived learning. A 2010 study explains how a Chinese language learning class

took a constructivist approach to idiom instruction and the primary school students benefitted from *in situ* learning through the collaborative, interactive and authentic use of mobile phones (Wong, Chin, Tan, & Liu, 2010).

A university-based study in Malaysia found that students working with technology in a collaborative constructivist environment experienced greater motivation, creativity, and understanding (Neo & Neo, 2009). Neo and Neo (2009) also suggest that the implementation of a constructivist environment for both working with and learning to use a new technology vastly improves learning and acquisition of the needed skills to use the technology.

The Flipped Classroom

In a *flipped* classroom, teachers/instructors are constructing a new pedagogy to develop skills in critical thinking and problem solving by changing the definitions of homework and classroom practice. In a flipped classroom, students use their time at home to connect to the content being taught instead of doing homework. Classroom time is used to actively engage with other students and faculty to think critically about real-world problems and to apply the newly learned content knowledge to projects, lab experimentation, and collaborative discussion both online and face-to-face (Pape, Sheehan, & Worrell, 2012).

The flipped classroom as an instructional model reverses the common instructional approach (Tucker, 2012). Created by two chemistry teachers, Bergmann and Sams, the flipped classroom model structures the class differently. Students watch at home instructional videos or learn teacher-created instructional materials that used to be the in class lecture and complete homework as classwork with the instructors' help in class (Electronic Education Report, 2011). Rather than a method, the flipped classroom is considered more of a teaching philosophy, the core idea of which is to maximize the time that can be used actively in class.

With the minimized lecturing time, the flipped classroom model enhances teacher-student and student-student interactions in class. It frees time for the instructor to organize collaborative activities, interact with students and provides individualized instruction (Brunsell & Horejsi, 2011). Inverting the traditional *chalk and talk* with the flipped classroom increases student-faculty interaction. This increased interaction allows the instructor to monitor student performance and clear up any confusion on course content immediately (Lage, Platt, & Treglia 2000). With the minimized lecturing time, the flipped classroom model enhances teacher-student and student-student interactions in class. It frees time for the instructor to organize collaborative activities, interact with students and provide individualized instruction (Brunsell & Horejsi, 2011). In addition, studying the course materials outside of the classroom allows students to learn at their own pace and on their own schedule. It requires successful students take responsibility for their own learning (Brunsell & Horejsi, 2011).

Learning technologies play an important part in flipped classrooms by delivering the instructions outside of the classroom. Web-based instructional videos or podcasts can be watched using any devices, such as a smartphone or tablets (Tucker, 2012; Economist, 2011). The importance of the instructor's role is not been weakened as an initial observation might suggest but rather in the flipped classroom model, the role of instructor changes from a lecturer who teaches the content from the textbook to a cognitive coach who helps students practicing to achieve the goals of the class (Berrrett, 2012).

Content Access

Access to higher education content during hours in which faculty are not available continues to plague learners. While some faculty are adept at placing content in learning management systems such as Blackboard, Moodle or Web pages, this

is not a skill at which most faculty are proficient. The recent development of mobile devices, i.e. laptops, netbooks and tablets, has placed pressure on universities and thereby faculty to make content more available. The increased use of e-learning to reach non-traditional learners away from campus has further increased the pressure to establish ways in which content can be accessed 24/7 to meet the needs of working adults. Issues of size, weight and mobility of devices as well as access to the Web can no longer be used as an excuse for failure to provide content. Moreover, learners are coming to class with these mobile devices and in an instant accessing the same materials the faculty are accessing and then questioning faculty lectures, adding content to the faculty lecture and demanding the faculty member remain current in his/her content area. These mobile devices challenge the very essence of the role of the *teacher*.

Changing Faculty Roles

The increasing use of technologies in the classroom is a challenge to many higher education faculty members. Studies suggest that faculty attitudes toward technologies have a great impact on the introduction of technologies into classrooms (Hartnell-Young, 2009; Hartnell-Young & Vetere, 2008; Hartnell-Young, 2006; Rosen & Weil, 1995; Hannafin & Savenye, 1993). The faculty member's role has also changed when interacting with technologies (Hartnell-Young, 2009; Hartnell-Young & Vetere, 2008; Hartnell-Young, 2006).

Hartnell-Young (2006) has identified four roles played by the faculty when using technologies in the classroom: (1) designing the learning environment; (2) managing people and resources; (3) mediating student learning; and (4) improving practice. In her later study on the importance of teacher's role in introducing Personal Digital Assistant (PDA) to a sixth year classroom, Hartnell-Young found that the teacher feels she is responsible for all of these roles (Hartnell-Young, 2009). During the one-year study, the teacher's clarity and

confidence about his/her role in the use of technology had a positive effect on implanting PDAs into the curriculum and in meeting students' needs.

