MOBILE TECHNOLOGY IN COLLEGE INSTRUCTION: FACULTY PERCEPTIONS AND BARRIERS TO ADOPTION

by

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Smartphone ownership by college students has reached 90% and by all indications ownership is still increasing. Smartphones and tablets like the Apple iPad® have attributes of information retrieval, media display and communications desirable for instruction. Furthermore, students voluntarily bring these devices to campus and are engaged in their use; this makes mobile devices an attractive resource to exploit for instruction. However, integrating mobile devices into delivering courses is not a simple task; time, expertise and resources are required. To take advantage of this resource it is important to understand the current state of technology use by faculty and their perceptions about mobile devices, student use of these devices and perceived barriers to adopting mobile technology. A mixed-methods design used survey and interview data to explore current technology use and faulty perceptions of mobile devices. Phase-one of the study invited 1152 faculty from a Midwestern Land-grant university to participate in a survey, 594 (52%) surveys were completed. A Kendall’s τ analysis found a significant positive correlation ($\tau = 0.288, n = 535, p = 0.01$) between the number of technologies faculty were using at the time of the survey and their agreement that more mobile technology should be incorporated into the curriculum. The survey indicated 43% (top-two box) agreed or strongly agreed that mobile technology should be incorporated into instruction.
Phase-two interviewed 28 faculty selected from the completed survey responses. Results revealed that faculty perceive mobile technology as potentially useful but are unsure of how to implement it, want to see empirical results of efficacy, don’t have the time to invest in adoption, and lack access to expert advice and devices. Faculty also expressed a desire for peer-to-peer support through communities of practice for the sharing of ideas, successes and failures around mobile integration. Overall, faculty are interested in adopting new technologies but feel constrained. Recommendations include further research into the efficacy of mobile technology to improve learning outcomes and engagement, increased administrative support for technology integration and the development of communities of practice to improve technology transfer.
DEDICATION

This dissertation is dedicated to those people in my life that made this work possible. To my mother, Ruby, who always supported my academic pursuits and to my father, Charles, who taught me the ethic of hard work. To my wife, Jeryl, for ignoring the piles of journal articles and library books in my office. To my children, Kestrel and Dustin, who allowed me the occasional absences from their activities; I challenge you to go further. To our dog, Carson, who was constantly at my side as this work progressed from idea to completion. You all had a part in making this a reality.
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CHAPTER ONE
INTRODUCTION

Mobile technology is touted as having the potential to revolutionize education (e.g., Ferenstein, 2011), but are low adoption rates of this technology diminishing its potential? Mobile computing is not a new idea; the first commercially available tablet computer was released in 1989 by GRiD Systems ("The BYTE awards," 1990). Early tablets had many liabilities, including poor handwriting recognition, diminished computational power, and a dearth of pen-based application. In a meta-analysis of prior research into mobile technology between 2008 and 2010, Hwang and Tsai (2011) report a fourfold increase in research into mobile technology for learning during the five-year period 2006-2010 compared to the previous five-year period; this indicates a rapidly increasing level of interest in mobile technology for the educational environment. With the release of Apple’s first iPhone® on June 29th, 2007 and the first iPad® on April 30th, 2010, these two mobile platforms set the bar for a new breed of portable computing devices. The iPad® in particular is advertised as a disruptive innovation that can revolutionize education. In the five years since the introduction of the iPad®, many competing devices have come to market. Both the Android™ and Windows™ Mobile operating systems (MOS) and associated hardware provide alternatives to the iPad® for mobile computing.

Mobile technologies have several characteristics that can positively augment instructional technology (IT), if properly implemented. In particular, small size, highly mobile, touch interface, availability of applications, and Internet connectivity are characteristics exploitable for instructional purposes. There is abundant research and
opinions about methodologies for the integration of mobile devices into the curriculum and classroom for the purpose of improving student engagement, collaboration, information seeking, and communication but little empirical evidence of efficacy exists. Adopting mobile technology is not without problems. For example, some schools that implemented early one-iPad-one-student programs have encountered problems (e.g., Stanford and Notre Dame) and had to rethink the programs (Fischman & Keller, 2011). The question that needs to be asked is; are mobile computing devices realizing significant integration into the college classroom? Significant, in this case, means in both the amount of integration and the positive impact on student engagement and outcomes. Related questions include are institutions investing in mobile technology, and are those investments producing results? Cuban (2001), in his book *Oversold and Underused: Computers in the Classroom*, questions large investments on instructional technology by educational institutions. In 2010, expenditures for Instructional Technology (IT) by post-secondary institutions in the U.S. exceeded 24 billion dollars (Council of Economic Advisers, 2011). One might assume that after all these years of investment in IT that technology utilization will be nearly ubiquitous, but according to the National Study of Postsecondary Faculty (2004) only 36% of faculty used both email and websites; 24% used neither. In today’s technology environment, email and the Web are at the low end of technology challenges for faculty and even in 2004; one would expect utilization for Web and email to be nearer 100%. Resistance by faculty to adopt and integrate IT into their instruction is documented by previous research (Lin, Singer, & Ha, 2010; Reid, 2014). The National Survey of Computing and Information Technology (Green, 2012) reports that in the years 2000 through 2003, “The single most important IT issue” to institution
administrators was “Assisting faculty integrate IT into instruction.” The issue of IT integration fell behind “Network and data security” during the years 2004 through 2008, according to Green, only to return as a top priority in 2010 and 2011. Green states that for 74% of institution administrators, “Assisting faculty integrate IT into instruction” will be “a top priority for the next two to three years.” Once again, integration of IT into instruction is a top priority for higher education administrators. In 2014 Green (2014) reports “Four-fifths (81%) of the CIOs and senior campus IT officers who represent the 470 colleges and universities that participated in the fall 2014 survey report that “assisting faculty with the instructional integration of information technology” is a very important institutional IT priority over the next two-three years.” This indicates there is a longstanding gap between the expectations of post-secondary administrators and the level of integration of IT into instruction by faculty. Is this gap a false perception held by administrators or is the reality that faculty are avoiding instructional integration of IT? Providing a technology infrastructure alone does not guarantee faculty will use it (Georgina & Hosford, 2009). Faculty need support and training to encourage technology integration: “Teachers of the future will be highly trained professionals, comfortable with technology…” (Sawyer, 2002).

Students too have high expectations for faculty’s use of technology. The ECAR study (Dahlstrom, Walker, Dziuban, & Morgan, 2013) of undergraduate students finds a majority of students expect anytime, anyplace access to course materials and desire increased use of course management systems (CMS), lecture capture tools, and other technology that will capitalize on students’ own digital devices. While technology integration has improved, the level of integration still falls short of student expectations.
There are a number of barriers to faculty adoption of technology reported in the literature. With the computer revolution and the introduction of computers into the learning environment, new demands have been placed on faculty choosing to integrate technology into courses. The integration of instructional technology requires a new repertoire of technology skills, knowledge and abilities as well as significant preplanning and preparation time. With earlier technologies (film, television, DVDs), faculty, as subject matter experts in their respective fields, required little technical savvy to integrate these new technologies into the classroom. The introduction of computers brought forth a steep learning curve and significant pre-class preparation time; the result is a significant time commitment on the part of faculty wishing to integrate new technology into instruction. Adopting mobile technology is one more burden placed on faculty.

Assessing mobile technology use is difficult due to the highly portable and personal nature of the devices. Further complicating assessment of technology integration is the use of what Flavin (2012) refers to as “disruptive technologies.” Flavin suggests faculty are using a wide array of technologies outside those provided by the institution. Furthermore, students’ bringing their own mobile devices (BYOD) into the institution provides both opportunities and risks; these non-institutional technologies pose many challenges to administration, including accountability, security risks, privacy issues, and quality control. Other influences also cloud assessment of technology use, for example, there are conflicting reports on the influence of factors like age and years of teaching experience on the adoption of new technology. Smerdon et al. (2000) reported that younger teachers are more likely to use technology, while Tabata and Johnsrud (2008) found that for each year of teaching there was a corresponding 1% increase in technology
utilization.

Research suggests there are many nuances to technology adoption by faculty and it cannot be assumed adoption will happen without institutional planning and support; this holds true for the adoption of mobile technology also. Research demonstrates that integration of mobile technology into the curriculum is never easy and has a history of mixed results. In a report on several iPad® initiatives in education, Lacey, Gunter, and Reeves (2014) suggest that these initiatives are costly in both time and expense and that there is a lack of empirical research that demonstrates the efficacy of mobile technology integration in education. One takeaway from a University of Central Florida campus wide survey (Chen & Denoyelles, 2013) is that both students and instructors need training in the effective adoption of mobile technologies.

Limitations of the Study

This study was limited by faculty members’ ability, availability and desire to voluntarily participate in the survey and interview. The topic of this research was mobile technology; some faculty may have been dissuaded from participation due to personal perceptions of the topic. Only faculty in a teaching role at the time of the survey were allowed to complete the survey. These limitations could perhaps produce skewed results.

Delimitations of the Study

Participants were selected from one Midwestern land-grant university. Survey participants were selected based on title and further delimited to those in a teaching role. Interview participants were selected based on the level of technology use (high and low) and other unique information provided in the survey.
The researcher worked in higher education for 26 years, a portion of that time at the subject institution of the research. The researcher had interacted with many faculty during these years and some of those casual acquaintances participated in the study, although, enough time had passed that all but one interviewee was aware of a connection to the researcher. The Interview data was separated from identifying information to facilitate unbiased analysis. The researcher was working at a different institution at the time of the study. It is difficult to gauge how these relationships may have affected the results if at all.

**Defining instructional technology**

The Association for Educational Communications and Technology (AECT) (from Seels and Richey, 1994) provides this definition: “Instructional Technology is the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning.” Instructional Technology (IT) is an evolving concept. Seels and Richey (1994) speak to the “evolutionary nature” of the definition of IT and cite six iterations of the definition of instructional technology between 1963 and 1994 from the AECT. Utilization of technology is a common theme in five of the six definitions of IT from the AECT. The existence of technology is useless without quality implementation and utilization and there seems to be a disparity between administrators’ expectations and the level of integration (utilization) of IT by faculty (Green, 2012, 2014).

In the long history of IT, new technologies have been met both with enthusiasm and skepticism; resistance to implementing new technologies in education is common. Even such now commonly accepted technologies like radio, audio recordings, filmstrips,
slides and film, television, overhead projectors, video disks, audio CDs, and DVDs, while heralded by some as revolutionizing the classroom, had their detractors - a percentage of faculty will resist using new technologies. This is true for mobile technology also.

This study explores the integration of mobile technology into the curriculum, both in the classroom and outside the classroom.

Defining mobile technologies

For this research, mobile technology is defined as any ultra-portable computing device with a touch-sensitive screen (generally less than 11 inches measured diagonally), capable of running applications, and able to connect to the Internet via a wireless network. Examples of these devices include, but are not limited to, tablet computers, Apple iOS®-based devices like the iPad®, iPod Touch®, and iPhone®; Windows-based systems such as Microsoft™ Surface™ Pro, and Windows phone®; Android™-based devices like the Google™ Nexus®, Samsung™ Galaxy®, and similar.

Problem Statement

Institutions need to identify how best to train and motivate faculty to fully integrate technology resources. Seasoned faculty may be more entrenched in teaching modalities and philosophies, financially secure, and have more time commitments than younger faculty; therefore, traditional motivators, professional development methods, and traditional technology support structures may not entice mature faculty to change instructional methods. Younger faculty may respond to a different set of motivators and support methodologies, such as monetary incentives, than more experienced faculty.

Unlike earlier classroom technologies (e.g., films, television, DVDs, etc.) new instructional technology is evolutionary and in a constant state of flux. New versions of
software and hardware present new challenges to faculty and possibly evoke new resistance to implementation. For this reason, periodic reevaluation of faculty use of technology is prudent. The introduction of mobile technologies is another step in the evolution of IT. As institutions of higher education consider investing in mobile technology infrastructures, implementing BYOD, or provide mobile devices to each student, there must be an understanding of how these technologies are currently used and what needs to be done to enhance adoption.

**Purpose Statement**

The purpose of this research is to discover if faculty are integrating mobile technology into the curriculum, to what degree is this happening, methodologies employed to accomplish it and barriers that inhibit adoption.

**Research Questions**

**Primary question:**

- Are faculty integrating mobile technology into instruction?

**Secondary questions:**

- In what ways is mobile technology used?
- Do characteristics exist that might distinguish technology adopters from non-adopters?
- What factors influence the adoption of technology in the academy?
- What can institutions do to encourage the integration of mobile technology by faculty?

