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An Exploratory Study On The Impact Of Mobile Wireless Technologies In A TeacherEducation Classroom

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AN EXPLORATORY STUDY ON THE IMPACT OF MOBILE WIRELESS TECHNOLOGIES IN A TEACHER EDUCATION CLASSROOM

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ABSTRACT

Mobile technology is revolutionizing the American higher education system. Integrating mobile technology into college classrooms is changing the teaching and learning process. Today's millennial generation students are tech savvy and using their mobile devices to learn and explore in many possible ways. Mobile technology devices can be used as effective tools to enhance teaching and learning. The ubiquitous nature of these mobile devices with wireless capabilities makes learning possible instantly anywhere and everywhere with easy access to information for everyone. The purpose of this study was to investigate the effects of integrating mobile wireless technologies (MWT) on preservice teachers' attitudes and learning outcomes in teacher education classrooms. A pretest-posttest exploratory model was used to examine the effect of using MWT in the classroom setting. Students' learning outcomes and attitudes were compared between two teacher education classes to see if there was a significant effect in using MWT.

This quantitative study explored the effects of using MWT for classroom activities. Undergraduate students enrolled in two sections of a teacher education course were the study participants; one section was the control group and the other was the experimental group that used iPads for in-class activities. Data were collected at pretest before the treatment and at posttest after the treatment using an achievement test on the assigned chapter for investigating students' learning outcomes and a Likert-scale survey for investigating students' attitudes. The attitude survey was categorized and analyzed using four factors: a confidence/anxiety factor, a liking factor, a usefulness factor, and a training factor. The study results showed no significant

change in students' learning outcomes and attitudes towards using MWT. Due to a small sample size, use of a single intervention, and a limited period for the experiment were some of the major factors for insignificant results of this study. The information from this study can be the basis for further research to determine better ways to use MWT in teacher education classrooms.

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CHAPTER 1

INTRODUCTION

People live in a continuously proliferating era of technology where increased numbers of mobile devices with networking and internet capabilities are carried around with them all the time. This increased use of mobile technologies is not just changing lifestyles but also impacting the higher education landscape; primarily, regarding teaching and learning. Educators have to rethink the way they teach so as to reach the "Net Generation" students where learning is expected to take place anytime and anywhere. Mobile learning is a commonsensical solution to this expectation. According to Rossing, Miller, Cecil, and Stamper's (2012) research study from Indiana University- Purdue University Indianapolis (IUPUI), mobile learning is defined as "the efficient and effective use of wireless and digital devices and technologies to enhance learners' individual outcomes during participation in learning activities" (p. 2). On that account, it is essential for educators to provide meaningful learning experiences for the students by integrating new technologies and creating programs that engage the learners. The proper use of innovative integration of technology will allow students to grow academically through investigation and collaboration beyond the classrooms. Integrating and introducing 21st century technology skills into the classroom will effectively support students' learning, engagement, and collaboration through contemporary teaching and learning practices (Lambert & Gong, 2010). This in turn

will take advantage of the ubiquitous nature of mobile wireless devices which allow easy access to information at the fingertips of students as well as the educators.

Colleges and universities these days find increasing numbers of students as well as faculty who bring to campus their own mobile devices such as tablets, smart phones and music players that have wireless capabilities to stay connected. Rapid changes in technology and its growing use and integration in higher education will not only continue to alter possibilities for learning but also to create new challenges for pedagogy by forcing educators to evaluate the merits and limitations of the new technologies (Rossing et al., 2012). The ever changing learning needs of Net Generation students are creating a drift in the American education system. More specifically, these students have different beliefs and expectations from education than their teachers who used technology such as desktop computers, overhead projects, and video tape recordings in physical classrooms. In addition, the current generation learners of higher education are familiar with multitasking, collaboration, and inquiry based learning through mobile wireless technologies (MWT) such as smart phones and tablets. Therefore, with today's tech savvy Net Generation students, it is important that educators rethink the pedagogical strategies that best fit the students' changing learning needs. This change in learning needs is resulting in a paradigm shift that is moving educational settings more toward learner-centered instruction than the traditional, didactic classroom teaching methods. Therefore, it is essential for educators to integrate technology in a way that fosters meaningful learning. With the ubiquitous nature of technology changing the definition of learning and society, it is absolutely necessary for educators to engage students by creating technology integrated environments for meaningful learning that promote critical thinking by solving real-life problems (Pianfetti, 2009). In addition, continued growth and integration of MWT into higher education creates more

opportunities for students as well as teachers to collaborate and make learning accessible anytime, including outside of the classroom. This development of MWT has also generated a considerable amount of excitement among emerging technology specialists, academic researchers, and educators because it results in shifting the academic instructional environment from traditional classroom settings to mobile learning settings (Kim, Mims, & Holmes, 2006).