At the same time, new technologies such as mobile technologies enable students to bring their voice into the curriculum. In a 2008 study by Hartnell-Young and Vetere, students were provided mobile phones with cameras and asked to capture their lives. The multimedia created by the students was used to make contributions to the curriculum. The teacher's role was important in making these contributions work. The teacher had to balance the different cultures between students' use of technology and teachers' use of technology as well as leading technological changes in the school culture.

In addition, the faculty member plays a role in providing technical support to the student when the technology fails. Faculty should be prepared to go beyond teaching pure content knowledge and be ready to also teach students how to use learning technologies in their classrooms. Students expect faculty support whether they are digital natives or not (Buzzard, Crittenden, Crittenden, & McCarty, 2011).

THE PHENOMENOLOGICAL STUDY

Tablet Use in Two Higher Education Classrooms

The perspectives of two faculty members participating in a phenomenological study in which the HTC tablet was provided for use in an undergraduate and graduate course in a large Midwestern university in the United States are presented. The study examined how the faculty members viewed the implementation from the perspective of their changing role in the development of content, use of the tablets in the classroom or the delivery of content when the course was augmented by the use of a tablet device. Does the use of the tablet place more responsibilities on the learner to access,

read, and collaborate with fellow learners in the courses and allow the faculty member more time for in-depth discussion of content when holding class? Do learners now play the role of *teacher* through their collaboration with fellow students? Do the faculty members believe that the use of the tablet has enhanced learning in such a way that faculty can now guide learning as opposed to directing learning?

The research also sought to examine the use of the HTC tablet by the faculty members and student participants in each class and to identify the positive and negative characteristics of the use of the tablet both educationally and personally in their daily activities.

Background of the Study

Examining the use of the tablet by faculty, their perspectives, and perspectives of students using the tablets through the lens of phenomenology allowed for an examination of the *real life happenings* within the lived experiences of the faculty and students using the mobile technologies. The phenomenological framework included both quantitative and qualitative data collection allowing for different experiences in and reflections on the use of tablets for teaching and learning as well as discussions of personal transformation through the use of mobile technologies (Campbell, 2012). Data collection took the following format:

- HTC Pre-Survey (all participants)
- Technology Efficacy Survey (all participants)
- Course Blogs (all participants)
- Focus Group Interviews (all participants invited – 85% participated)
- Individual Interviews (all participants invited – total of 11 undergraduates and 6 graduates participated)

The study took place over a nine-week period in which all participants had access to the HTC

tablet, wireless, and 3G/4G networks, as well as pre-installed software. Originally, an exit survey was to be included as part of the study; however, the data from the blogs, interviews and focus groups provided the same and consistent information and the data from the final survey did not provide any new information to the researchers.

The settings for the study included two higher education courses: 1) an undergraduate business education course focusing on management which met face-to-face and 2) a graduate course in early childhood education focusing on early childhood learning theory which met online. Each faculty member was new to the use of the HTC tablet device although the graduate faculty member had recently purchased an iPad. The undergraduate faculty was very interested in the use of the tablet device to *flip* his classroom pedagogically and was very excited about the possibilities of tablets in helping to reach his goal. The graduate faculty member was interested in the communication aspects of the tablet since many of his students lived a great distance from the university campus. He saw the device as a means to communicate and connect the class members without having them drive to campus except on select occasions. He hoped that the Adobe Connect and Blackboard Mobile software applications (called apps) would provide the needed connectivity to engage in discussions of theory and practice in the early childhood classroom with his graduate students.

The sample from the Midwestern University included 38 undergraduates plus one student that declined stating he would rather use his iPad and 13 graduate students that chose to participate in the study and agreed to the informed consent process. Those students choosing not to participate in the study also received HTC tablets to use in the course but data that might have been entered into any surveys or blogs was not included in the data outcomes. Each tablet contained a suite of software selected by the faculty for use in their course. The university technology administration (OIT) placed software on the tablet called SOTI

which allowed the tablet to be located if lost or stolen. The SOTI software also tracked usage of all software and how long software was used as well as information concerning the use of the software on a 3G/4G network or wireless networks. The SOTI software had the unique ability to track whether the device was being used on 3G/4G or wireless networks, thus, it had the capability to tell the university administration where the network was not responding appropriately when a student complained of the inability to access the Internet through the tablet device. Of those students electing not to participate, the use of the SOTI software was the main reason for not participating as students believed this to be an invasion of their privacy.