**Methods Overview**

For the current study a mixed-methods design was implemented. First,
quantitative data was generated through an online survey. All faculty determined to be in a teaching role at a large, Midwestern, Land-grant university were invited to participate. Results of the analysis of the quantitative data informed the selection of participants for the qualitative portion of the design. One-on-one interviews were conducted with a select group of 28 participants from the survey. The interviews were conducted via phone or Skype™. The interviews allowed for deeper questioning of the relevant topics and provided triangulation and validation to the online questionnaire data (Creswell, 2007). Greater detail of the methodology for this study can be found in chapter three.

**Significance of Study**

Mobile technology has the potential for significantly changing pedagogy, but doing so requires a strong commitment from faculty and administration. Development of content, applications, and new methodologies around a mobile platform demands resources. As investment in technology rises, especially during a time of weak economic recovery and reduced funding for higher education, institutions need to maximize return on investment for their technology investments; implementations must be measured for success. Resistance to adopting new methods is common. If resistance to adopting mobile technology integration remains significant, finding ways to overcome this resistance will have a positive impact on the overall success of mobile technology integration.

Furthermore, technology has become a factor in student recruitment and retention. Institutional technology presence is increasingly a selection criterion for students evaluating potential schools (Palloff & Pratt, 2003). Educational institutions are moving to online courses to increase revenues, therefore, it is critical to institutional goals to have all faculty be comfortable using the technology resources provided and to embrace the
technology students are using – mobile technology. At this writing, research indicates integration of mobile technology in the curriculum is happening in a haphazard, non-systematic way; this can be frustrating to today’s mobile student. Part of the problem seems to be reluctance by a good portion of faculty to adopt new technology in significant, quality ways. The quality of mobile integration is of the upmost importance; if technology integration is poorly conceived and implemented, it can become a distraction and a detriment to the learning experience. Discovering and mitigating barriers that will increase technology integration is a top priority for administration (Green, 2012, 2014). The first step towards greater mobile technology integration is to assess the current state of integration and utilization of mobile technology in the curriculum and to ascertain barriers to adoption.
CHAPTER TWO

LITURATURE REVIEW

This literature review presents a background of the integration of mobile technology in the curriculum; a theoretical basis for technology adoption by and propagation through organizations; as well as research into factors attributing to resistance by faculty and barriers to the adoption and integration of technology. Reviews are grouped by topic and are ordered chronologically (Bryant, 2004).

Mobile Technologies in the Classroom

Mobile technologies present a number of new benefits and challenges compared to previous technology. The highly portable, connected, easily concealable, and feature-rich devices provide a previously unavailable always-on, anytime-anyplace computing device with significant computational power, information gathering, and communications abilities. These attributes makes mobile technology both attractive and a potential liability in the classroom environment. Mobile-learning (m-learning) is the natural progression from e-learning. The research in this section provides a historical perspective on mobile technology and demonstrates that the integration of mobile technology into the curriculum thus far has led to both successes and failures.

Elwood, Changchit, and Cutshall (2006) surveyed 272 undergraduate students at a mid-sized university about a laptop program. Results indicated that an additional factor, perceived change, in addition to perceived usefulness and perceived ease of use proposed in the Technology Acceptance Model (TAM) (see the discussion of TAM below) is a major factor in technology adoption by students. Therefore, a higher perceived change provided by a new program, the greater likelihood of acceptance. The authors suggested
that perceived change become a new component in the TAM model.

Stickel and Hum (2008) investigated the use of tablet-PCs by instructors as content delivery systems during lectures. The two investigators incorporated animated and complex graphics into PowerPoint presentations during lectures. Skeleton versions of PowerPoint were distributed to students prior to lectures for students to use as advanced organizers and to facilitate note taking. Of the 129 survey respondents, 63% said the use of tablet-PCs by the instructors enhanced the learning experience, and 65% liked having the skeleton outline as an organizer. Two findings to note; first, students (45%) preferred a mix of blackboard and PowerPoint use. Secondly, it takes significant effort to move a lecture to a multimedia platform. While this was a small study, it does present findings on integration of mobile technology from both sides of the lectern.

In 2008, Reed College (Marmarelli & Ringle, 2009) embarked on a pilot study to investigate the suitability of the Kindle DX® as an augmentative technology to the curriculum. The study found general agreement among participants that the Kindle™ was not (in the model available at the time) suitable to the needs of students and faculty. In 2010 Reed College (Marmarelli & Ringle, 2011) conducted a similar study using the first generation iPad® and found the state of digital rights management was detrimental to full adoption of iPads® and other tablet platform. Furthermore, the traditional controlled deployment model that provided the institution a level of control over deployed devices did not work well with tablets. Marmarelli and Ringle recommended a more open consumer-focused deployment model that puts more control in the hands of the user.

Hawkes and Hategekimana (2009) conducted a small study of the effects on academic performance by the introduction of mobile wireless technology into the
classroom. Four courses from different disciplines were evaluated. For each course provided mobile technology, a control class without the mobile technology was used for comparison. Results demonstrated no effect, positive or negative, in three of the four subject classes. Only the students in the college algebra class improved outcomes. This research created more questions than it answered. For example, was technology more beneficial in math courses than it was in English, composition, or history courses? Since outcomes were neither improved nor diminished in the non-math courses, did this mean the mobile technology was not worth the effort to implement or was the technology poorly implemented?

In a two year longitudinal study, Weisberg (2011) examined the efficacy of e-readers in the classroom. Beginning in 2009, various models of e-readers (Amazon Kindle®, Sony eReader®, Touch®, Apple iPad® released in 2010, etc.) were loaned to students for the semester. Teams were created and control teams were assigned physical textbooks only. Findings suggested no difference in outcomes between the e-reader and physical textbook conditions. Interestingly, the first cohort students generally felt the e-readers were not ready for classroom use, although, over the two year study, students’ opinions changed dramatically to the positive. This change in opinion was partially due to improvements in the devices, the introduction of the iPad®, and availability of tablet devices in the home towards the end of the study. This study illustrated how a rapidly changing technology landscape can impact usability and outcomes.

Hahn and Bussell (2012) studied iPad® use by first-year students. Checkout devices were made available from the library for one week durations. Students were allowed to link the device to their personal iTunes® account and load any applications the
student desired. Devices were wiped of all content upon return. Results indicated that students were more likely to use the iPad® to conduct non-class related activities like email, social media, and other non-class activities during class over a smartphone, because they felt that the iPad® was sanctioned for use in class. The portability of the iPad® was cited as a significant positive characteristic when compared to laptops. While students found the iPad® convenient for taking class notes, they found the iPad® to be less attractive for more intensive writing and research activities. Finally, compatibility issues and no support for Adobe® Flash® prevented students from interacting with the course management system and playing some multimedia content.

In a case study at Indiana University-Purdue University Indianapolis, Miller (2012), described the results of an iPad® integration initiative. Three cohorts of faculty formed learning communities to investigate how iPads® might enhance teaching and learning. Cohort members came from a diverse variety of disciplines, including English, communications studies, music, engineering, organizational leadership and supervision, physical education, library studies, and tourism management. This iPad® study focused on student perceptions and engagement with iPad® integration in the class. Of the 209 respondents, students generally agreed that the iPad® improved learning and engagement. On the negative side, some students found the iPad® to be a distraction during class, posed technical issues, or struggled to effectively use the technology. While this case study focused on students, the faculty cohort approach provided a good example of peer engagement and support for the development of faculty skills.

Hesser and Schwartz (2013) reported on their experience using iPads® in creating a “paperless chemistry laboratory course.” Using various applications, standard
laboratory notebooks and procedures were moved to a digital format. Students were able to download laboratory procedures from a course management system and take lab notes on the iPad®. Students’ results and conclusions were then uploaded via Dropbox™. The researchers warned that considerable effort is needed to implement an all-digital course. Furthermore, though the students are accustomed to technology, they could struggle adapting to the all-digital format for the first several weeks. Positive attributes such as the iPad’s® size, touch interface, lower cost, and available applications make it more conducive to the laboratory environment than a laptop.

Yamakawa, Delgado, Diaz, Garayar, and Laguna (2013) used the Technology Acceptance Model (TAM) (see TAM below) to understand undergraduates’ intention to use mobile technology. Survey results from 300 of the 2,000 undergraduates showed a strong association with perceived usefulness and perceived ease of use, two of the three major tenets of TAM. These results helped inform considerations for faculty undertaking a mobile technology integration project, in other words, students must find the technology useful and easy to use.

Yusup (2014) surveyed 93 teachers in an undergraduate education program. Results indicate that the iPad®’s light weight, touch-screen, and mobility made it a useful pedagogical tool; however, dependence on Wi-Fi connectivity makes the device nearly useless as an educational tool in the absence of connectivity.

DiVall and Zgarrick (2014) explored the impact of iPads® on faculty productivity. Thirty-four pharmacy faculty were issued iPads® as part of a technology pilot program. The results of an anonymous survey indicated that while faculty used the devices to communicate with students and manage papers and projects, 86% and 68% respectively,
only 43% of faculty actually use the devices in the classroom. Furthermore, while the overall perceptions of faculty remained positive after 9-months, perceptions about the usefulness of the iPad®, especially in the classroom setting, declined.

**Technology Adoption Theoretical Base**

There were numerous theoretical frameworks used to describe technology adoption and diffusion within a community. These theories and models provided practical approaches to assessing technology utilization in the organization, as well as mechanisms to understand and promote technology adoption. Several of these theories are discussed below.

**Theory of Reasoned Action**

The Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen (1975) provides a model to measure behavioral intention (BI)(intention to perform a behavior) based on personal attitude (A) and subjective norms (SN). Subjective norm is the measure of perceived expectations from social operatives and their possible positive or negative reactions to the person performing the behavior or not. Fishbein and Ajzen provide a formula to calculate Behavioral Intention: \( BI = A + SN \). The Theory of Reasoned Action is the basis for several other technology adoption and diffusion through the organization models.

**Technology Acceptance Model**

The Technology Acceptance Model (TAM) has its origins in the Theory of Reasoned Action of Fishbein and Ajzen. In it, Davis (1986) proposed two factors affecting the adoption or rejection of new technology innovations; perceived usefulness and perceived ease of use (see Figure 1). If a potential adopter believes the new
innovation will help them perform better, the more likely the new technology will be adopted. Furthermore, perceived ease of use also plays an important role in the decision to adopt. As one can imagine, these two factors can have a reinforcing or negating effect on one another; if perceived usefulness is low or perceived ease of use is low, i.e., useful but difficult to use, likelihood of adoption is reduced. This theory is applicable to educational environments and can help inform formation of methods to change the perceptions that hinder adoption of technology. Professional development, interface design, and technology support can help change perceptions of usefulness and ease of use. Davis presented assessments to elicit responses about perceived usefulness and perceived ease of use.

Figure 1

Technology Acceptance Model as defined by Davis (1986).
Venkatesh and Davis (2000) proposed an extension to TAM; TAM2. Davis and Venkatesh state that the perceived usefulness determinate of TAM is a good predictor, while the ease of use construct is a less reliable predictor of technology adoption. TAM2 adds three social influence constructs (subjective norm, voluntariness, and image) and three cognitive constructs (job relevance, output quality, and result demonstrability), and experience to the TAM model (see Figure 2).

Figure 2

*TAM2 extensions to TAM proposed by Venkatesh and Davis (2000).*

These additional constructs act as modulators over perceived usefulness and perceived ease of use. Fishbein and Ajzen (1975) describe subjective norm as the adoption or rejection of a behavior based on one’s perception of persons considered important by the person. Venkatesh and Davis (2000) explain that voluntariness and compliance, especially compliance, can affect the perceived usefulness and perceived ease of use. Simply put, if it is perceived that someone with some level of reward or
punishment over an individual expects implementation of a solution, the social pressure in this situation can force adoption of the solution even if perceived usefulness or ease of use is low. “Image” is the perception of how one will be viewed within the social network by the adoption or non-adoption of a behavior. The proposed cognitive constructs, job relevance, output quality and result demonstrability are obvious modulators of perceived usefulness of a solution. Furthermore, experience will affect perceived usefulness and the intention to implement a given solution. Empirical results indicate that TAM2 improves on the results provided by TAM.