Given the impact of mobile technology and the Internet on day-to-day lives, most undergraduate students in teacher education programs are already using MWT tools such as tablets and e-readers for their work. Therefore, to integrate this technology into preservice teacher classrooms is to provide students with the knowledge and the tools that they are more likely to be using in their future career. According to Koehler and Mishra (2009), facilitators in teacher education programs have to make an effort to teach their students how the combination of appropriate pedagogical skills and content knowledge are related to technology and how all of these contribute to its effective integration into the classroom. This connection between technology and pedagogy helps preservice teachers to create better ways of integrating technology that fit their learners' needs. Similarly, it is important to understand the beliefs and attitudes of preservice teachers towards using mobile technologies for academic purposes. In this respect, Brush et al. (2003) found that there was a positive effect on student attitudes when technology was integrated into the classroom by preservice teachers themselves. This effect on student attitudes also encouraged preservice teachers to learn more about technology and its integration into the classroom. Today's MWT are used as effective classroom tools for teaching and learning by enhancing the learning environment. These mobile devices encourage students to learn inside and outside the classroom. In this respect, it is important to investigate student attitudes and perceptions on incorporating MWT into their classrooms. This research study is

intended to examine the impact of MWT on preservice teachers' learning outcomes and to examine the effects of integrating MWT on preservice teachers' attitudes in teacher education classes, as it is essential for the preservice students to understand and experience classroom technology in order for them to become more comfortable when teaching with technology. The results of this study may be used to create new techniques or improve existing techniques to help ease the use of MWT, into classrooms for preservice teachers. This in turn will prepare them better to use emerging and changing MWT into their school classrooms.

Purpose of Study

The purpose of this study was to investigate the impact of integrating MWT on preservice teachers learning outcomes and preservice teacher attitudes towards undergraduate teacher education classes. Significant changes and effects were examined by comparing two different sections of a teacher education class: one using MWT and the other not using MWT in the classroom. This study also provided information about preservice students' anxiety and their likeliness to use mobile wireless devices in the classroom apart from personal use. This study had also provided additional information on how the ubiquitous nature of mobile wireless devices facilitates academic goals. Furthermore, this study provided information that will help instructors to successfully integrate mobile wireless devices into their teacher education courses in a way that better prepares preservice teachers to teach using mobile wireless devices.

Problem Statement

We are living in a mobile and wireless culture, where students are attached to their technologically advanced wireless devices and depend on these devices mostly for personal use. Therefore, incorporating these MWT into teacher education classes will allow preservice teachers to learn ubiquitously at their own pace and convenience. At the same time experiencing

the effective integration of this technology into teacher education classes helps preservice students to get acquainted with classroom technology. This integration will facilitate to determine students' attitudes towards using technology for academic purposes. In addition, investigating student attitudes will help educators analyze, develop, and implement programs that will increase and enhance learning outcomes and student learning experiences.

It is pertinent to explore the perceptions and attitudes of preservice teachers towards classroom technology because it will help to determine their readiness to effectively integrate technology into their classes and to provide their students with meaningful learning tasks. According to Teo and Lee (2010), the willingness of preservice teachers to incorporate technology into their classes for effective teaching and learning is based on their perceptions and behaviors towards technology during their training. Thus, by incorporating MWT in preservice teacher education programs, educators are providing students with valuable tools that they will need in their near future.

Although, there are many studies that determine preservice student attitudes towards technology in various areas of concentration, this study is specifically designed to investigate preservice students' learning outcomes and attitudes towards using MWT in teacher education classes.

Research Questions

The research questions proposed for this study were

1. Does the integration of mobile wireless technologies in the classroom affect student learning outcomes?
2. Does the integration of mobile wireless technologies in the classroom change student attitudes towards learning?

Definitions

Mobile wireless technology refers to any wireless technology that uses radio frequency spectrum in any band to facilitate transmission of text data, voice, video, or multimedia services to mobile devices with freedom of time and location limitation (Kim et al., 2006).

Mobile wireless technologies (MWT): Mobile wireless technologies are devices such as PDA's, smart phones, tablets, laptops, and other devices that have wireless connectivity capabilities and mobility for convenience.