Data from the *HTC Pre-Survey* indicates gender within the two groups (undergraduates and graduates) was 53% male and 47% female. In the sample, 96% of the students owned a laptop (57% PC; 32% Mac; 11% Both). All participants owned a cell phone with 69% versus 31% having a data plan. Concerning tablet ownership, 77% did not own a tablet with 23% owning a tablet. All but one of the tablets owned was an iPad. The other tablet was a Samsung Galaxy 1.0. Eighty-eight percent of the students used their laptop or desktop to access the Web with 8% using a cell phone and 2% using a tablet (2% used some other device not noted in the survey).

Facebook was a common application identified in the interviews and focus groups as used by the students. The *HTC Pre-Survey* noted that 88% of the students had a Facebook account while 13% do not use Facebook (of those not using a Facebook account, 4 out of 6 were graduate students). Only 27% of the students use Twitter and 77% of the students seldom receive a 'tweet' and 88% had not sent a 'tweet.'

In examining the *Technology Self-Efficacy Survey*, a Likert scale of 1 to 7 was provided with 4 identified as the midpoint. A rating of '1' indicated low confidence in the ability to use a certain technology or technology skill, while a '7'

indicated high confidence in the ability to use a certain technology or technology skill.

At the undergraduate level, the only areas of concern surrounded the use of technology centered on using Google Scholar and Learning Management in this case, Blackboard 9.0 (*Using Google Scholar to locate a journal article*, which had a rating of 3 [20% of the students] and *Printing a Web site*, which had a rating of 3 [24% of the students]). The other areas in which undergraduates felt less confident in using technology were:

- Posting a new message to an asynchronous conference system (i.e. Blackboard, Moodle) (16.7%)
- Reading a message posted on an asynchronous conference system (i.e. Blackboard, Moodle) (16.7%)
- Replying to a message posted on an asynchronous conference system so that all members can see my response (17.2%)

Using the same examination, graduate student responses in the *Technology Self-Efficacy Survey* with the same rating of '1' (low confidence) to '7' (high confidence), it was noted that the graduate students had less variance in their ratings. Most ratings were either in the 6 or 7 range or had a rating of 4. The areas of most concern to graduates centered around *Google Scholar* (23.1% of students; rating of 4) and *Google Books* (23.1% of students; rating of 4) *for locating materials*, *Using Google Documents to share and collaborate with others* (23.1% of students; rating of 4), and *Uploading a file to an asynchronous conference system from my computer* (23.1%; rating of 4). *Using Skype to conference call other participants* had 21.3% of the students rating it at a 2.

Overall, both the graduates and undergraduates were very confident in their use of technology with most of the concerns focused on the use of conferencing software for asynchronous use or the Google Suite. This concern may stem from the fact that the university provides the Microsoft Of-

fice Suite to all enrolled students and students are very proficient in its use on university computers and laptops. The HTC tablet is able to use both the Google and Microsoft Office Suite but the student user of the tablet must download an app to implement both the Google and Microsoft Suites.

The Undergraduate Faculty Perspective

The undergraduate faculty instructor participating in the use of HTC tablets in the management class was very excited about the flipped classroom model as a change pedagogically in the delivery of his course. The flipped classroom represented a more constructivist pedagogy in which students build upon previous knowledge and take ownership for the construction of new knowledge. Care was taken by the instructor to design video content of the lectures in Adobe Presenter for students to view before attending class and use the content of the lecture in the completion of projects that were assigned for in-class collaborative teamwork.

The faculty instructor found that the flipped classroom model was successful but that some areas of the delivery of content needed to be improved or clarified such that the student realized that the lecture was not going to occur in class. The flipped classroom required that the student take ownership of learning the content before coming to class. Analysis, application, and evaluation of the content occurred during the class sessions. For the typical business student, this was a new instructional method as most attend lectures and leave to do their homework. The beginning of the course required more reminders to view the video lectures, posted content and Web page links on the Blackboard site (the Learning Management System used at this university) and to communicate through the use of the tablet with the team members for continuous connectivity to the team. Given the perspective of students that the course ends when the instructor finishes delivering content and the time in class is met, this flipped model was a

paradigm shift for the student as to when learning occurred. Most (92%) of the undergraduates stated that the constant connection to the course materials, the lectures and their classmates encouraged them to keep up with the work and to re-visit the content through the use of the tablet.

Through the use of the tablet, the content became more fluid; having content available 24/7 suggested that learning could also be 24/7 without the worry of lack of access to the faculty or the content. Over the course of approximately three weeks, the students realized that learning continued after the weekly meetings had ended and that the tablet provided the technological support to reach out and connect to the content at any time. Student athletes traveling during the course were able to maintain connection to the course content and the collaborative project team members through the wireless and 3G/4G connectivity of the tablet. The students came to understand that learning could occur anywhere, any time and without a concern for location as the tablet was in a sense the *location* for the course.