Venkatesh and Bala (2008) offer an extension to TAM2 in the model referred to as TAM3. TAM3 added measures of computer self-efficacy, perception of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability as modulators of perceived ease of use. TAM3 also introduces new relationships between experience and perceived usefulness, behavioral interaction, and perceived ease of use; prior experience has influence over the three aforementioned constructs. Venkatesh and Bala proposed that TAM3 (figure 3) is an important model to inform decisions of both employees and management when implementing technology in the organization.
**Diffusion of Innovation and Bandwagons**

Bandwagon theories propose models to explain the sometimes deleterious decisions made in regard to the adoption of technical solutions. Bandwagon theories are based in and expand diffusion of technology theory. Abrahamson and Rosenkopf (1993)
explored institutional and competitive bandwagons suggesting that organizations react to “institutional bandwagon pressures” and attach added value to an innovation simply because other institutions have adopted it; this perceived added value often outweighs the actual return for adopting the innovation. They describe “competitive bandwagon pressures” as a perceived competitive disadvantage that would result from not adopting an innovation. This perceived pressure increases as more and more organizations adopt the innovation, again, overshadowing rational decision-making. Later, Abrahamson and Rosenkopf (1997) expand bandwagon theory further by examining earlier bandwagon theories’ assumption that all potential adopters experience the same pressures. They stated that when faced with ambiguous information, decision makers will turn to social networks to find answers. The order in which adopters receive information impacts the order of adoption. Abrahamson and Rosenkopf (1997) suggest that a focus on social networks could improve adoption of technology innovations in the organization.

Lanzolla and Suarez (2012) add to technology diffusion theory using a contiguous user bandwagon model “that can explain the likelihood of technology use after adoption.” They stated that current technology diffusion theory did not sufficiently explain why “technology use does not necessarily follow from technology adoption” and does not take into account the evolutionary nature of technology. Contiguous user bandwagon theory focuses not on administrators but on users and make further distinction between (early) adopters and users. Furthermore, Lanzolla and Suarez argued that adopters react to different motivators and stimuli than users and that some users can have negative reactions to adopter bandwagons. The application of the contiguous user bandwagon theory can help inform institutional policy makers to focus more on technology use and
not just the adoption of technology.

**Critical Mass**

Markus (1987) proposed that “universal access” is the desired end result whenever a new interactive medium is introduced into a community. A community, as defined by Markus is “a group of individuals with some common interest and stronger communication flows within than across its boundaries.” Universal access is important to maintain the fabric of the community, provide equal access, and prevent disintegration into sub-factions of haves and have-nots. Lower adoption rates in this model means higher costs with fewer benefits for early adopters. Economies-of-scale are realized as adoption becomes more universal. Markus’ critical mass theory for interactive media is grounded in the critical mass theories of Oliver, Marwell, and Teixeira (1985). Oliver et al. described interests and resources as two primary variables for collective action; as both interest and resources for obtaining a goal increases, the likelihood for success in obtaining the goal in the community increases. Markus suggested that “universal access will be favored by heterogeneity of resources and interests. In the educational community, heterogeneity of resources and interests is often difficult to cultivate.”

**Perceptual Control Theory**

Y. Zhao and Cziko (2001) proposed a theoretical model for the understanding of technology adoption. The “Perceptual Control Theory” (PCT) examines teachers’ goals and technology’s role in achieving them. Three major themes that emerged from this theory that predominately agree with previous research; there must be a belief that technology can effectively support goals, not impede other goals, and that the teacher has the ability and support to successfully implement the technology. While this proposed
theory was not based on research, it does present an interesting approach to understanding motivations and barriers to technology utilization.

**Technology Adoption and Utilization**

A survey of a random sample of faculty of three historically black colleges and universities (HBCU) finds that at the time of the study, email and word processing were the “teaching tools” that respondents use the most and are most comfortable with. (Okpala & Okpala, 1997) Other technologies were at best used by 37% of respondents. Further findings indicate that technologies “have not yet been widely accepted within the academe,” traditional instructional techniques are the norm and that home ownership of computers increase acceptance of educational technologies. This survey had a 39% response rate with 216 respondents from the distribution of 550 surveys.

Spotts, Bowman, and Mertz (1997) explored the relationship between gender and the use of instructional technologies. Three hundred and sixty-seven of the 760 full-time faculty at Western Michigan University participated in the study. The 48% response rate provides a sufficient sample to make inferences about the population (Dillman, 2007). Of the respondents, 71% were male with 29% female. The survey asked respondents’ to rate their knowledge and experience with 13 different technologies. The results find gender plays little role in self-reported technology knowledge and experience. However, discipline area of respondents does have significance as influencing technology use.

Pajo and Wallace (2001) surveyed faculty in the College of Business, College of Science and College of Education at Massey University Palmerston North campus. Two hundred five of 719 (34.8%) responses were received. Greater than 70% of respondents indicated the primary barrier to technology use was time to learn new technologies.
Utilization of technologies, other than email and library resources, by faculty in this study is at best 30 percent, with several categories at or below 10 percent. A small sample of convenience limited to only three schools limits the significance of this study.

Ferneding (2003), in the book *Questioning Technology* presented a case study of middle and elementary schools and the impact of technology when introduced into those environments. Finding indicate that insufficient time to gain training, and steep learning curves to integrate new technology into courses are a significant barrier to the adoption and integration of technology into the classroom.

Allen and Seaman (2003) in a Sloan Consortium report from a survey of 994 degree granting institutions in the United States found that 59.6 percent of institutions “agree that their faculty accept the value and legitimacy of online education.” This implied that 40 percent of institutions are not so convinced of the value of online education.

Finley and Hartman (2004) reported on a case study at Western Michigan University exploring potential barriers to technology integration among teacher-educators. The study found that faculty adopt technology if they feel comfortable with it, it fits with their teaching philosophy, it enhances pedagogy, and that they are rewarded for integrating the technology.

Assessing levels of technology anxiety is one of several factors Redmann and Kotrlik (2004) studied in a population of 1,288 educators in the fields of agriscience, business, and marketing in all career and technical institutions in Louisiana. A random sample of 599 instructors was solicited for the study with 319 returned surveys (53.3% response rate.) Results showed that technology anxiety is a significant barrier to
technology integration and that the level of anxiety varied by program area.

Brzycki and Dudt (2005) provided a number of insights into barriers to faculty integration of technology. The review was of a three-year Preparing Tomorrow’s Teachers to Use Technology (PT3) program. The program’s intent was to increase technology in teacher-preparation programs at three Pennsylvania universities. The review identified five major barriers to faculty integration of technology: time, support, models, infrastructure, and culture/tradition. One find is that after three years of increased infusion of technology, the old barriers still persisted. The barriers became most evident when attempting to move “mainstream users and late adopters” to new modalities. It is evident that prevailing barriers resurface with introduction of each new technology.

Leh (2005) reviewed a PT3 program at California State University San Bernardino. This project explored service learning and reverse mentoring in faculty development. Reverse mentoring had graduate students mentor university faculty in the use of technology. If age and years of service are factors in faculty resistance to technology, reverse mentoring, either by graduate students or junior faculty mentoring senior faculty, could be a successful model. Time constraints of faculty and administration involvement were cited as important considerations to implementation of faculty development.

Maguire’s (2005) literature review titled Faculty Participation in Online Distance Education: Barriers and Motivators found significant agreement in a number of areas across the reviewed research. Major areas of agreement included: concern about course quality; lack of grants for materials, expenses, design & development; lack of technical support; lack of training; lack of time to develop and maintain course materials; personal
motivation to use technology; opportunity to use technology more innovatively; and credit towards tenure & promotion and recognition of work. Monetary incentives are not strongly indicated as motivators to overcome resistance.

Meyer and Xu (2007) applied Bayesian network analysis in a 2004 National Study of Postsecondary Faculty. The results of this analysis indicate that instructional workload, teaching/research field and highest degree obtained all influenced technology use. The problem with these findings is there is a severe limitation in the data source—the NSOPF data includes email and Web use as the only measures of technology use. Instructional technology utilization has a much broader scope than email and Web. While this is a novel analytic approach to the data, the results fall short of significant in the full realm of IT.

A Sahin and Thompson (2007) study of College of Education faculty looked at a number of variables as possible predictors of technology adoption. An interesting outcome is that collegial interaction is one of the three significant predictors of technology adoption. While this study had a small sample (43 out of 87 faculty) and was limited to faculty only in the College of Education, collegial interaction as a predictor of technology use deserves further investigation.

Years in higher education and perception of effectiveness of technology are predictors of technology use in classroom instruction based on a sample of 187 faculty in the social sciences in a quantitative study by Senjo, Haas, and Bouley (2007). The sample for the study was selected from various postsecondary schools in the state of California.

Gibson, Harris, and Colaric (2008) surveyed 110 of 235 (46.8% response) from both the college of business and college of education from a large regional university.
Davis’ (1989) TAM assessment for technology acceptance was used to ascertain faculty acceptance of online education. Findings are similar to other TAM based research of faculty acceptance of online education. Respondents’ age was captured with demographic information but unfortunately age was not included in the analysis of data. Interestingly, the authors suggested that age and gender should be examined as factors in technology use. This study was limited, like so many others, to a small segment of the university population. The authors suggest it would be of interest to include faculty from a broader range of disciplines.

Georgina and Olson (2008) and Georgina and Hosford (2009) examined faculty perceptions and technology literacy. The sample consisted of \( n = 1115 \) faculty from fifteen institutions’ Colleges of Education considered peer institutions to the University of North Dakota. Findings indicate no relationships between training or years of teaching and the integration of technology into courses, however, results indicate a strong relationship between technology literacy and technology integration. The majority of respondents believed that it is the responsibility of the institution to provide the training to increase technology literacy. The study found those faculty teaching less than five years feel more proficient with newer technologies. The findings suggested that further research into faculty training strategies was needed. While the number of participants in this study was significant, and it included multiple institutions, limiting participants to only schools of education possibly skews results.

In a larger study \( (n = 2,048) \), Tabata and Johnsrud (2008) surveyed faculty of a 10-campus system in the western United States. Participants were asked to rate their level of technology use, attitude toward technology, attitude toward distance education, and
adoption of innovations by responding to 129 questions using a 5-point Likert scale. An ordinal regression analysis of data found 11 variables associated with increased and 5 with decreased likelihood of participation in distance education. Analysis of demographics data indicated three variables to be significant; age in years, minority status, and Associate’s and Baccalaureate Colleges. Analysis indicated a 1% increase in the probability of implementing online education for each additional year of service. This finding is in stark contrast to those of Georgina and Olson (2008) and Georgina and Hosford (2009). These conflicting findings indicate that further investigation of age and years of service as factors in technology integration is warranted.

Berryhill and Durrington (2009) invited 513 faculty that had previously used the technology classrooms at a southeastern U.S. university to participate in a survey. 188 of the 513 (37%) invited faculty responded to the invitation. The surveys sought to elicit faculty utilization of technology. Diffusion of innovations theory and social network analysis showed no correlation between demographic characteristics and technology utilization. Social networks were not a relevant predictor of technology use. A significant correlation between training and technology integration did exist. The findings linking training to increased technology integration supported previous findings, but the lack of correlation between demographics and social networks was counter to previous findings, e.g.; Georgina and Hosford (2009), Georgina and Olson (2008), Sahin and Thompson (2007), Tabata and Johnsrud (2008), etc. Limiting the population to only faculty previously using the technology classrooms possibly pushed the results towards a more technologically savvy population.

A study of a small (n = 25) pool of faculty by Keengwe, Kidd, and Kyei-Blankson
(2009) further supported previous findings of importance of organizational support and leadership, professional development for faculty, and sufficient technology resources as being crucial to enabling faculty to integrate technology. The small sample size from a single institution reduced the quality of this study but participants did represent a diverse spectrum of disciplines.

J. J. Zhao, Alexander, Perreault, Waldman, and Truell (2009) surveyed both faculty and students on their use of instructional technology. Participants were selected from business schools that indicated they had some form of online education. A large number of instructional technologies were included in the survey questions. Analysis showed that the most used technologies for distance education among faculty and students at the subject schools include internet lecture notes and assignments, e-mail, and internet and Web-based discussion groups. Demographics data collected for this study included age for students and years of distance education experience for faculty, but this information was not included in the analysis. No follow up was conducted with respondents which make the data less reliable. Administrators of targeted institutions were asked only if their school provided distance education classes; no assessment of the quality, breadth, or depth of those online course offerings was made.

A study published by Lin et al. (2010), examined use of and resistance to the learning management system Blackboard on one campus. The case included administrators, faculty and staff at a research university in the Midwest United States. One thousand twenty-two respondents completed open-ended questionnaires and 20 faculty and staff were selected for one-on-one interviews. Results find a clear gap between administration and the rest of campus on issues of technology. Administration
was enthusiastic about technology while faculty and staff were less enthusiastic and more resistive to the use of technology. Administration offered various incentives to entice faculty to develop and teach online courses; these incentives had little effect on faculty attitudes towards online teaching. Findings showed faculty used Blackboard in ways that supported their teaching methods but resisted moving beyond current use to more fully utilize the resources provided by Blackboard as administration desired. This research supported earlier findings that monetary incentives are ineffective motivators, e.g., Maguire (2005) and illustrated the gap between administration and faculty referred to by Green (Green, 2012, 2014).