Net Generation: this is the generation of students who "expect to be engaged by their environment, with participatory, sensory-rich, experiential activities (either physical or virtual) and opportunities for input. They are more oriented to visual media than previous generations and prefer to learn by doing rather than by telling or reading." (Jones, Ramanau, Cross, & Healing, 2010)

Mobile learning: is learning by means of wireless technological devices that can be carried and utilized wherever the learner's device is able to receive unbroken transmission signals (Attewell & Savill-Smith, 2005).

Mobility: refers to the capabilities of the technology within the physical contexts and activities of the students as they participate in higher learning's institution (El-Hussein & Cronje, 2010).

Personal digital assistant (PDA): is a portable handheld device that is used to store and access information.

Smart phone: smart phone is a mobile computing device that has the combined features of a cell phone and the processing capabilities of a computer, along with potential wireless capabilities.

Cell phone: Cell phone/mobile phone is a device that has the capability to receive and make calls similar to a traditional telephone. Apart from voice calls, cell phones also have texting/SMS (Short Message Service) capabilities.

Tablet computer: tablet computer is a computer that is smaller than a conventional laptop and larger than a smart phone with touch screen, mobility, and wireless capabilities.

Netbooks: netbooks are a smaller version of laptops that are lighter and less expensive than notebooks/laptops.

In this study, mobile wireless technologies, mobile technologies and mobile devices were used interchangeably, and their integration in the classroom was used to evaluate student learning outcomes and student attitudes.

Limitations

The limitations for this study include the following:

1. This study only included information from undergraduate students from a mid-western university; this precludes generalization of results to other student institutions with different populations.

2. Evaluating a single instructional unit was also a limitation. Student outcomes and attitudes were assessed based on a single unit of instruction, and the results may not reflect the outcome of the course itself.

3. No follow-up data on students' attitudes was collected to explain any potential unanticipated results of the study.

Delimitations

The delimitations for this study include the following:

1. As the study was purely quantitative, students' self-perceptions on using MWT in the classrooms may have provided stronger insights.

2. This study only included students enrolled in a teacher education program in the Bayh College of Education at Indiana State University. The results of this study cannot be generalized to other institutions of higher education with similar programs and populations.

CHAPTER 2

REVIEW OF LITERATURE

Mobile Technology in Education

The development of MWT has generated a considerable amount of excitement among practitioners and academics because it results in shifting the learning environment from a traditional classroom setting to mobile learning (m-learning) settings (Kim et al., 2006). Malladi and Agarwal (2002) claimed that MWT consist of two aspects—mobility and computing; these aspects of MWT provide students with the flexibility to access class materials regardless of their location. MWT use public stations—antennas—or wireless access points (WAPs) that are connected to wired-networks in buildings or public areas that allow access to web resources and communication for mobile wireless devices users (Kim et al., 2006). These technologies and their connectivity capabilities are more and more important because increasing number of higher education institutions are moving towards mobile learning. The current generation of students has different learning and instructional needs than previous generations. More specifically, these students have grown up with technology and are surrounded by various devices like smart phones, cell phones, laptops, and video games. These students are also familiar with multitasking and collaboration. In addition, this current generation of students quickly adapts to classroom technology because they are surrounded by technology and raised in a world of internet and computers, however, educators face the challenge of helping students to grow to

their fullest potential (Fitzpatrick, 2000). For this, students need to be engaged and motivated in a way that is most appealing to them; hence, it is a challenge for educators to accommodate the emerging digital learning styles. As mentioned above, MWT make content readily available for mobile learning and delivers information to students during learning activities (Jeng, Wu, Huang, Tan, & Yang, 2010). This functional accessibility of information through these ubiquitous mobile devices facilitates easy searching for required information.

Moreover, Prensky (2001) stated that

> Digital Natives accustomed to the twitch-speed, multitasking, random-access, graphics-first, active, connected, fun, fantasy, quick-payoff world of their video games, MTV, and internet are bored by most of today's education, well meaning as it may be. But, worse, the many skills that new technologies have actually enhanced (e.g., parallel processing, graphics awareness, and random access) – which have profound implications for their learning – are almost totally ignored by educators. (p. 11)

According to Rajasingham's *Critical Factors for Successful E-Learning* (as cited in Rajasingham, 2011) to attend to changing learning needs of students, technology with its advancements in Internet and wireless applications is moving the teaching and learning settings to more student-centered collaborative learning. It has become evident that most institutions of higher education need to focus on providing professional development programs for their educators to improve the quality of student learning and also to meet their students' constantly changing learning expectations which are associated with their evolving digital learning styles that change rapidly with the growth in mobile technology (Fisher & Baird, 2007).