The faculty instructor found that the students were using the tablet designed techniques from his course to negotiate other business courses. The tablet software app called *Evernote* allowed the students to record the collaborative teamwork sessions. When there was a disagreement of responsibilities, the recordings provided the needed information on who was responsible for which assignment in the team. The recording acted as a record of the level of participation of each team member. When a member of the team had to miss a session, the recording could be shared to help the student catch up on what had occurred during the class session or team meeting. The faculty instructor noted that students shared the use of a second piece of software called *TeamViewer* for use in team settings which was not an app that the instructor was familiar with. The app allowed PowerPoint presentations to be streamed across multiple tablet devices such that each member could annotate with all members viewing the anno-

tations. Students, especially international students who had difficulties in language, identified this software as especially helpful in those class settings in which the instructor relied on PowerPoint for lectures. While the reliance on PowerPoint in the management course was limited, the students were quick to share this software with all members of the course for use in other business courses in the business college. One business student noted that the Evernote and TeamViewer had been the mainstay of student survival for her in all of her business courses and that the use of the tablet helped her to earn a much higher grade than if she had been required to handwrite all the notes. The recording of the lectures allowed her to revisit content for clarification and to gain a better understanding of how the content connected to the work of the course. The dictionary and translation apps found on the tablets were widely used for translations by international students in the course and all of the international students identified this as a major component to their use of the tablet.

From the perspective of the undergraduate faculty member, the tablets were an asset to the course both pedagogically and as a tool. The faculty member noted that he felt his own understanding of how to *flip* a course and use the technology to provide content was improved but that there was a certain amount of trepidation as he began the course and learned to use the tablet. The instructor suggested that the students were very adept at identifying software apps and *reverse mentoring* (i.e., sharing an app with the instructor or showing the instructor how the app worked) (Kwoh, 2011). The students have more time to search and *play* on the device than most faculty members and the willingness of the students to share ideas for the use of the tablet and apps was very rewarding to the instructor. The undergraduate instructor also discovered that there was more time to walk around the classroom and work individually with the project teams than in the past. Students were more engaged in the project and used the tablet to quickly connect to the Internet to search for content and materials needed to complete the project. The

tablet created a partnership for learning between the instructor, students, and content.

The instructor did suggest that more time and more hands-on use of the tablet before deciding to use them in the course would have made some exercises go more smoothly. The instructor noted that he had planned to use the tablet to assess whether the materials had been read outside of class with a short quiz. However, the campus wireless did not have the capacity to support 38 plus devices at one time when the quiz was given which required students to try several times before reaching the online quiz. This frustrated students and many would stop using the tablet and move to their smartphone or personal laptops to complete the quiz. In the end, the instructor determined that the quiz could be taken any time before the course meeting so that the tablet could be used for the quiz, which worked very well. Students said that the ability to take quiz outside the classroom gave them more flexibility in learning because they could decide where and when to study for the quiz and where and when to take the quiz based on their on schedule.

A blog topic was presented to students each week for discussion of tablet use in and out of the course. Students suggested that the tablet was not easy to type on and that an external keyboard would help to solve the typing issues noted by many of the students. Students believed that the tablet had very useful capabilities for working with teams. The tablet allowed the teams to move around campus and still remain connected through a single login to materials. Several students noted that the tablet needed more external devices to support it such as a USB drive—but this comment was always followed with a comment such as, “well, I can use Dropbox so maybe I really do not need a USB—I guess.” Students were very frank and forthcoming on the blogs concerning the use of the tablet for their courses, personal life and staying connected to both friends on campus and off campus. The use of Skype to call family members for free saved money on long distance calls.

The undergraduate instructor had a very positive attitude toward technical problems with the tablet. The undergraduate instructor explained that he was as unfamiliar if not more so with the tablet than the students as he had very limited time before the course started to explore the device. The common way in which he handled technical problems was to send the student to the university technology help desk or to announce the problem in class and see if others were having or had developed and solved the same problem in the past with their tablet. This allowed all students to hear of possible problems and to identify people in the class that might be able to help with a solution. This sharing of technical problems became a common occurrence except that the sharing of technical problems evolved into the sharing of apps for conquering coursework and new ideas for tablet use by students.

The Graduate Faculty Perspective

The graduate faculty experience was somewhat different from the undergraduate faculty experience. The expected use of the tablet for communication among distance learners did not materialize as expected. The Blackboard Mobile app and the Adobe Connect app did not work as successfully on the tablet as anticipated. The needed bandwidth and strength of the mobile app to stream video was found to be very limited in the area of video conferencing. Sound delivery during video conferencing was limited or at times nonexistent. While the HTC tablet streamed YouTube and Netflix videos quite well, the Adobe Connect app was not robust enough for the tablet. The off campus students moved to Skype or Adobe Connect on a laptop to meet one-on-one or to Google Hangouts for a larger group.