Moseley (2010) conducted surveys and interviews of community college faculty in a mixed methods study in an effort to discover perceptions of faculty and students as to the usefulness of technology in the community college environment. While the findings were somewhat ambiguous, the study reinforces previous research that technology resources and professional development continued to be important factors that encouraged faculty to implement technology.

Perry (2010) examined the use of a course management system (Blackboard) at a rural California community college. Ten faculty characteristics (age, gender, degree earned, subject area, teaching load, class size, years teaching, salary, employee status, and how many other faculty were teaching in the discipline) and five instructional conditions (location, delivery method, course type, duration, and career status) were used to test the relationships and influences related to CMS use. All faculty (n = 259) teaching during the target semester were included in the data. Results indicated moderate to strong effects of gender, degree, status, salary, location, delivery method, and duration on CMS
use. Perry included measures of 14 CMS features used by faculty and found the top 5 to include distribution of course documents and syllabi, grades, announcements, and assignments; utilization of other CMS features other than these top-5 drops off sharply. Perry found a weak negative but non-significant relationship between age and CMS use. It was found that “the more years a faculty member taught at rural CCC the greater the tendency to use Blackboard's interactive and multimedia features.” This may have indicated that age was a weak predictor of use and that a more important predictor was years of teaching.

Contrary to other research, Palmore (2011) found age to have a significant relationship on technology utilization. The study included survey responses from 212 of 514 (41%) faculty from 7 colleges and schools within one southeastern U.S. institution of higher education. Other significant findings generally supported previous research in that professional development and faculty self-efficacy related to technology have a positive impact on technology utilization.

Macharia (2011) used data from 162 of 1500 (10%) faculty solicited from a university in an east African developing country. The study relied on the Unified Theory of Acceptance and Use of Technology (UTAUT) as a model. Macharia found that for the population of the study, age and gender were factors in technology use, which is different from previous findings for similar studies in China, suggesting social/political pressures may have an impact on technology adoption. The response rate for this study was only 10% and too low to make inference about the target population, findings do provoke questions for further study.

In looking at faculty satisfaction with learning management systems (LMS), Al-
Busaidi and Al-Shihi (2012) found anxiety to have a negative association with LMS satisfaction. This study surveyed 82 faculty at the Sultan Qaboos University in Oman. Age was among the demographic data collected, but was not part of the analysis.

Ford (2012) found that age and computer ownership did not have significant effect on perceptions of technology in a study of 365 faculty at an urban public university in Tennessee. Ford remarked that these findings are “contrary to other studies.” Ford also found technology anxiety was a significant factor in perceptions. Ford’s findings that age was not a factor but anxiety was a factor in the perceptions of faculty seemed to conflict with T. Johnson, Wisniewski, Kuhlemeyer, Isaacs, and Krzykowski (2012) findings. T. Johnson, et al. suggested that older and more experienced faculty were more likely to succumb to technology anxiety. Technology anxiety has previously been found to be a significant barrier to the use and integration of technology.

D. R. Johnson (2013) indicated that faculty hold a perception that “technological change threatens professional autonomy.” Data obtained through interviews with 42 faculty from one private and two public research-intensive universities in the United States revealed concerns among faculty that technology-based instruction removed faculty from the decision-making process, and increased workload. D. Johnson also finds that there is little relation between technology integration and pedagogy and that faculty find technology to be of little or no value to instruction.

Lack of technology resources, perceived usefulness, and internet self-efficacy are primary factors in faculty utilization of instructional technology according to Buchanan, Sainter, and Saunders (2013) from a survey of 114 faculty at a large university in London, England. The participants were not restricted by subject area. These findings
were consistent with previous research; lack of institutional support, a perception that instructional technology is of little value, and a low internet self-efficacy were all barriers to the adoption of technology by faculty.

Celik and Yesilyurt (2013) also found computer anxiety to be a barrier to technology supported education. A sample of 471 pre-service teachers completed the survey. Results indicate a direct relationship between attitude and self-efficacy towards technology and technology anxiety.

**Summary of Literature**

Notwithstanding several limitations, a number of common themes emerge from the research:

1. Mobile technology offers unique opportunities and challenges.
2. Faculty must feel that the results of technology integration are worth the investment of time and resources to implement.
3. Students must view the use of technology as useful, as well as easy to use.
4. Technology support is critical.
5. Professional development improves adoption.
6. Recognition of technology adoption, especially in promotion and tenure is important to faculty.
7. Technology anxiety plays a role in resistance.

There are some conflicting themes also:

1. Between tablets and smartphones; maybe smartphones need more attention.
2. Monetary incentives may or may not motivate faculty to integrate
3. The role of age and experience in technology utilization. Perhaps years of teaching are a more useful predictor.
CHAPTER THREE
METHODOLOGY

Research Design

A mixed-methods design was used in this research. A mixed-methods approach is defined by Hesse-Biber and Leavy (2006) as “The use of both qualitative and quantitative methods in one study.” Mixed-methods designs provide benefits that a single methodology does not. Greene, Caracelli, and Graham (1989) provide five advantages to employing a mixed-methods design; first, “triangulation” allows data from different methods to support and validate one another. Second, the individual methods can be “complementarity”, providing better clarity and understanding of the results from one method using the results of the other method. The third advantage, “development”, informs the development of one method from the results of another. “Initiation” provides for the exploration of new dimensions, problems, or reinterpretation of results of one method with results of a second method. Finally, “expansion” broadens the scope of the research through use of multiple methods best suited to components under examination.

Sequence and priority given to each method is important in a mixed-methods design (Creswell, 1994, 2003; Greene et al., 1989). Sequence refers to the order in which the quantitative and qualitative parts are conducted and priority is the relative significance ascribed to the methods. Creswell (2008) describes four possible mixed methods designs: Triangulation, Embedded, Explanatory, and Exploratory. Triangulation simultaneously implements quantitative and qualitative methods to collect and analyze data. One rational for Triangulation is the compensatory nature of combining methods, thus providing validation of both methods. The Embedded design also uses simultaneous
data collection but has data from one method play a supporting role to the data from the other method. The Explanatory design uses sequential methods in a two phase design with quantitative data from the first phase informing the qualitative method of phase two and phase two helps “explain or elaborate” on the phase one results. Finally, the Explanatory design starts with a qualitative method and then applies a quantitative method to “explain relationships” in the qualitative data.

An “explanatory” or “two-phase” design (Creswell, 2008; Creswell & Plano Clark, 2007) was used for this study. Phase-one of this study used a short survey to collect the quantitative data. Phase-two of this study used one-on-one interviews to develop the qualitative data component. Hesse-Biber (2010) suggests using a quantitative study to inform the qualitative study by identifying a target population of interest and to improve the validity and reliability of the quantitative phase of the study. For this study, phase-one data informed the selection of phase-two participants, in particular, those respondents providing answers to survey questions that fell outside the norm, or provided answers that demanded further investigation and deeper understanding.

Figure 4

*Sequential Strategy for this research as suggested by Creswell (2003)*
Quantitative Phase

**Purpose**

For phase-one of this research, a short online survey of fourteen questions was developed by the researcher and used to collect demographic information and data about the use of technology within the sample population. A survey is the preferred data collection procedure for this study because surveys have the “ability to estimate quantitatively the distribution of a characteristic in a population, and to accomplish this by obtaining information from only a small portion of that population” (Dillman, 1991). The survey was cross-sectional in nature obtaining a snapshot of a point in time. The survey was kept deliberately short in an effort to improve response rate from busy faculty members.

A pilot of test of the first survey was conducted at an institution other than the focus of this research. The pilot survey received responses from 32 faculty members. Participants were asked to provide feedback on the questions and design of the survey. The pilot survey results in concert with the feedback received resulted in modifications to improve the survey design.

To increase response rate, respondents were informed that each completed survey would result in a $1.00 donation to a local charity. The survey was self-administered via a Web-based instrument. The rational for a Web-based survey over other data collection methods includes low cost, better control of survey flow, convenience and ease of access for both the survey taker and researcher, easy extraction of data, and automated nagging.

**Participants**

Creswell (2008) illustrates the relationship between population, target population,
and the sample as concentric rings representing respectively smaller portions of the population. The purpose of sampling is to generalize a characteristic of the population from studying the sample. The population consists of all individuals that share a common characteristic. The target population is a subset of the population know by or accessible to the researcher. Finally, the sample is those individuals from the target population that actually participate in the research.

For this study, the population of interest is faculty at institutions of higher education; the target population is faculty at a large, Midwestern, Land-grant university; and the sample will be those faculty that completed the survey instrument. The subject institution is reported to have 1,350 full and part-time employees with a faculty designation ("College Factual," 2014). To reduce coverage and sampling error, names of faculty from the subject institution were developed from publicly available or institutional records such as annual budgetary records. Faculty with titles that indicated research only or other non-teaching appointments were eliminated from the list. The resulting panel included 1,152 participants. Since a comprehensive list of the population exists, a single-stage sampling method was used. No population stratification was used in the sampling and a sample of convenience of those individuals completing the survey will be the basis for analysis.

Dillman (2007) provides the following formula for determining sample size:

\[
N_s = \frac{(Np)(p)(1-p)}{(Np-1)(\frac{b}{E})^2 + (p)(1-p)}
\]

Where: 
Ns – completed sample size for level of precision
Np = size of population
p = proportion of population expected to choose one of two responses

B = acceptable sampling error

C = Z statistic at confidence level

For the target population of this study at a 95% confidence level and ±3% sampling error, the equation would be:

\[ N_s = \frac{(1152)(.5)(1-.5)}{(1152-1)(.03)^2 + (.5)(1-.5)} \]

\[ N_s = 554 \]

Therefore, a minimum of 554 (48%) responses were required to achieve a 95% confidence level with ±3% sampling error. From the 1,152 invitations, 610 participants responded and 597 completed the survey for a response rate of greater than 52%. This response rate exceeds the 554 responses needed to achieve a 95% confidence level with ±3% sampling error.

**Survey Instrument**

The survey instrument was developed specifically for this research. The short, fourteen-question survey includes questions of basic demographic information and questions about mobile technology use in the curriculum. Question types used included binary (Yes/No, True/False, etc.), multiple choice (only one selection allowed), multiple selection (multiple selections allowed), and Likert ranking. A copy of the survey instrument is located in Appendix A.

**Communications Plan and Survey Delivery**

To increase response rate for the survey portion of this study a pre-survey
message was sent to inform potential participants about the nature of the study, that participation is voluntary, and when to expect the invitation to participate. An invitation to participate in the survey was sent via email a few days after the initial message. Three follow-up messages were scheduled at one-week intervals to remind non-responders to complete the survey. Reminder messages were only sent to individuals that had not previously completed the survey. The survey was delivered via the Qualtrics online survey service. The Qualtrics system allows for building distribution lists and automation of invitations and reminder messages. In addition, the Qualtrics system has a “prevent ballot box stuffing” function that improves validity of data by preventing a single person from completing multiple surveys.
Variables

Table 1 relates quantitative variables, research questions, and survey questions.

Table 1

*Relationship of quantitative variables, research questions and survey questions.*

<table>
<thead>
<tr>
<th>Variable Names</th>
<th>Research Question</th>
<th>Items on Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, Ethnicity, Experience, Role</td>
<td>What characteristics exist that might distinguish technology adopters from non-adopters.</td>
<td>Questions 2, 3, 4 &amp; 4</td>
</tr>
<tr>
<td>TechUsing, DesignedFor, DevicesUsed, DeviceRequired</td>
<td>Are faculty integrating mobile technology into courses?</td>
<td>Questions 7, 8, 9 &amp; 10</td>
</tr>
<tr>
<td>Adoption</td>
<td>Do characteristics exist that might distinguish technology adopters from non-adopters.</td>
<td>Question 11</td>
</tr>
<tr>
<td>Motivators</td>
<td>What factors influence the adoption of technology in the academe?</td>
<td>Question 12</td>
</tr>
<tr>
<td>SigMotivator</td>
<td>What can institutions do to encourage the integration of mobile technology by faculty?</td>
<td>Question 13</td>
</tr>
</tbody>
</table>

Quantitative Data Analysis

Analysis of the quantitative portion of this study provided information on the general characteristics of the sample, including numbers and percentages of respondents.

The survey was open for only 28 days; because of the narrow timeframe, it was decided...
that wave analysis (Creswell, 2003, 2008) was not required. Descriptive analysis provided means, standard deviations, and ranges for the variables. Finally, with the small number of variables in this study, it was determined that factor analysis was not required. IBM® SPSS® and other software were used to perform data analysis.