It is believed not only that the digital experiences and digital devices themselves have changed way today's young people communicate, socialize, and entertain; but they have also

fundamentally altered students' learning styles and their learning approaches that are different from those of their teachers (Dede, 2005). According to Barab, Thomas, Dodge, Carteaux, and Tuzun (as cited in Parker, Stylinski, Darrah, McAuliffe, & Gupta, 2010) it is necessary to explore the impact of technology on student-centered learning and provide faculty with professional development with opportunities that facilitate the productive integration of technology into classrooms in order to promote student learning. Rossing et al. (2012) stated that, "learning with mobile technology allows students to expand discussion and investigation beyond the walls of the classroom. It enables students to collaborate and create knowledge and to interact with a larger range of content" (p. 3). Similarly, Al-Fahad (2009), argues that "m-learning activities can much better engage students in the learning process. Students transform from passive learners to truly engaged learners who are behaviorally, intellectually and emotionally involved in their learning tasks" (p. 118).

The mobility and connectivity of MWT facilitates the effective and efficient improvement of teaching and learning (Maginnis, White, & McKenna, 2000). According to Franklin, Sexton, Young, and Ma (2007), mobile devices provide students with continued learning by working on projects and assignments when they are away from a desktop computer, to take in-class notes, and also to organize their personal life events. The idea of a classroom without boundaries, where anytime and anywhere learning is a reality, and the evolving progress of education boosts hope of both educators and students. Franklin et al. (2007) stated that mobile devices have already begun to revolutionize and open the door of lifelong learning as students become capable of moving from environment to environment with their personal learning devices. However, despite the advantages of mobility, flexibility, and connectivity of digital devices and technology, many instructors are still resistant to use technology as an effective tool

in the classroom. Because of this reason, in the past two decades, American educational institutions have experienced increased efforts in integrating educational technology for effective teaching, learning, and administration as well. Therefore, classroom learning expectations and educational standards have also changed because of this integration of technology in the classroom; resulting in technology becoming a classroom necessity rather than a luxury (Hicks, 2011).

In this changing higher education setting, it is important to understand the role of instructor in the teaching and learning process. The role of a teacher as facilitator was described by Monaco and Martin (2007):

> As a facilitator, [instructors] are teaching students how to learn, understand, apply, and critique the subject matter by engaging students in the value of the content, rather than repetition. Students have immediate access to vast amounts of information, but often do not have the tools to use technology to extract the depth of information needed to develop critical thinking. (p. 45)

In this digital age of student-centered learning, the role of the instructor is constantly evolving to address individualized student experiences and learning needs. Collaboration and communication with the peers as well as the instructors through emails and instant messaging are the important aspects that motivate and foster learning. Therefore, the instructor should be the facilitator of concepts and also use technology to engage learners in the classroom so that preservice teachers can individualize the content and use it when required which improves the preservice teachers' critical thinking skills.

Likewise, the use of mobile wireless devices like PDAs, cell phones, smart phones, etc., in the classroom provides educators with many potential ways to innovate both curriculum

development and classroom management (Doolen, Porter, & Hoag, 2003). Because of this, apart from the pedagogical concerns of integrating mobile wireless technology, the critical challenges facing higher education systems in incorporating wireless devices into their classrooms are purely technical, such as infrastructure, technical support system, and classroom technology workshops for teachers. Thus, the availability of a plausible in-house support team in schools promotes effective integration and use of wireless technologies in classrooms (Oriaku, 2008). The growth in wireless applications, however, presents school technology officials with a range of challenges in addition to their e-mail, electronic documents, and multimedia instructional content; the greater demands for wireless capacities to download or upload videos and music files are the critical technical challenges (Trotter, 2007). Furthermore, MWT also have limitations of small screen size, limited processing power, limited battery life and restricted memory capacity that might affect educational technology integration (McKenzie, 2001).

Mobile devices are not replacements for existing desktop computers or laptops but are critical technological tools in assisting and facilitating effective learning. MWT provide students with time and allow them to learn at their own pace for better understanding; MWT also encourages collaboration for work projects. Some examples of these implementations are (a) elementary school students using iPad applications for learning math through specific activities that are designed to keep them engaged and motivated with graphics and audio assistance, (b) mobile wireless devices are used for student-teacher communication and also among the peers through short message service (SMS) or social networking websites (Facebook, Twitter).