Most abandoned the HTC tablet for a laptop to connect for video or audio conferencing. This problem with the ability of the Adobe Connect app caused the class to be split into a group living close enough to campus to come to a classroom

for face-to-face discussion and a second group that was at a distance using Skype or Adobe Connect to connect with the face-to-face classroom through a laptop connection. Moving to a blended model, the campus class projected the video conference of the distance students and discussions took place between the face-to-face group with the distant video conferencing group. The graduate faculty instructor noted the blended learning model was difficult in the beginning of its implementation. At times, the graduate faculty member found that the group on the video conference was having one conversation and the face-to-face group was having a second conversation—sometimes unrelated!

Organizational strategies for a blended model were adopted and taught to the graduate students to improve the discussions and keep everyone on topic. The graduate instructor noted that Google Hangouts provided a better discussion location for a larger group but he had hoped the tablet would be the connection device for these discussions. Valuable time was lost in the attempt to identify a communication tool once the tablet was unable to maintain a connection through the Adobe Connect app. The implementation of the blended pedagogical model supported the remainder of the course at the desired level of interaction, engagement, and connectivity that had been expected from the implementation of the tablet and using the Adobe Connect app.

The tablet was less embedded in the graduate course than the undergraduate course and therefore was seen more as an add-on to the course and not a requirement for meeting the assignments or content requirements of the course. The graduate instructor made content available on Blackboard in PDF or other formats that could be read on the HTC tablet for the graduate students. All but two of the graduate students noted that they downloaded the content to their laptops or an iPad if owned but not to their HTC tablet. The graduate faculty member noted that the graduate students would go to the Internet and download PDF files with the tablet research app for use in their completing

research for the course but did not download the instructor identified content to their tablet for use.

The Undergraduate and Graduate Student Perspectives

Undergraduates in this setting were between the ages of 19 and 21 years of age behaved very much within the definition of Prensky's digital native. Most undergraduates owned more than one mobile device, i.e., a cell phone/smartphone, a tablet, and/or a laptop or desktop. They found the HTC tablet to be an outstanding communication device, which allowed them to stay connected to friends and family. The undergraduates downloaded more apps to their HTC tablet devices and were quick to identify which apps were useful and which were not useful for college work. The undergraduates were less concerned with the weaknesses of the tablet and more focused on how it could be used to save time and improve productivity. Given their extensive use of Facebook, which was identified in the *Technology Efficacy Survey*, the use of the tablet increased their access to social networks, games and movies. YouTube and Netflix were found to be easily downloaded to the tablet when on the go, in the car using the 3/4G network or while waiting between classes on campus using the wireless access points. Forty percent of the undergraduates noted that they were able to share the screen with friends even with the small size.

Information about the devices was readily shared with others in their project team or with friends. Undergraduates with cell phones lacking data plans were very pleased with the HTC tablet and perceived that the tablet helped to increase their productivity in courses and in the end helped to improve their grades in the courses in which they used the tablet to locate information, contact classmates for help with projects, connect with the instructor through email, or share project work with team members. The ability to connect easily through wireless connections made the device indispensable to those students without data plans.

Several noted that the use of the Dropbox app for sharing content allowed them to go home to visit family and still stay connected, share assignments and view the course content through the use of the mobile apps found on the tablet. This flexibility of access was highly motivating and allowed for more time on task as content and team projects were always available.

Undergraduates did not feel intimidated by the tablet technology or lack of training. While several noted that more time to learn to use the tablet before implementing it into a course would be helpful, most insisted that when they did not know how to solve a problem, they asked their friends. The adage that *two heads are better than one* in solving a problem seemed to be the most common solution to technical problems. When asked if they felt like a teacher in helping others learn to use an app or solve a tablet problem, those questioned indicated that when a classmate has a problem with the tablet, it was like teaching but was really more about *helping* someone not so much *teaching*. This suggests that the undergraduates may still see *teaching* as a more formal role rather than an expansive role in which *helping* and *mentoring* might be seen as *teaching*.

The graduate students observed that the tablet has to be more connected to assignments if the tablet is to be a viable tool in a course. The graduate students did not see the tablet as essential to the work of the course and noted that it was the faculty member's responsibility to make sure the tablet was used in the coursework. This was a very different perspective of the faculty member's responsibility to make sure the graduate students used the device when compared to the perspective of the undergraduate students. The undergraduate students suggested that the tablet be more embedded in the content of the course but they noted that the student was responsible for whether he/she chose to use the tablet over other devices used to complete an assignment. Undergraduates tended to take more ownership of the use of the device and the sharing of the use of the device

to complete assignments than did the graduate students. It could be that the flipped classroom model in which the undergraduates were exposed to more collaborative work both through the use of the tablet and the projects assigned increased their understanding of the importance of collaboration with others.