**Qualitative Phase**

*Qualitative Data Collection*

Data for phase-two, the qualitative portion of this study, was collected from interviews of a subset of respondents to the online questionnaire. To encourage participation in the interview phase of this research, a $20.00 donation was made for each interview to the same local charity as in phase-one. The interviews were conducted via phone or Skype™ and generally lasted 30 to 60 minutes, although a few ran shorter or longer. The interviews allowed for deeper questioning of the relevant topics and provide triangulation and validation to the online questionnaire data (Creswell, 2007). Audio recording were made of the interviews and later transcribed.

*Participants*

Participants for phase-two were selected based on results from phase-one of this study. Analysis of the quantitative component produced outlier cases. Deeper exploration of these outliers through qualitative interviews revealed better understanding of the factors that make these responses diverge from the norm (Creswell, 2003).

*Qualitative Instrument*

An initial set of questions was developed based on results from the quantitative phase of this study. Interviews began with the same set of initial questions and were augmented with follow-up questions and deeper probing based on responses to the base
Qualitative Analysis

Interview transcripts were coded and analyzed for descriptive and topical themes or categories. Several coding techniques are available for qualitative analysis. “Descriptive coding” can provide factual and contextual information about data, while “topic coding” was used to identify topics for later analysis, and “analytic coding” allows for the analytical development of new themes that may emerge from the coded data (Morse & Richards, 2002).

Procedures

This research design was submitted to the University of Nebraska-Lincoln Institutional Review Board (IRB) for consideration of compliance with University and Federal human subject research regulations. Approval of both phases was sought and approved. Once IRB approval was obtained, initial invitations were sent via email.
CHAPTER FOUR
RESULTS AND ANALYSIS

Quantitative Analysis

Data for the quantitative phase of this research were collected using an online survey instrument consisting of fourteen questions. An invitation to take the survey was emailed to 1,152 faculty at a large land-grant university. From the 1,152 invitations, 610 participants responded and 597 completed the survey for a response rate of greater than 52%. This response rate exceeds the 554 responses needed to achieve a 95% confidence level with ±3% sampling error.

Descriptive Analytics

Of the 609 respondents, 395 (65%) identified as male and 214 (35%) identified as female. Teaching experience was represented by 115 (19%) faculty with less than 10-years of teaching experience and 492 (81%) with ten or more years of teaching experience. At the time of the survey 542 (90%) indicated they were in a teaching role and 62 (10%) were not currently teaching. The survey instrument was designed such that if someone answered no to the question of whether the respondent was currently in a teaching role, they would be taken to the end of the survey with no other questions presented. Table 2 lists the ethnicities reported by respondents. Respondents came from across the academic spectrum and all major academic divisions were represented; Table 3 summarizes the academic affiliations of the respondents.
Table 2

*Respondent Ethnicity*

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>$N$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>502</td>
<td>83%</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>22</td>
<td>4%</td>
</tr>
<tr>
<td>Black/African American</td>
<td>17</td>
<td>3%</td>
</tr>
<tr>
<td>Native American/American Indian</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>53</td>
<td>9%</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>608</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 3

*Faculty Academic Affiliation*

<table>
<thead>
<tr>
<th>Academic Affiliation</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>College of Arts and Sciences</td>
<td>183</td>
<td>30.81%</td>
</tr>
<tr>
<td>College of Agriculture</td>
<td>169</td>
<td>28.45%</td>
</tr>
<tr>
<td>College of Engineering</td>
<td>72</td>
<td>12.12%</td>
</tr>
<tr>
<td>College of Education</td>
<td>51</td>
<td>8.59%</td>
</tr>
<tr>
<td>College of Fine and Performing Arts</td>
<td>32</td>
<td>5.39%</td>
</tr>
<tr>
<td>College of Business</td>
<td>21</td>
<td>3.54%</td>
</tr>
<tr>
<td>College of Journalism</td>
<td>21</td>
<td>3.54%</td>
</tr>
<tr>
<td>Libraries</td>
<td>20</td>
<td>3.37%</td>
</tr>
<tr>
<td>College of Law</td>
<td>11</td>
<td>1.85%</td>
</tr>
<tr>
<td>College of Architecture</td>
<td>8</td>
<td>1.35%</td>
</tr>
<tr>
<td>Museums</td>
<td>6</td>
<td>1.01%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>594</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Respondents were asked to select from a list of various types of digital resources they were currently using; they could also select “other” and enter freeform text to describe resources not listed. Figure 5 provides a graphical representation of the results of this question. The top four technologies used by faculty in connection with teaching are email (94%), presentation software (PowerPoint®, Keynote®, etc.)(76%), links to Web content (74%) and a learning management system (Blackboard™, Sakai, Moodle, etc.)(72%). The percentages drop for videos (53%), images (48%) and online discussions (29%). The other listed technologies are used by 25% or fewer of the respondents.
A bar graph comparing technology use by gender (Figure 6) demonstrates slight differences in adoption rates for various digital technologies used by faculty. The proportion of males and females using each technology category were calculated and z-score computed. The null hypothesis for each category was assumed $H_0: p_1 - p_2 = 0$ or no difference based on gender. The computations were done such that a negative z-value indicates female. Computing z-test for means for each technology category by gender reveals significance exists in only four of the categories; videos ($z = -3.04, p < 0.002$, two-tailed), text messaging ($z = -2.70, p < 0.00694$, two-tailed), podcasts ($z = -3.05, p < 0.00228$, two-tailed) and online discussions ($z = -3.21, p < 0.00132$, two-tailed). This indicates female faculty use these four technologies significantly more than their male counterparts. Differences in use of other technologies are not significantly different.
Comparing years of teaching experience to technology use in the curriculum (Figure 7) reveals slight, but in most instances insignificant differences in technology adoption between faculty with less than ten years of experience and faculty with ten or more years. Proportions of the teaching experience groups using each technology category were calculated and z-score computed. The null hypothesis for each category was assumed $H_0: p_1 - p_2 = 0$ or no difference based on years of teaching. The calculations were done such that a negative z-value indicates teaching experience $\geq 10$-years. One technology, email, is used significantly ($z = -3.12, p < 0.0018$, two-tailed) higher in faculty having ten years or more of teaching experience.
When asked if mobile devices were a consideration when formatting digital content and activities for students (Figure 8), 10% of respondents said they do format for mobile devices while 89% said they do not. It is interesting to note that 1% or about 6 respondents said they used no digital resource in their courses.
When asked what devices are used or targeted when deploying materials for mobile use (Figure 9) 72% of respondents said none, 19% said iOS® devices, 13% indicated Windows®-based devices and 6% said Android™. It is not unusual for professional schools to require students to provide their own computer or make devices available for students to use. As faculty move to more mobile friendly content there may be a move to requiring students to provide their own devices. When respondents were asked about the current policy on this (Figure 10) 85% said they neither provide devices nor require students to own a device. Eight percent encourage students to have a device, 4% require students to provide their own device and 2% are providing devices to students to use.
Figure 9

**Mobile Devices Targeted**

- None: 72%
- iOS* devices: 19%
- Windows-based device: 13%
- Android* devices: 6%
- Other: 3%
- E-reader: 1%

Figure 10

**Device Requirements**

- Neither provide nor require: 85%
- Encourage students to provide: 8%
- Require student to provide: 4%
- Provide to student: 2%
Attitude towards adoption of mobile technology

To find out the attitude of faculty towards the incorporation of mobile technology into the curriculum, in light of the ubiquitous nature of the devices amongst students, respondents were asked to make a choice between 5-likert scale options; “Strongly Agree”, “Agree”, “Neutral”, “Disagree” and “Strongly Disagree”. Figure 11 graphically represents the results indicating that 12% strongly agree and 31% agree that mobile technology should be integrated into the curriculum. On the other end of the scale 12% disagree and 4% strongly disagree with the use of mobile technology. Considering a “Top Two Box Score”, 43% of respondents feel mobile technology should be integrated into the curriculum. Using a “Bottom Two Box” score, 16% disagree with the idea of adopting mobile technology.

Figure 11

Faculty Attitude towards Mobile Technology Adoption
Kendall’s Tau was computed to determine the relationship between the number of technologies used and the Likert scores selected by individuals. The results of this analysis are found in Table 4 below. A significant positive correlation ($\tau = 0.288$, $n = 535$, $p = 0.01$) between the number of technologies faculty were using at the time of the survey and their agreement that more mobile technology should be incorporated into the curriculum.

Table 4

*Kendall’s $\tau$ for Faculty Technology Use and Agreement on Mobile Adoption*

<table>
<thead>
<tr>
<th>Kendall's tau_b</th>
<th>Support Adoption</th>
<th>Correlation Coefficient</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.29**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td></td>
<td>535</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

The graph in Figure 12 plots technologies used vs agreement on adoption of mobile technologies. The Likert choices “Strongly Agree”, “Agree”, “Neutral”, “Disagree”, and “Strongly Disagree” were assigned the values 5 to 1, respectively. Responses were grouped by the total number of technologies currently used (1 to 10) and the mean of the Likert scores for each group was calculated.
Motivators

Study participants were asked to select from a list of motivators those that would help them potentially adopt more mobile technologies. The possible selections included: Improved outcomes for students, improved student engagement, additional resources, professional development, institutional development resources, peer support, reduced teaching and research load, monetary stipend, credit towards promotion and tenure, special recognition, none of these, and other. If other was selected a text field was made available for the respondent to enter alternative answers. Figure 13 graphically depicts the results from this question.
Motivators by Percent of Respondents Selecting

To further understand the question of motivators, participants were asked to rank the motivators selected; only the motivators selected in the previous question were presented for ranking. The results of the motivator ranking are presented graphically in figure 14. An examination of the role of gender and years of teaching in the selection of motivators (figures 15 and 16) show only slight differences between how male and female faculty or faculty with less than 10 years of teaching verses those with ten or more years selected motivators. A z-test for means calculated for each category revealed no significant differences.
Figure 14

**Ranked Motivators**

![Bar chart showing ranked motivators.]

Figure 15

**Motivator by Gender**

![Bar chart showing motivator by gender.]

- Male
- Female
Summary of Quantitative Analysis

Faculty are using a number of technologies for communications and content delivery related to courses. Email, presentation tools, Web content, videos, images and online discussions were reported as most frequently used by faculty. Gender seems to generally not play a role in the type of technologies used; however, significant positive correlation between being female and the reported use of videos, text messaging, podcasts and online discussions was found. Years of teaching had little significant influence on the technologies used by faculty except in the use of email; a significant positive correlation was found for teaching experience greater than or equal to ten years and the use of email. About 10% of faculty consider mobile devices as they prepared materials for electronic distribution of course materials. One percent of respondents said
they use no technology for courses. Mobile devices primarily targeted by faculty for content delivery and applications include iOS® (19%), Windows™ (13%) and Android™ (6%); the majority of faculty (72%) did not consider mobile devices. At the time of this research most faculty neither provided nor required students to have a device while a very small percentage required students to provide their own device. A very small number of faculty were providing devices to students. A portion (43% top-two box) of faculty agreed that mobile technology is a resource that needs to be capitalized on. There was also found to be a significant positive correlation ($z = -0.657311438, p = .255$) between how much technology faculty currently used and their attitude towards the integration of mobile technology.

Motivators that most likely encourage faculty to integrate mobile technology into their curriculums include (in order of importance) improved outcomes, improved engagement, additional resources, professional development, reduced teaching and research loads and peer support. It was found that gender and years of teaching had no correlation to the selection or rankings of motivators.

**Qualitative Analysis**

Interviews were conducted after an analysis of survey results. One question on the survey asked if the respondent would be agreeable to an interview; any respondent that responded “no” was eliminated from consideration for an interview. The remaining respondents were evaluated as potential interviewees based primarily on current technology use but also on the nature of interesting or unique survey responses. There were 19 possible digital resources listed in one question on the survey and a respondent could choose all that were applicable. The selection process resulted in identifying 35
participants of interest. Of the 35, 12 (34%) indicated they used 4 or less listed digital resources and 14 (40%) indicated use of 11 or more of the digital resources. The other 9 (26%) were using 5 to 10 of the digital resources but also listed other unique technology solutions that they had incorporated into their teaching. Some of the unique activities included self-authored e-books, G+ Learning Communities, interactive polling (phones as clickers), etc. An initial invitation to participate in a telephone or Skype™ interview was emailed to the 35 identified participants. Of the 35 invited, one ultimately opted out of the interview, and six never responded. Twenty-eight interviews were conducted. Of the 28 interviewees, 19 (68%) identified themselves as male and 9 (35%) female; this ratio is similar to the proportion of male and female respondents to the survey. Three (11%) of the interviewees indicated that they had less than 10 years of teaching experience and 25 (89%) said they had 10 or more years of teaching experience. Discipline was not a consideration in the selection process but a diversity of disciplines was represented by interviewees, including the physical and earth sciences, arts, education, humanities, social sciences and professional schools. Actual disciplines represented in the interview pool included: advertising, agronomy, animal science, art history, astronomy, atmospheric science, biological sciences, broadcasting, education, educational psychology, engineering, entomology, geography, horticulture, journalism, law, modern languages, music, physics, psychology, and veterinary medicine.