The Net Generation

The Net Generation, also called the millennials, born during 1979–2000 are the current generation of students in the American educational system. These students belong to the most

heavily populated generation in American history since the Baby Boomers, and they are said to have a profound impact on American culture. Millennials have grown up in a world of technology and possess an entirely different set of values and lifestyle than previous generations. They are referred to as NET Generation, as they are born into the world of the Internet; "iGeneration," as they are born into the world of technology; "Generation WE," as they prefer to call themselves; "Generation Y," as they are born after generation X, "Echo Boomers," as they are born after the most heavily populated generation of Baby Boomers, and also "Gen M," as they are called Millennials. It can be added to this list "Facebook Generation," as they socialize mostly through social networking websites, with Facebook being the major one used. This generation also has a unique set of characteristics and cognitive abilities that requires new and innovate teaching strategies to reach them effectively. Millennials are said to be good at multitasking, which has an enormous impact on their learning styles.

Students of the Net Generation rely on large amounts of readily available information through the World Wide Web or Internet; this kind of flexible and instant information is perceived to reduce their creativity and thinking skills. According to El-Hussein and Cronje (2010), "While the content of education may remain the same, it is delivered by means of a radically new technology that combines the advantages of the internet as a convenience of portability and education 'at any time and in any place'" (p. 15). It is also argued that this generation of students cannot be expected to have specific intellectual skills in gathering and understanding information that differ from those of other generations, given their exceptional familiarity with technology (Thomas & McDonald, 2005).

Student Attitudes

According to Doolen et al. (2003), students have positive attitudes towards using PDAs in the classroom. Martin and Ertzberger (2013) looked at the effect of delivery methods' effect on student attitudes and stated that

> the students enjoyed the authentic learning environment that the mobile technologies allowed them to access. Both the iPad and iPod groups had positive attitudes compared to the CBI [Computer Based Instruction] group on the items "content presented in a easy to understand manner", "enjoyed the use of technology" "provided precise information" and "viewed this type of learning as effective". This shows that students enjoy learning while using this type of delivery method. The iPad group had positive attitudes compared with the CBI treatment stating that the length of the material was appropriate, and it maintained their interest. (p. 84)

The attitudes of students may be positively impacted by integrating MWT into the classroom, but it is equally important to remember that this positive attitude needs to be translated to student engagement. Students should and focus on the content and learning materials themselves. Chen (2013) demonstrated a similar view in the conclusion of this study:

> Participants who used tablet computers to learn English in a tablet-enabled interactive and collaborative environment they created. It can be concluded that tablet computers, as well as other mobile technologies, are ideal tools to foster learner autonomy and ubiquitous learning in informal settings, provided that their technological affordances have been carefully studied and clearly manifested to student users, who usually have a positive attitude towards the usability, effectiveness, and satisfaction of mobile

> technologies as language learning tools, because they are the generation that has grown up using these technologies. (p. 29)

Mobile technologies are considered as effective language learning tools that make ubiquitous learning possible. Consequently, they are said to have a positive effect on student attitudes towards using MWT for academic purposes.

Learning Outcomes

Examining the learning outcomes of students is important and analyzed in different researches. For instance, Chompu-Inwai (2005) found that "the frequent and individual use of the MWT with wireless capability inside and outside classroom was positively related to student learning outcomes as measured by student performance on homework" (p. 248). Similarly, McConatha, Praul, and Lynch (2008), found there was a positive significant change in student learning outcomes in students who used cellphones for mobile learning compared to students who used other classroom resources.

Hawkes and Hategekimana (2009) stated the following while discussing mobile technology and student learning.

> Assessment outcomes actually showed an improvement in the test scores. Math assessment test scores of students in the mobile computing courses improved over those of students in the non-mobile computing environment. These results suggest that at some degree, the use of mobile technology in the classroom has positive effects on student learning. (p. 71)

Similarly, a study by Cheng (2013) found that the students who used iPads for their class outperformed the students who worked on desktop computers.

Chompu-Inwai (2005) presented another view on the impact of MWT on student learning:

> The teaching and learning processes, interactions between the instructor and students, and interactions between students were also impacted both positively and negatively by the use of MWT. The use of MWT positively impacted course learning objective achievement and student overall learning as evaluated by students and instructors, particularly for those course learning objectives where the MWT was necessary. (p. 245).

This investigation shows that the integration of MWT in the classroom has positive influence on student learning outcomes. The study also reports that MWT has both positive and negative effects on students' collaboration with their peers as well as constant communication with the instructors inside and outside the classrooms. Looking at all these studies a case could be made that using mobile technology not only improves test scores but also has positive effect on students' learning.