Graduate students were quick to abandon the HTC tablet for their laptop or iPad when there were glitches in the connectivity to the Internet. This may be in part the result of differences in the lifestyle of graduates versus undergraduates. The graduates were all employed in full-time positions in the field of education typically as PK-12 teachers or community college teachers at the time of this study. The amount of time graduate students have to learn a new technology is limited as their time is split between family, going to graduate school and a full-time job.

Seven of the thirteen graduate students had already invested in iPads and were not as accepting of the HTC, which is an Android device. Those having iPads found the HTC tablet camera to be lacking and the location of apps for education to be very challenging. The PK-12 schools in which some of the graduate students worked were already using iPads as part of a 1-to-1 computing solution and therefore these graduates were more versed in the use of the iPad and did not want to invest time in another tablet technology.

One community college math instructor who was a graduate student in the course was very pleased with the HTC tablet's ability to create mathematical formulas and the large number of math apps found in the Market (the Android app store). This graduate student noted that he would be very happy to have this tablet to use with his own students, as he would be able to push content to the students and then use software such as TeamViewer to watch the student solve a math problem. He believed this use of the tablet would allow him to work with students after class when they encountered misunderstandings at home with math homework problems. He noted that students

often have no problem solving the math problem during class time – once the student goes home and works often the frustration begins with math homework.

FUTURE RESEARCH DIRECTIONS

Technology has a ubiquitous presence in many educational institutions around the world. Many higher education institutions are moving to a 1-to-1 computing environment in which students are required to have mobile devices such as smartphones, tablets, and laptops. This Bring Your Own Device (BYOD) environment is causing a major shift in infrastructure and faculty roles in the university classroom. When a student is part of the BYOD environment, pedagogical complexity for the faculty member is increased as the student can during the faculty lecture contact an expert, fact-check the faculty materials, reach out and touch other faculty members via email and tweet or Facebook about the level of the lecture presented in the class by the professor. The learner becomes a “*free agent learner*” (Speak Up, 2010, p. 1) in much the same way sports figures become free agents seeking out their own contract for engaging in a sport with a certain team. These *free agent learners* “...seek out online learning resources on their own, follow a passion for a topic and fully explore it on the Web, self-remediate when necessary, and are tapping into the power of educational games inside and outside of school” (Speak Up, 2010, 2010, p. 1).

The use of mobile technologies including both tablets and smartphones has reached the tipping point globally (Franklin, 2011). The widespread use of cell phones and smart phones internationally will further promote the use of tablet devices because they are portable, lightweight and quick to connect to the Internet over the same wireless and Bluetooth network as most computers. The larger screen found on a tablet and the fact that many of the tablets will in the near future also

have a cell phone as part of the operating system only makes the device more desirable with the younger and older technology user. In reality, today's technology user has the expectation of being always connected. The device is always on and always on the user in the same way one carries a purse or wallet or car keys (Franklin, 2011).

Issues for the Mobile Institution

A chapter on the implications of mobile devices and changing roles would not be complete without providing some of the issues and recommendations for those institutions seeking to engage students in opportunities for mobile learning on mobile devices such as tablets and smartphones. The need for a robust wireless network on campus and a robust 3/4G network off campus is vital to the success of students using mobile devices for access to content found online or within a learning management system such as Moodle or Blackboard. The network should allow for a single login for the campus as a student moves from building to building on the campus so there is no need to re-login to maintain connection with content or team members working on projects. This login should be transparent across all mobile devices especially given this generation often carries more than one mobile device. When networks fail, both the faculty instructor and technology department on campus must have a back-up plan to ensure that learning continues.

The high cost of a data plan for both a smartphone and tablet makes the use of both devices problematic. Most students identified that the tablet would have to be used only on a wireless network while maintaining the data plan on their smartphone. This means that use of the tablet becomes restricted to only those areas with open wireless access or on campus with a login. If an institution seeks to use tablet devices that can

access networks away from campus, then data delivery will be a problem for those students unable to afford the cost of multiple data plans. The institution should seek out the data carriers and negotiate a lower cost for college students who already have a data plan with their smartphone.