**Interviews**

A semistructured approach, as described by Merriam (1998), was employed for the interviews. Twelve questions (Appendix D) were developed and used as a framework for the interviews. The questions were generally asked in sequence and as written but
diversions were allowed and follow-up questions asked to elicit deeper responses and improve interview flow. The interviews took place over a 5-week period and were scheduled to best accommodate the interviewees schedule. Interviews were conducted via phone or Skype™. Audio recordings and notes were kept for each interview. At the beginning of the interview participants were asked if an audio recording of the session was acceptable. A link to the “Participant Informed Consent Form” (Appendix C) was included in the email invitation to provide an opportunity for review prior to the actual interview, if a participant had not viewed the informed consent form, it was read to them. Verbal consent was obtained from each participant. Once consent was given the interview commenced. Most interviews lasted approximately 30-minutes but some lasted more than an hour or as short as 15-minutes, all depending on the length of the answers provided.

Qualitative analysis

During interviews, notations of important comments were kept. The notes served as an aid in the transcription process. Hesse-Biber and Leavy (2006) suggests that it is the researcher’s prerogative to select the transcription process most appropriate for the study at hand. Merriam (1998) describes the interview log as an organizational tool for transcribing and summarizing “important statements and ideas” and researcher notes and tying them to reference timecodes from the recording. For this project, an interview log constructed in Microsoft® Excel® was employed for the organization and textual recording of key statements from interviews. An example of the interview log is available in Appendix E. Responses were transcribed from the audio recordings verbatim into the interview log. The transcribed phrases from each interview log were then copied to a
master spreadsheet for coding. A hierarchical textual coding schema was developed to classify and group the transcribed remarks. The coding schema employed general-to-specific code string of descriptive terms separated by a period. For example:

behavior.student.mobile.addicted.

Statements rich in content had multiple code strings assigned. Once all statements were coded, all the code strings were copied to another spreadsheet for sorting, normalization and grouping. The hierarchical coding schema allowed for easy sorting and grouping of code strings. Code strings were finally grouped using color fill properties of the spreadsheet cells to provide a visual organization.

**Qualitative Results**

A number of themes were woven throughout the responses. Broad themes emerged in the areas of student and faculty behavior, resource allocation, technology in general and mobile technology use specifically. Five dominant themes formed around the idea of adoption of mobile technology; time, expert help, best practices, technical knowledge and resources.

*Resources:* statements related to resources were frequent. Obviously, the root resource implied is money; money to provide equipment, software, services and people. There were more than 70 statements involving the need for some form of resource. The most frequently discussed resources included experts, graduate assistants, devices, software and online services. Time and experts will be presented separately below. Many participants felt strongly that if the university has an expectation for faculty to integrate technology into instruction, the devices and applications should be provided such that faculty can become better versed in their use. With the frequent advancements and rapid
obsolescence of technology faculty also feel that it is imperative that devices and software be refreshed frequently. Many services now reside in the cloud, so continued funding of these services is important to faculty using them.

*Time:* phrases referring to time occurred 33 times. Many participants spoke of the already overwhelming demand on their time due to teaching, research and service responsibilities. Finding time to learn new technologies and incorporating them into their instruction in a meaningful way would be a challenge for most faculty under current workloads.

“It's going to go back to the time issue. I have absolutely no problems if administration says ok, we want you to move towards the mobile format or more technology for everything, that's fine, but what's going to have to happen is you're going to have to give me a release in other areas because of my job description. Because I have a research program I have to maintain and I have to keep funded, I have to keep publishing, I have to do all of that, but then the university expects you to serve on faculty committees, expect[s] you to do service works, all of this, and if you don't do that, then they start sending nasty email asking why you're not doing that.”

Several suggestions were made as how to overcome the time constraint, including reduced teaching, research and service responsibilities, and greater availability of summer pay for course development and technology integration. Another common suggestion to help alleviate the time constraints of faculty is funding for additional graduate student positions explicitly for technology integration and management. Graduate students could offload much of the day-to-day technology development and course management tasks from faculty.
“You do what you are used to doing, if it seems successful. If you're not forced to in some way to adopt some other methods, even if you believe they are useful, you're busy people. People are extremely busy and rely on what they have been doing in the past.”

*Expert Help:* references to some form of expert help occurred 33 times. Many interviewees said they would consider moving more content and activities to a mobile environment if they had access to a person knowledgeable of sound pedagogical practices, the technology and best practices when implementing mobile technology for instruction. To be effective, this person would have to be readily accessible and available for extended desk-side coaching sessions. The need for an embedded instructional technologist, one knowledgeable of the discipline was repeated several times. The notion of extended one-on-one, focused support time seems to be an important prerequisite for faculty to venture into new technology-based course innovations.

“I team up with people that have the skills.”

*Community of Practice:* faculty express great interest in forming “communities of practice” for the sharing of knowledge and examples amongst faculty; not only within the department and campus but extramural also. Faculty are eager to see what others have tried, what has been successful, and what not to do. Terms related to peer-to-peer exchanges, communities of practice, and collegial support occurred 22 times.
Best practices: several interviewees expressed concern that they do not know what the best practices are when incorporating mobile technology into instruction and based in sound instructional theory. Understandably, this concern prevents some faculty from even exploring new technologies.

“As far as workshops, I’d appreciate some workshops on some of the newer types of formats that come out; primarily just to get a feel for it and get enthusiastic about and see what can be done.”

Technical knowledge: lack of personal knowledge and understanding of mobile technology concerned many of the interviewees. It was expressed that having to rely fully on someone else to implement a new technology left many faculty feeling uneasy and not in control. To overcome gaps in knowledge it was suggested by some that having mechanisms for knowledge transfer, such as seminars, workshops and institutes lead by experts knowledgeable in the best practices in both pedagogy and technology integration would make faculty less fearful of unknowingly implementing poor practices. Concerns were expressed with existing training in that workshops are often lead by “techies” gifted in “tech-speak” that leaves less technology savvy faculty feeling left out. To be effective, technology workshops should be presented in ways that are accessible to faculty with all levels of technology experience.

“There’s just all kinds of design issues which training, [...] real training in that particular area are required to really have a sharp snap, good product. I don’t have those skills but hook up with people that do.”
**Banning:** When asked about the practice of banning mobile devices in the classroom, most faculty were reconciled to the fact that mobile devices are endemic and attempting to ban their use in class is futile. Terms used to describe the practice of banning mobile devices during class included uninformed, hypocritical, futile, ineffective, ivory tower thinking and over reaction. Feelings about the use of mobile devices in class range from outright disdain to welcoming. There is general agreement that non-structured use of mobile devices during class can distract students from engaging in the class or become disruptive; however, there is also general agreement that structured use can be enriching and engaging. Strategies to cope with mobile devices in class include ignoring them altogether, suggesting that students disengage from their technology during some class activities or to plan class activities incorporating mobile devices. Only four participants supported banning mobile devices during class. Three participants expressed sensitivity to the need for students to remain connected even during class so they could receive alerts from the university alert system or emergency calls about children.

“[…] but I think that [banning devices] is lost already. Were probably better off strategizing how to make it work for us instead of trying to avoid it because I just don't know how you can.”

**Behavior:** Many statements were made that revealed sentiment about the behaviors of faculty and students around the use of technology and class structure. Three statements suggested that having more class materials online allows students to procrastinate. There is also an emerging sense that there is a digital version of “the dog ate my homework” excuse where students claim that they did not know how to perform
some technological process or something crashed. Another theme is that students’ behavior around their mobile devices is addictive and distracting; however, those sentiments are countered by statements such as students’ use of mobile devices in class is respectful, they’re quick adopters and engaged with class. Comments from faculty about faculty behaviors about lack of integrating technology in the curriculum included the phrases lazy, resistive to change, set in their ways, nervous about new stuff, and fear students know more about technology than faculty.

**Incentives:** Incentives were mentioned infrequently frequently during interviews but there were two important ideas expressed. First, credit towards promotion and tenure and other recognition for the integration of technology into the curriculum seems to be important to some faculty. Secondly, money in the form summer pay, stipends or grants for the development and integration of technology would help move more faculty to adopt more technology.

**Efficacy of technology:** Another topic that came up less frequently but seemed important is the desire by faculty to have available results of quality research into the efficacy of mobile technology. While most faculty interviewed believed that mobile technology holds some promise of improved learning outcomes and better engagement for students; some expressed concern that without the guidance of empirical research into the efficacy and best applications of this technology, they were unwilling to invest the time and resources to adopt it.

**The potential of mobile:** While some faculty were unsure of the role of mobile technology in the curriculum, the overall message was that faculty recognize there is some potential positive use of mobile devices in the curriculum. Some are already using
mobile technology to assess understanding and provide immediate feedback to students.

"I am using Poll Everywhere in my large lecture this semester and many of the students are texting or tweeting their answers to in-class polls. I think that it's easier than using things like clickers because everyone has their phone with them all the time, you don't necessarily remember the clicker."

"One aspect that is very easy to use on its surface is that ability to use it [mobile device] as a clicker system, as a response system."

Some faculty are embracing the information retrieval abilities of mobile devices to drive discussions. Digital books (eBooks) are another resource faculty are beginning to use to make media more accessible on students’ mobile devices.

“I use eBooks as supplemental material for students that may not have sufficient background in the course.”

“I've written 3-iBooks for my classes as my textbooks. I'm putting Pearson out of business one [...] at a time.”

There is also recognition that this is technology that students are already engaged with and willing to use. Phrases used to describe the use of mobile technology include positive, better access to materials, expand boundaries and improves student-teacher communications. Even a self-described technology “laggard” acquiesced that for some use cases, mobile technology could be a beneficial part of the curriculum.

“We found that the side effect was they were engaged more and if you're engaged more you want to read more, so they are reading it more than if I was just giving them a handout because it was fun clicking on the words and they could get it, it wasn't too hard.”
“I think access is huge. The first thing I would say from my professional doctoral learning communities is that they're not having to spend $330-$500 a semester for a course because I provide them total access to key resources that I have permission from National Academy Press or National Academy of Sciences. So, when I was going to school I was spending $200, $400, $500 per course, for books, library materials, educational resources. Today's students I reduce that cost to, you know, less than, I don't have them buy many things anymore because I try to get them easy [access] and they can just buy some paper and they can print what they want, and they can buy the hardcopy at used bookstores or whatever. I'm trying to minimize their costs maximize the interconnected resources that they can draw on as they're building the research literature reviews and writing their thesis proposals and doing what I would say the careful reading and design part with colleagues in my class. So, in that sense the digital age that we are living in has provided that opportunity for students to gain access to these materials and that's what I've been doing with my google learning communities, I can provide that private space that I promised to the National Academy.”

“Yes, in terms of accessibility, I would say so. I think one of the ongoing debates is what is the best experience. I personally still believe that face-to-face classroom in the same space is a better experience probably for the most part but using a wireless device to be able to communicate with people but certainly in terms of being able to have access globally, anyplace you have wireless link is a wonderful thing to use.”

**Summary of qualitative findings**

Analysis of interview transcripts reveals that faculty have a sense that the unique qualities of mobile technology holds some promise for engaging students in ways not available with previous technologies; the immediacy of information access, portability, always connected and anytime-anyplace availability provide many options for faculty to incorporate mobile technology into the curriculum. Most of the participants interviewed
felt that mobile technology had a place in the curriculum. Faculty are beginning to figure out ways to capitalize on this resource; however, there are a number of barriers limiting broader adoption. With the introduction of computers into instruction, the complexity of adopting new, computer-based instructional tools has become vastly more complex than say, video tape machines and 16mm film projectors. This higher level of complexity have left faculty feeling uneasy about their own understanding of new technology and fearful of implementing something they don’t fully understand. To overcome this gap in knowledge and reduce anxiety, faculty need a number of resources to help adopt new technology.

First, professional development opportunities in the form of workshops, in-service training and week-long institutes were suggested as ways to build faculty knowledge and comfort. Furthermore, for professional development to be successful, it needs to be presented in a way that reaches audiences of all levels of technical understanding.

Secondly, it is important that faculty be part of a community of practice where the free exchange ideas around new technology and pedagogy integration can take place. Faculty are interested in what others have tried, the efficacy of those innovations and suggestions on how it might work for them. Faculty seem to be more comfortable with the peer-to-peer exchange of ideas over other methods of knowledge acquisition.