Theoretical Framework

Some of the learning theories that define the learning process are mainly categorized into behaviorism (learning occurs as a result of behavioral changes), cognitivism (where learning occurs as a result of information processing of individual), and constructivism (where learning is a process of constructing new knowledge based on the prior knowledge of the individual). In constructivist theory, students work towards the solution rather than following a specific instructional sequence; they tend to collaborate and try to solve real world problems based on a situated learning process. Based on their prior knowledge and experiences each learner develops their individual learning style. Learning through interaction and participation are the major aspects of constructivism. In terms of the use of technologies, these interactions include peer

discussions, student-teacher interactions through emails or instant messaging, and podcasts or blogs.

In this technology and information driven world, learning can occur any time and any place through mobile devices, this concept is described as ubiquitous learning. According to Burbules's ubiquitous learning (Burbules, 2009), this "anytime, anywhere" (p. 15) learning has six elements that complement each other in a way that allows deeper understanding of the concept for academic purposes. The six dimensions of ubiquity are

1. Spatial sense: learning can occur anywhere with constant access to information through mobile devices with wireless capabilities when provided with wireless connections to access the Internet. This kind of accessibility to readily available information makes the learning process more effective and easier for the learner than being confined to a particular physical location.
2. Portability: the portable nature of the mobile devices allows people to be constantly online and available to connect with anyone at any given time for social interactions. This aspect of portability encourages students to learn according to their needs.
3. Sense of interconnectedness: technological devices can help us enhance our knowledge by always being connected, not just with information but also to people that might help in finding the information through the Internet.
4. Practical sense: the divide between formal and informal learning is disappearing with the progress and integration of mobile technology into everyday lives. In this manner, learning becomes meaningful to the learner, and yet a common activity that improves creativity and problem solving skills is based on learner experiences that occur "anytime, anywhere."

5. Temporal sense: the ease of availability of information makes it learning convenient and continuous at every moment.

6. Sense of globalization: the influence of networks is affecting the way in which people are constantly connected through the internet at the global scale which in turn influences individual opinions and choices.

According to Pianfetti (2009), "ubiquitous learning through the integration of technology allows for reflection, questioning through inquiry-based practices, meaningful learning through context-rich instructional environments, and problem solving in which students engage in critical thinking" (p. 94). Based on this ubiquitous learning theory it is important to understand the ever changing needs and preferences in student learning allow educators to focus on the most appropriate ways to accommodate those needs and ensure meaningful learning. It is also important that educators recognize the role of technology and its impact on students' lifestyles in order to transform and redefine the way they teach and to better fit their learners' needs.

Handheld Computer Attitude Scale

In 2005, van't Hooft stated that "integrating technology in teaching and learning has become an increasingly difficult yet essential task for educators" (p. 18). For instance, this becomes especially true for today's students and their use of technology. In order to identify the best way to use technology in the classroom researchers have used different tools. The Handheld Computer Attitude Scale (HCAS) was used to determine preservice teacher attitudes towards handheld technology. It is a modified version of an already existing instrument, Computer Attitudes Scale (CAS) developed by Loyd and Gressard (van't Hooft, 2005). The validity and reliability of the HCAS were established for a shortened 27-item instrument, which was piloted three times on a sample of 94 preservice teachers in secondary social studies, math, and language

arts training programs during the academic year 2004-2005 at a public university in the Great Lakes Region. In this study the reported internal consistency of the survey using Cronbach's Alpha was greater than .80, which indicates that the instrument is reliable. A panel of three expert researchers in educational technology and measurement were given a list of the HCAS items to determine its purpose of measuring preservice teacher attitudes towards handheld computers based on constructs like "handheld computer confidence/anxiety, handheld computer liking, handheld computer usefulness, and learning activities related to handheld computers" (van't Hooft, 2005, p. 44).

van't Hooft's (2005) study found the effect on preservice teachers' attitudes towards using handheld technology in their classrooms:

> Analysis of the HCAS survey data revealed that there is a statistically significant, positive difference over time of the combination of the three factors (handheld anxiety, handheld use, working with handhelds) across groups. This means that handheld use in a preservice teacher social studies course has a positive effect on preservice teachers' attitudes toward handheld computers over time. (pp. 85-86)

The above statement indicates that there is a positive influence on preservice student attitudes toward constant and consistent use of handheld technology for classroom activities. The results of van't Hooft's study indicate that the use of handheld technology in secondary social studies courses had a significantly positive effect on student attitudes; "the handheld use factor showed a statistically significant positive increase, the working with handheld factor showed a positive increase, and the handheld anxiety factor showed a negative increase over time" (van't Hooft, 2005, p. 91).