Bundling the tablet with e-books not only makes the tablet more useful but also defrays the cost of textbooks and lightens the load in backpacks. In many instances, students cannot afford textbooks and basically borrow books from friends off and on during the semester; therefore, never completely having time to read the text. E-books are cheaper and can be maintained on the tablet long-term allowing the student to return to the text as needed over time. Faculty must be proactive in their support and pressure on textbook companies to publish their text in e-book format.

Faculty must be provided with professional development to learn how to embed the tablet device within their course content. Identification of a standard set of apps to be placed on the tablet by the institution along with apps recommended for a particular course should be identified. This review takes time as not only does the app need to be appropriate for use in the course but also the faculty member needs to feel comfortable using the app and modeling its use in the course.

Faculty frequently discuss the best ways to communicate with students, yet ignore and bypass the use of texting, a communication technique that is a part of most college students' daily lives. Text messaging and email can communicate feedback on student performance and quality of work in a timely manner. Not only does the tablet allow the faculty member to provide content but it also allows the student constant contact with the faculty member. Boundaries for connecting and providing assistance to the student after office hours and course time must be developed to meet the needs of both parties.

Issues for Supporting the Undergraduate Student

The undergraduate in this study was very flexible in the use of the tablet device as an educational tool. Eighty-three percent stated that the tablet was useful for learning either in the blog, focus group, or interview setting. The need for the tablet to be embedded within the content was apparent and most saw the device as useful due to its mobility and portability, noting that the device will fit in pockets, purses and backpacks with ease and weighed very little. Most used their tablet to surf the Internet and conduct research for projects.

While we may think of the 19 to 21 year old as a digital native, it was the undergraduates who most noted the need for professional development when a tablet is purchased for use in their courses. The specific needs for hands-on professional development included:

- Program specific training that covers the educational programs installed.
- General use of the device dealing with apps, downloading of items, removal of items, and troubleshooting of the device.
- Demonstrations on how the Android windows work and how items saved on the tablet can be quickly located for later use.
- Care of the device and stock add-ons (keyboards, stylus).
- File sharing and saving files on the SD card for examination is needed as files tend to get lost on the device if one is not familiar with the file saving hierarchy of the tablet.

Many found it difficult to become familiar with the Android operating system and suggested that the operating system needed more explanation than the OS operating system found on the iPad. The operating system discussion prompted a discussion on apps and their use in learning. The undergraduates noted the need to download a similar set of apps on all tablet devices used on

campus so that the smartphone, laptop, and tablet used the same apps making it easier to move from device to device. Many indicated that having the stylus for highlighting information when reading e-books and other electronic materials aided not only in the retention of material but made the reading go much quicker on the tablet. The undergraduates found that they could transfer the notes and add more notes when using their laptops that had similar apps or that notes taken on the laptop would transfer to the tablet and smartphone under the same app.

In the realm of software and apps, most undergraduates remarked on the compatibility of the HTC tablet with the Microsoft Office Suite found on their laptops an added benefit of the tablet when working on coursework. The TeamViewer app provided screen capture, note taking and for presentations to be annotated with the stylus and streamed to project team members one of the most positive aspects of the tablet. Students even noted reading newspapers, checking their bank accounts and for searching streaming video from courses an added benefit of the tablet. Ninety percent indicated that a tablet was a suitable alternative to a laptop for communication, classroom interaction, research, and Web searching.

Issues for Supporting the Graduate Student

Portability was the major benefit of the tablet for graduate students. Most felt that the tablet and the use of e-books was the future of technology. However, that said, most indicated that the tablet still needed upgrades and design changes if it is to replace their laptop. While many identified the small screen as a problem for ‘older eyes,’ most felt the smaller screen size made the device more portable. The limited battery life was the most identified issue with the graduate students. Like the undergraduate students, the graduate students would move to their smartphone or laptop when the tablet either could not connect to the network

or the student had difficulty manipulating the tablet. The graduate students suggested that the use of the tablet, smartphone and laptop kept them completely connected to their coursework and project team and the use of Dropbox across all devices was a strong method for connectivity and collaboration.

The camera, while noted as not as clear as the iPad camera, was found to be beneficial for use in the classrooms in which many of the graduate students taught. One fourth grade teacher gave the tablet to a team of fourth grade students to help them complete a photography lesson on symmetry, close-up and landscape photography. The fourth graders produced a complete a digital story using digital photos taken with the tablet to demonstrate to others their understanding of the photography concepts. The fourth grade teacher was able to use the video to identify misconceptions and clarify concepts with the students immediately. As many of the graduate students were teachers in PK-12, the need for apps that were educationally appropriate and less expensive was a discussion among the graduates. The need for large numbers of apps to place on a class set of tablets could be expensive and ways to reduce the cost for PK-12 was a concern. The graduate students also mentioned that many schools had laptops and that the tablet would increase software costs as schools tried to make the software/apps consistent across devices. The graduate students, like the undergraduates, positively noted the ability to use Microsoft Office products on the tablet as opposed to the incompatibility issues often found with these products on the iPad.