Thirdly, faculty repeatedly express distress over their already overwhelming time commitments. Faculty feel that their schedules are overloaded with teaching, research and service responsibilities and do not have time to research and implement a new, complicated technology into their courses. Additionally, it must be understood that to take advantage of professional development opportunities places yet another burden upon
faculty’s already full schedules. Remedies suggested to alleviate time constraints included temporary release from teaching or research, reduced committee and service responsibilities or summer pay for instructional development. Another resource that would in effect provide faculty more time is the hiring of more graduate assistants to implement and manage new technology integration.

The fourth resource is access to current devices, software and services. Faculty need to have devices in-hand to become familiar with the nuances of any given solution; hardware and/or software. The sense is that if the university administration desires faculty to try new technology then it has to step up and fund the acquisition of the tools so that faculty can learn how to best adapt them. This goes for cloud-based services also. For example, some faculty are using services like Poll Everywhere™ that allows students to use their phone as a “clicker.” Some services like this may have a no-cost option but with significantly reduced features or limited use. Generally, these services require a monthly or annual fee to access or to unlock more advanced features and obtain support.

Lastly, access to experts that can provide a high level of support with the integration of technology and pedagogy; instructional technologists that have expertise in best practices, current technology and learning theory that are available for one-on-one, intensive and focused sessions with faculty. The preference is for an embedded expert that has or develops an understanding of the discipline and courses taught in a given department.

Overall, faculty are cognizant of new technologies in general and mobile technology in particular and have a sense, at least on an intuitive level, of the potential these devices hold, but the barriers of time, resources and knowledge prevent many from
venturing into uncharted territories. Regardless of the challenges, a number of brave souls are entering into this new territory willingly, or driven by professional demands of their respective fields, charting the course for others to follow.

Integration of Qualitative and Quantitative Results

This section will attempt to align the quantitative and qualitative results by discussing the findings in relation to the research questions.

Primary Research Question

Are faculty integrating mobile technology into instruction?

The primary research question asks a simple but important question – what are faculty doing with this new technology. This question was answered by this research through integrating both the quantitative and qualitative data derived from questions of general technology use, mobile technology use specifically and questions about the efficacy of the use.

The results indicate that only 10% of faculty currently used or considered mobile technology when developing materials or activities for students. A few were actively developing applications for mobile devices but the majority of faculty used simpler, easier approaches to mobile integration by using existing services that automatically scaled to a mobile platform. Examples of these self-scaling services include Blackboard™, WordPress sites, YouTube™, Skype™ and similar.

Secondary Research Questions

In what ways is mobile technology used?

Primary uses of mobile technology were found to be information retrieval and communications. In some disciplines, Journalism for example, text messaging,
information retrieval and social media have become important tools for professionals. To ensure graduating students are fluent in the technological demands of their professions, faculty in these areas rely heavily on mobile technologies. Less frequently, custom or third-party applications were used to provide interactive tools or models to students. Faculty are also starting to recognize the value of the immediacy of information retrieval available with mobile devices and are beginning to incorporate these tools in the classroom. Mobile devices are helping to stimulate discussions as students can research topics and provide arguments in real-time during class. Another example provided was the replacing of audience response devices (clickers) with mobile devices. Faculty are turning to cloud-based materials, commercially available eBooks or self-authoring eBooks as a means to economically provide media content to students.

**Do characteristics exist that might distinguish technology adopters from non-adopter?**

When asked what first moved faculty towards the use of technology the most common response related some event inspired an epiphany. One participant talked of attending the Apple® conference where Steve Jobs debuted the first iPad®

> “That moment when Steve Jobs came out on that stage and showed the iPad, I knew in my heart that this had changed my life.”

Others spoke of attending workshops, seminars or conferences and seeing demonstrations of new technologies in ways that illustrated a use case important to the participant. Beyond the epiphany moments, adopters used terms such as fearlessness, risk-taker, and a willingness to learn from others – including students. Finally, faculty using technologies generally hold some personal affinity towards technology in general, while those using little or no technology have little personal attraction to it.
When years of teaching were compared to technology use, the survey data demonstrates that there is no relationship between years of teaching and technology use. This finding seems to dispel the popular notion that younger faculty are driving the use of technology; a notion promoted by some of the interviewees.

**What factors influence the adoption of technology in the academy?**

Looking at the ranking of motivators, additional resources, professional development, institutional support and reduced teaching/research load were ranked third, fourth, fifth and sixth.

The most frequently mentioned influence is the availability of expert technology support; specifically, embedded support personnel with expertise in instructional technology, learning theory and an understanding of the subject matter. Participants expressed a strong desire for having a support person available for focused, one-on-one time before each semester to help prepare the technology. In addition to expert support to provide suggestion, guidance, best practices and trouble shooting, faculty expressed a need for graduate assistants to help with the implementation and management of technology resources.

Time was the second most cited factor related to the adoption of technology. Faculty feel they have little time to devote to the pursuit of investigating new methods of instruction. Reduced teaching or research loads or summer pay were suggested as ways to provide time for exploration of technology integration.

Professional development, workshops, training – faculty need to feel comfortable with the technology they are using in their courses. To be effective, these need to relevant to faculty and presented in a way that matches the level of understand of the faculty.
Faculty need access to devices, applications and services. Faculty feel that they need hands-on experience with the devices and software before they implement it.

Finally, Participants demonstrated a strong desire to interact with their peers to discover what others are doing with technology, what mistakes they have made, and hear of the outcomes from using the tools.

**What can institutions do to encourage the integration of mobile technology by faculty?**

Additional funding – faculty frequently expressed the need for additional funding to provide embedded support; summer pay, graduate assistants; and for the acquisition of devices, applications, and cloud services.

Provide relief – faculty need time to investigate and adopt new methods of instruction, this is especially true for the integration of mobile technology. Providing reduced teaching and research loads will provide time for faculty to devote to instructional improvement.

Provide Communities of practice – develop methods for peer-to-peer knowledge transfer.
CHAPTER FIVE
DISCUSSION AND RECOMMENDATIONS

Summary

The purpose for this research was to investigate the level and methods of curricular integration of mobile technology at a large, Midwestern, Land-grant university. Furthermore, this research sought to discover the barriers that hinder faculty from adopting new technology. This chapter provides a summary of the study and a discussion of findings.

Discussion

The introduction of computers to the classroom demanded a significant leap in knowledge and skills to effectively incorporate this technology into the curriculum. The introduction of the iPhone® in 2007 and the iPad® in 2010 represented evolutionary steps in computer technology. Overhead projectors, audio tape recorders and video cassette recorders presented faculty with only minor challenges because the skills to operate them were acquired quickly. Mobile technology presents complexity far beyond those of the earlier instructional technologies. Minimal research exists specifically examining faculty use of mobile technology and perceived barriers to integrating this new technology into the curriculum. This study was designed to address several questions. First, the study measured the current state of instructional integration of mobile technology, methods used and the significance of pedagogical improvements. Second, characteristics that might distinguish technology adopters from non-adopters were explored. Lastly, the study researched the factors that influence the adoption of technology and whether institutions should or can encourage the integration of mobile technology into the
curriculum. To answer these questions the researcher used a two-phased sequential mixed-methods approach suggested by Creswell (2003) and Hesse-Biber (2010). The design for this collected and analyzed quantitative data first and used those results to inform and guide the collection of qualitative data. This method incorporates the strengths of both quantitative and qualitative methods and allows for triangulation of data between the two methods. To accomplish the quantitative portion of the study, a short 12-question survey was developed by the researcher and administered online. Potential participants were identified from publically available financial records. The target population was faculty in teaching roles. Job titles were used to identify 1,152 faculty that most likely had teaching responsibilities. Of the 1,152 invitations to participate, 610 participants responded and 597 completed the survey for a response rate of greater than 52%. This response rate exceeds the 554 responses needed to achieve a 95% confidence level with ±3% sampling error. The results of the survey helped inform the creation of interview questions and identify a pool of potential interviewees. Interviewees were selected based on either a high- or Low-level of current technology use or unique and interesting answers to survey questions. Thirty-five participants were invited to participate in interviews; one withdrew from consideration, six never responded and 28 were interviewed. Interviews were recorded and later transcribed. Transcriptions were organized into interview logs and collected into one spreadsheet for analysis and coding. Topological coding (Hatch, 2002; Morse & Richards, 2002) of qualitative data was employed to organize and discover emerging themes within participants’ perceptions.
Alignment with Previous Research

Current literature informed the development of this study which strives to expand upon the research that has come before. Several themes emerged from earlier research that emphasizes the unique opportunities and challenges of mobile technology in the curriculum, faculty perception of technology in general and barriers to adoption of technology. Since technology evolves quickly and new, disruptive technologies emerge over time, i.e., iPhones® and iPads®, periodic reevaluation is justified.

This research finds that years of teaching experience has no effect on the amount of technology used by faculty. This finding stands in contrast to previous findings, e.g., Smerdon et al. (2000) and Tabata and Johnsrud (2008). Faculty want to see empirical evidence of the efficacy of new technology before investing the time and resources to implement it, this finding supports earlier research, e.g., Finley and Hartman (2004) and Lacey et al. (2014). In this study faculty expressed a desire for peer-to-peer knowledge transfer for the use of technology, Miller (2012) discussion of faculty learning community cohorts formed around an iPad® initiative are consistent with findings here. The idea of communities of practice also supports the social networks of bandwagon and technology diffusion theories (Abrahamson & Rosenkopf, 1997; Lanzolla & Suarez, 2012; Sahin & Thompson, 2007). Gibson et al. (2008) suggested age and gender should be examined as factors in technology use. Macharia (2011) found that age and gender are factors in technology use. This study finds limited significant differences in technology use based on gender.

Recommendations for Further Research

The focus of the present research is on mobile technology, though the results
could be applied to any new technology introduced into the curriculum. While faculty recognize the potential of mobile technology they are also unsure of the best practices for implementing mobile technology in the curriculum. Broader empirical research into the efficacy of methods using mobile devices is needed; focusing on defining best practices for adopting mobile technology to improve engagement and outcomes is important.

**Conclusion**

Technology will continue to evolve and that evolution will continue to impact the academic environment. Administration and faculty need to be poised to quickly adopt to the changing technology landscapes. As this research was concluding, Apple® released the Apple Watch; the most advanced wearable technology to date. *The Chronicle of Higher Education* (Young, 2015) reported that faculty at Penn State were already planning research into the new wearable devices to find “how can we use wearable technologies like the Apple Watch to help students think about and reflect about how they learn.” Faculty need to see the efficacy of technologic solutions before they will be willing to invest vast amounts of time and resources to implement. This research shows that Faculty are interested in technology if it can improve engagement, learning outcomes or improve student-instructor relationships. Students are heavily engaged with mobile technology for media access, instant communications and information retrieval; faculty need to be prepared to meet student expectations and address “…the reality that students use these [mobile] devices to browse the Web over 50% of the time.” (Siemens, Gašević, & Dawson, 2015). Administrations need to provide the financial resources to ensure faculty have adequate time, training, expert support, graduate assistants and new devices to enable successful technology integration. Furthermore, institutions need to enable
communities of practice to encourage the free exchange of instructional technology practices.
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APPENDIX A

SURVEY INSTRUMENT

Q1
Participant Informed Consent Form    IRB# 20141215000 EX
Title: Mobile Technology Use in College Instruction

Purpose: This dissertation research project aims to discover the level of instructional use of mobile technologies at the University of Nebraska-Lincoln. You must be 19 years of age or older to participate. You are invited to participate in this study because you are a faculty member at the University of Nebraska-Lincoln.

Procedures: This survey consists of 12 questions. Time to complete the survey is approximately 5 minutes. You may be contacted to participate in a short interview.

Benefits: There are no direct benefits to you as a research participant. Risks and/or Discomforts: There are no known risks or discomforts associated with this research.

Confidentiality: Any information which could identify you will be kept strictly confidential. The data will be stored in a locked cabinet in the investigator’s office and will only be seen by the investigators during the study and for 5 years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings but the data will be reported as aggregated data.

Compensation: No direct compensation to participant. For each completed survey $1.00 will be donated to the Lincoln Food Bank.

Opportunity to Ask Questions: You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator(s) at the phone numbers below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Freedom to Withdraw: Participation in this study is voluntary. You can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, or in any other way receive a penalty or loss of benefits to which you are otherwise entitled.

Consent, Right to Receive a Copy: You are voluntarily making a decision whether or not to participate in this research study. Your checking the box below certifies that you have
decided to participate having read and understood the information presented and have
saved a copy of this informed consent form.