Technology Integration and Preservice Teachers

In the specific case of teachers' education, Davis (2010) stated that "effective teaching of technology in preservice teacher education recognizes that technology, pedagogic, and content knowledge are all involved, including combinations of all three separately and together" (p. 217). In this respect, Brush et.al (2003) found that preservice teachers had a positive effect on their instruction and student attitudes through technology integration into their classes. With this objective in mind, the U.S. Department of Education's "Preparing Tomorrow's Teachers to Use Technology" (PT3) program effectively promotes technology integration in the daily practices of future teachers. In this respect, the University of Florida Teaching and Technology Initiative (UFTTI) was designed to as part of the US Department of Education's PT3 program to facilitate and accelerate systemic change related to technology integration in their teacher education program. One of the goals of this UFTTI was to provide innovative professional development opportunities for faculty (Swain & Dawson, 2006). This systematic preparation in the use of technology is needed in order to help preservice teachers learn more about using advanced technologies that could be helpful in education, specifically in improving the implementation of classroom technology and developing assistive technology skills. It is also important that preservice teachers become able to connect available technologies and classroom teaching with the possibility of transitioning from digital-native students to digital-native teachers (Jing, 2009). Given the fact that digital natives, as students, are already playing an active role in using technology in the classroom, it seems reasonable to expect them to also be more prepared to use technology for teaching as preservice teachers than previous generations of teachers (Jing, 2009).

CHAPTER 3

METHODOLOGY

The primary objective of this research study was to investigate the effects of incorporating mobile wireless technologies (MWT) on student learning outcomes and student attitudes towards learning in teacher education classrooms at a public university in the Mid-West region of the United States. This chapter addresses the research questions, data collection, and the data analysis procedures that were used for this study.

Purpose of Study

The purpose of this study was to investigate the impact of using mobile wireless devices on preservice teachers learning outcomes and preservice teacher attitudes towards undergraduate teacher education classrooms. Significant changes and effects were examined by comparing teacher education classes; one using MWT and the other not using mobile wireless devices in the classroom. This study has provided information about preservice teachers' anxiety and their likeliness to use mobile wireless devices in the classroom apart from personal use. This study has also provided additional information on how the ubiquitous nature of mobile wireless devices facilitates achievement of academic goals. Furthermore, the information from this study will also help instructors to successfully integrate mobile wireless devices into their teacher education courses in a way that better prepares preservice teachers to teach using mobile wireless devices.

Research Questions and Hypotheses

The research questions and the related hypotheses proposed for this study were

1. Does integration of mobile wireless technologies in the classroom affect student learning outcomes?

$H0_1$: The use of mobile wireless technologies in the classroom produces no significant difference in students' learning outcomes between the experimental group and the control group.

2. Does the use of Mobile Wireless Technologies change student attitudes towards learning during the research process?

$H0_2$: There is no significant difference in students' attitudes between the experimental group and the control group at the time of testing.

$H0_3$: There is no significant difference in students' attitudes for the time of testing, pretest-posttest, across both the experimental and the control groups.

$H0_4$: There is no significant interaction in students' attitudes between the two groups and the time of testing.

Methodology

The study was an experimental investigation using a quantitative research method to test the effect of incorporating MWT in preservice teacher classrooms on preservice teacher learning outcomes and attitudes. Participants for this study were recruited from two sections of Introduction to Teaching, CIMT 200, offered during the fall semester at the Bayh College of Education. The course curriculum is designed and developed jointly by two instructors together so that the classes are similar and all the students from both sections have similar learning experiences and content knowledge at the end of the course. Although two instructors developed

the course curriculum, only one instructor taught the experimental group and the control group during the intervention. Totally 48 students enrolled for both sections of the class, of which 26 were assigned to the control group and 22 were assigned to the experimental group. Typical enrollments for the classes were undergraduate college freshmen or sophomores students with some exceptions of undergraduate upperclass and non-traditional students.

CIMT 200, Introduction to Teaching, was a two-credit course where the two sections met twice every week. The purpose of the course was to introduce preservice teachers to (a) the professional teaching program across P-12 school settings and (b) teacher licensure requirements for the state of Indiana. In addition to these, students were also required to participate in field experiences and community based learning activities that are used to gain a better understanding of the teaching profession. All the reading materials for the course were online on the course Blackboard site, the material was based on a textbook that was followed for the course previously, *Your Introduction to Education*, 2nd Edition (Powell, 2012).