CONCLUSION

Faculty's use of technology is often guided by the fundamental beliefs of the teacher's role in teaching and learning (Ertmer, Ross, & Gopalakrishnan, 2000). While many faculty have yet to fully embrace the use of technology in higher

education, the pedagogical field is changing and embracing mobile technologies through the use of the flipped classroom and blended learning models. The changing role of faculty instructors and students was readily apparent when a mobile device was inserted into the learning environment. This demonstration of role changes provides future mobile technology users with the evidence that these devices do change how learning occurs.

The undergraduate faculty instructor in this study found the flipped classroom a promising model for his use of the tablets and continues to improve his course and the implementation of mobile learning devices. Undergraduate students at the end of the study were reluctant to return the tablet and some of the undergraduates purchased the tablet to continue to have the device available for learning and connectivity to future online content and classmates. While the graduate faculty instructor and graduate students saw less need for the tablet device due to their access to laptops, the faculty instructor stated that the availability of apps was more the issue than the tablet, citing the need for more robust apps for the tablet when video conferencing. The graduate faculty observed that the blended model that was used to connect face-to-face with some members of the class and online through video conferencing was a very positive experience. He suggested that his own thinking about how blended learning occurs had to change, as the graduate students were more adept at the use of the technology than he was in connecting online.

While undergraduate students did not see themselves as teachers, the examples shared as *helping or mentoring* other students could easily be identified as a person acting as a teacher. The undergraduate faculty instructor very clearly identified the activity as *teaching* when he discussed the actions of the undergraduates in helping him learn to use the tablet and the many apps located by students in his course. The level of collaboration was enhanced by the use of the tablet among the project members and others within the class.

In both respects, teaching and collaboration could easily be noted as roles that were the outcome of having tablets in the classroom.

Overall, the continuing barriers to the use of tablet devices are the high cost of data plans for use with the devices, the need for a robust wireless network on campus and more robust apps for classroom implementation. These are all barriers that can be overcome with discussion between business and universities and should not be allowed to stand in the way of the use of tablets and other mobile devices as a means of accessing learning 24/7. These are the tools of today and the future. Our digital natives will own many such tools over their lifetime and the need for students to learn how to learn 24/7 will continue to increase, thus placing pressure on the higher education system to embrace these new formats for learning.

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KEY TERMS AND DEFINITIONS

App: Software that is typically downloaded to a mobile device for use by the owner of the mobile device. The app can be software used for productivity, connectivity, collaboration, and personal use. The most common download sites for obtaining apps are the iTunes store and the Android Market.

Blended Model: Refers to a pedagogical model in which the faculty member delivers instruction both online and face-to-face depending on the needs and location of students within the class.

BYOD: Refers to Bring Your Own Device in which the student is allowed to bring any mobile device for use in the classroom. The institution works to maintain connectivity for the student without regard to the particular brand or configuration of the chose device to be used in the classroom.

Cell Phones: In this chapter, cell phones are those devices that allow for phone conversation but are not connected to the Internet through a data plan.

Evernote: (www.evernote.com) An app that allows the user to record, take notes and share with others their work. This app is also found for use on the laptop and smartphone allowing a broad spectrum of ways in which content may be shared across multiple types of devices both PC and Apple based.

Flipped Classroom: Refers to a classroom using a constructivist pedagogy in which the teacher/instructor places content on the Web for use by the student when not in class. Class lectures, links, readings and other content is online and there is an expectation that the student will go to the site and read and/or listen to the content before attending

class. During the class time, the teacher/instructor uses the time to move about the class helping individual students or teams of students to analyze, reflect, and apply the content to problem solving activities. This pedagogy places the responsibility for learning more heavily on the student.

Mobile Devices: Cell phones, laptops, tablet devices, which have portability and mobility and allow for connectivity to the Internet.

Mobile Learning: Learning that occurs anywhere, any time and any place through the use of the Internet or other connectivity software with a computer; also noted as content which is available to a learner for 24/7 access.

OS: Refers to the operating system of the tablet and smartphone devices and is dependent upon the company from which you purchase the mobile device. The iPad uses the iOS by Apple and the HTC tablet uses the Android OS by Google. Each OS has the ability to connect to a store online for the purchase of apps to use on the device.

Smart Phones: Cell phones which have a data plan allowing for connectivity with the Internet thus allowing Internet searching and connectivity.

TeamViewer: An app which can be downloaded to the tablet for streaming content across devices. This allows for collaboration among students and the annotation of content, which can be shared.