Name and Phone number of investigator:

Phillip Hunter Hauptman, MA, Principal Investigator  Office:(785) 393-8490
David W. Brooks, PhD, Secondary Investigator  Office:(402) 472-2018

☐ I agree to participate having read and understood the information presented and
saved or printed a copy for my records. (1)

Q2 Gender
☐ Male (1)
☐ Female (2)

Q3 Ethnicity origin (or Race): Please specify your ethnicity.
☐ White (1)
☐ Hispanic or Latino (2)
☐ Black or African American (3)
☐ Native American or American Indian (4)
☐ Asian / Pacific Islander (5)
☐ Other (6)

Q4 Teaching experience
☐ Less than 10 years. (1)
☐ Equal to or greater than 10 years. (2)

Q5 Are you currently in a teaching role?
☐ Yes (1)
☐ No (2)
If No Is Selected, Then Skip To End of Survey

Q6 For the purpose of this survey "mobile technology" is defined as any ultra-portable
computing device with a touch-sensitive screen generally less than 11 inches measured
diagonally, capable of running applications and able to connect to the Internet.
Q7 What types of digital resources do you provide to students? (Check all that apply)

- Videos (1)
- Animations (2)
- Digital images (3)
- Teleconferencing (Skype™, FaceTime®, Lync®, Adobe® Connect™, GoToMeeting™, etc.) (4)
- Interactive graphs, charts, maps, or models (5)
- Presentation tools (PowerPoint, Keynote, etc.) (6)
- Links to web content (7)
- Email (8)
- Text messages (9)
- Audience response via mobile device (clicker) (10)
- Podcasts, RSS feeds (13)
- Learning Management System (Blackboard, Sakai, Moodle, iTunes-U, etc.) (16)
- Online discussions (19)
- eBooks (22)
- Lecture Capture (23)
- Audio recordings (24)
- Other (11) ____________________
- None of these (12)

If None of these Is Selected, Then Skip To Do you use any of the following mobil...

Q8 The digital content I selected above is:

- Specifically designed for ease of access from mobile devices (tablets, smart phones, etc.) (1)
- Not specifically designed for mobile access (2)
- I do not provided any content in a digital format (3)

Q9 Do you use any of the following mobile technology devices in your curriculum? (Check all that apply)

- iOS® devices (iPad®, iPod®, iPhone®) (1)
- Android™ OS devices (Google™ Nexus™, Samsung™ Galaxy®, and similar) (2)
- Windows-based device (Microsoft Surface Pro™, Windows™ smart phone, etc.) (3)
- E-reader device (Kindle®, Nook®, Kobo®, etc.) (4)
- Other (5) ____________________
- None of these (6)
Q10 Do you provide or require students to provide mobile devices for course related work?
- Neither provide nor require (1)
- Provide to student (2)
- Require student to provide (3)
- Encourage students to provide (4)

Q11 With the ubiquitous adoption of mobile technology by today’s students, educators should capitalize on this technology through mobile technology integration into the curriculum.
- Strongly agree. (1)
- Agree. (2)
- Neutral. (3)
- Disagree. (4)
- Strongly disagree. (5)

Q12 Which of the below factors would motivate you to move course content to a mobile technology platform? (Select all that apply)
- Monetary stipend. (1)
- Credit towards promotion and tenure. (2)
- Special recognition. (3)
- Additional resources (media developers, technology, graduate personnel). (4)
- Professional development and training. (5)
- Reduced teaching/research load. (6)
- Institutional development services. (7)
- Peer support and collaboration. (8)
- Improved learning outcomes for students. (9)
- Improved student engagement. (10)
- Other (11) ____________________
- None of the above (12)

Q13 Please rank these motivating factors in order of importance to you with 1 being the most important. Click and drag items to reorder.

Q14 A sample of respondents will be selected for a short interview on the use of technology in the curriculum. Participation in an interview will result in a $20.00 donation to the Lincoln Food Bank, up to $500.00 maximum. Are you willing to participate in a short interview?
- Yes (1)
- No (2)
APPENDIX B

SURVEY INFORMED CONSENT FORM

Title: Mobile Technology Use in College Instruction

Purpose:
This dissertation research project aims to discover the level of instructional use of mobile technologies at the University of Nebraska-Lincoln. You must be 18 years of age or older to participate. You are invited to participate in this study because you are a faculty member at the University of Nebraska-Lincoln.

Procedures:
You are asked to answer an online survey of 12 questions. The survey portion will last for only as long as it takes to complete the survey, approximately 5 minutes. The survey will be online and conducted from your computer. A small number of respondents to the survey will be asked to participate in a short interview. The interview portion will last generally less than one hour and will take place via Skype, telephone, or in person.

Benefits:
There are no direct benefits to you as a research participant.

Risks and/or Discomforts:
There are known risks or discomforts associated with this research.

Confidentiality:
Any information obtained during this study which could identify you will be kept strictly confidential. The data will be stored in a locked cabinet in the investigator’s office and will only be seen by the investigator during the study and for 5 years after the study is complete. The information obtained in this study may be published in scientific journals or presented at scientific meetings, but the data will be reported as aggregated data.

Compensation:
Everyone who completes the survey will be entered into a random drawing to have a $500.00 donation made to a local charity. As part of the survey, participants will have the opportunity to indicate a local charitable organization from which to receive the $500.00 if the participant is selected in a random drawing. Furthermore, for participants that complete the survey, agree to be interviewed, and are selected for an interview, they will have $20.00 donated to the charitable organization indicated in the survey.

Opportunity to Ask Questions:
You may ask any questions regarding this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator(s) at the phone numbers below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Freedom to Withdraw:
Participation in this study is voluntary. You can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, or in any other way receive a penalty or loss of benefits to which you are otherwise entitled.

Consent, Right to Receive a Copy:
You are voluntarily making a decision whether to or not to participate in this research study. Your checking the box below certifies that you have decided to participate having read and understood the information presented and have saved a copy of this informed consent form.

☑ I agree to participate having read and understood the information presented and saved or printed a copy for my records.

Name and Phone number of investigator:
Philip Ruster Hapeman, MA, Principal Investigator
Office: (785) 301-8400
APPENDIX C

INTERVIEW INFORMED CONSENT FORM

Script to Obtain Informed Consent for Participation in Interview Research

[ask if recording is permissible, if so turn on recorder]

This interview will last approximately 30-45 minutes. Notes will be written during the interview. An audio tape of the interview and subsequent dialogue will be made. If you don’t want to be taped, you will not be able to participate in the study. Do you give your consent to be recorded?

You volunteered to participate in this research project conducted by me, Phillip Hauptman, a graduate student at the University of Nebraska, Lincoln. This project is designed to gather information about academic work of faculty on campus. You will be one of approximately 30 people being interviewed for this research.

Your participation in this project is voluntary. You understand that you will not be paid for your participation. Your participation in the interview will result in a $20.00 donation to the Lincoln Food Bank. You may withdraw and discontinue participation at any time without penalty or risk of disclosure.

Most interviewees will find the discussion interesting and thought-provoking. If, however, you feel uncomfortable in any way during the interview session, you have the right to decline to answer any question or to end the interview.

You will not be identified by name in any reports using information obtained from this interview, and that your confidentiality as a participant in this study will remain secure. Subsequent uses of records and data will be subject to standard data use policies which protect the anonymity of individuals and institutions.

Other than Doctor David W. Brooks, secondary investigator, faculty and administrators from UN-L campus will neither be present at the interview nor have access to raw notes or transcripts. This precaution will prevent your individual comments from having any negative repercussions.

This research study has been reviewed and approved by the Institutional Review Board, IRB# 20141215000 EX for Studies Involving Human Subjects. For research problems or questions regarding subjects, you may contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965

Do you have any questions at this time?

Do you voluntarily agree to participate in this study?

Have you received a copy of this consent form?
Please state your name.

For further information, please contact:
Phillip Hunter Hauptman, MA, Principal Investigator  Office:(785) 393-8490
David W. Brooks, PhD, Secondary Investigator  Office:(402) 472-2018
APPENDIX D

INTERVIEW QUESTIONS

Q1. Is your teaching done in the classroom, on-line, or both? If both – which is primary?

Q2. Forty-four percent of respondents say they agree or strongly agree that faculty should integrate mobile technology into the curriculum but only 10% provide resources specifically designed for mobile devices; why might this disparity exist?

Q3. Do you feel that the adoption of mobile technology for instruction can improve student engagement and learning outcomes? Positive response follow-up: Why do you feel that way? Negative response follow-up: what would persuade you that this technology can improve engagement and learning outcomes?

Q4. About 90% of students own a smartphone; adoption of this technology for instruction would extend the classroom to almost every student’s pocket. How do you think we could best capitalize on this resource? How might we address the 10% that don’t have a smartphone?

Q5. Your answer on the survey indicates you currently use _________ digital resources. How effective have these been in engaging students and improving outcomes? How have you tested this? If it could be demonstrated that formatting these resources for a mobile device would increase student use of the materials, would that influence you to undertake the redesign?

Q6. What is your perception of students’ use of mobile devices in class? Can you tell me how you have come to that perception?

Q7. There are media reports of faculty banning mobile devices in the classroom; what are your thoughts on this practice? How might this change if students are provided useful instructional materials and activities created to work well in a mobile format that would be used during class time?

Q8. Professional development and support resources are important factors to help faculty move course materials to a mobile environment; what would you consider essential professional development opportunities and support resources that would increase the likelihood you would move content to a mobile platform?

Q9. What one thing could the University do that would influence you to use more mobile technology in your courses?

For current mobile adopters: What first influenced you to adopt mobile technology?

For non-adopters: For you personally, what are some of the barriers that prevent you from adopting mobile technology?
Q10. On the survey you indicated that you were open to being interviewed so you may have thought about possible questions that I would ask. Is there a question or are there questions you think I should have asked you and, if so, what would your answers have been?
## APPENDIX E

### INTERVIEW LOG

<table>
<thead>
<tr>
<th>Timecode</th>
<th>Title</th>
<th>Date</th>
<th>Discipline</th>
<th>Respondent's Comment</th>
<th>Recorder's Notes</th>
</tr>
</thead>
</table>
January 30, 2015

Phillip Hauptman
Teaching, Learning and Teacher Education

David Brooks
Teaching, Learning and Teacher Education
MABL 202, UNL, 68588-0355

IRB Number:
Project ID: 15000
Project Title: Mobile Technology Use in College Instruction

Dear Phillip:

The Institutional Review Board for the Protection of Human Subjects has completed its review of the Request for Change in Protocol submitted to the IRB.

1. It has been approved to modify the survey instrument; the order of questions has changed and new response options have been added.

2. The informed consent form has been revised to remove the details about the interview. However, the interview is still briefly mentioned so that participants know it’s a possibility.

3. Please use the informed consent form submitted with the change request to distribute to participants. If you need to make changes to the document, please submit the revised document to the IRB for review and approval prior to using it.

We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event:
* Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures;
* Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur;
* Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research;
* Any breach in confidentiality or compromise in data privacy related to the subject or others; or
* Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff.

This letter constitutes official notification of the approval of the protocol change. You are therefore authorized to implement this change accordingly.

Becky R. Freeman, CIP
for the IRB
APPENDIX G

IRB APPROVAL LETTER FOR INTERVIEW PHASE

February 26, 2015

Phillip Hauptman
Teaching, Learning and Teacher Education

David Brooks
Teaching, Learning and Teacher Education
MABL 202, UNL, 68588-0355

IRB Number:
Project ID: 15000
Project Title: Mobile Technology Use in College Instruction

Dear Phillip:

The Institutional Review Board for the Protection of Human Subjects has completed its review of the Request for Change in Protocol submitted to the IRB.

1. The interview phase of your research has been approved. The interview questions, recruitment script, and informed consent document have all been approved.

We wish to remind you that the principal investigator is responsible for reporting to this Board any of the following events within 48 hours of the event:
* Any serious event (including on-site and off-site adverse events, injuries, side effects, deaths, or other problems) which in the opinion of the local investigator was unanticipated, involved risk to subjects or others, and was possibly related to the research procedures;
* Any serious accidental or unintentional change to the IRB-approved protocol that involves risk or has the potential to recur;
* Any publication in the literature, safety monitoring report, interim result or other finding that indicates an unexpected change to the risk/benefit ratio of the research;
* Any breach in confidentiality or compromise in data privacy related to the subject or others; or
* Any complaint of a subject that indicates an unanticipated risk or that cannot be resolved by the research staff.

This letter constitutes official notification of the approval of the protocol change. You are therefore authorized to implement this change accordingly.
If you have any questions, please contact the IRB office at 472-6965.

Sincerely,

Becky R. Freeman
Becky R. Freeman, CIP
for the IRB