There were two facets to this study:

1. Determining if there was a significant difference in student learning outcomes between the experimental group and the control group. To determine student learning outcomes, achievement test grades of both the experimental group and the control were collected and compared. The achievement test was administered twice, once before the treatment and then at the end of the treatment. For this purpose, Chapter 3 of the course materials based on the textbook was used, and the content taught for that chapter during the semester was considered as the treatment period.
2. A pretest and posttest survey method was administered to investigate for any significant changes in student attitudes for using MWT in their teacher education classes. The use of

van't Hooft's (2005) Handheld Computer Attitude Scale survey allowed in an examination of student attitudes during the time of testing. The pretest survey was given to the participants during the beginning of the semester and then the posttest survey was given after the instruction and the achievement test on Chapter 3. The attitudes survey also included a question about the students' inclusion in any laptop technology iInitiative (LTI) at their high school level. The data for the LTI was also collected twice along with the HCAS, once for the pretest and then for the posttest. This data was used to investigate how student prior experiences of using classroom technologies would affect attitudes and learning outcomes.

Research Participants

Undergraduate preservice teachers enrolled for CIMT 200, Introduction to Teaching, in the Bayh College of Education, Indiana State University, were the research participants. Almost all of the students enrolled for this course were undergraduate freshmen with exceptions of some college upperclassmen and also non-traditional students. Students enrolled for this course were both female and male, all over 18 years of age. Provided their willingness to participate, participants were required to sign an informed consent form. Participants were not required to provide any personal information, thereby protecting their identities. Participants were provided with contact details of the researcher for further contact or in case of any concerns. However, participants were allowed to choose not to participate in the study and withdraw at any point during the research process without penalty.

Instrumentation

The survey instrument used to examine preservice student attitudes for this study was van't Hooft's (2005) Handheld Computer Attitude Scale (see Appendix A). The attitudes survey

was a 40 item 5-point Likert Scale survey that was used to determine preservice student attitudes towards handheld technologies with ratings *5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree and 1 = strongly disagree*. The data collected using this instrument for the pretest and the posttest was compared to explore any pattern changes in students' attitudes towards using MWT in the classroom.

The HCAS which was used to determine preservice teacher attitudes towards handheld technology was a modified version of an already existing instrument, CAS developed by Loyd and Gressard (1984). Validity and reliability of HCAS were established for a shortened 27-item instrument which was piloted three times on a sample of 94 preservice teachers in secondary social studies, math, and language arts training programs during the academic year 2004-2005, at a public university in the Great Lakes Region. In this study the reported internal consistency of the survey using Cronbach's alpha was greater than .80, which indicates that the instrument was reliable.

The current HCAS instrument was used and modified with the author's permission (see Appendix B) to better fit this research by replacing the term handheld computer to mobile wireless technologies (see Appendix C). Due to these changes in terms, the validity and reliability of the instrument was tested. From the collected data, a case was made to verify the content validity and Cronbach's alpha was used to test the reliability of the instrument. The HCAS is a 40-item instrument that is grouped into four categories: anxiety, liking, usefulness, and technology training. The numbers of items in each category are mentioned below.

- Anxiety factor: a total of 15 items determine the levels of student anxiety towards using MWT. The items are 1, 4, 6, 9, 12, 14, 15, 16, 18, 22, 24, 28, 30, 33, and 40.

- Liking factor: a total of 10 items determine how well students like working with MWT. The items are 2, 7, 11, 19, 25, 27, 31, 35, 36, and 37.
- Usefulness factor: a total of 9 items determine student perceptions of the usefulness of MWT. The items are 3, 8, 13, 17, 21, 23, 32, 34, and 38.
- Training factor: a total of 6 items determine student comfort level of using MWT. The items are 5, 10, 20, 26, 29, and 39.

Changes in preservice teachers' learning outcomes in using MWT were determined by gathering student achievement test scores on Chapter 3 (see Appendix D) from the instructors of the experimental group and the control group. Series of *t* tests were used to compare the achievement test scores to investigate any significant differences in student learning outcomes before and after the treatment. The achievement test consisted of 25 multiple choice questions, 3 short answer questions, and 3 essay questions on the content of Chapter 3. Although validity and reliability statistics were not available for the test, the test was part of the instructional and assessment materials associated with the Pearson Education text. Therefore, validity of the test was assumed.

Data Collection

The data collection process was done in two ways as this study had two different facets of investigation. The first stage of data collection occurred before the actual instruction on Chapter 3 for both the experimental group and the control group. In this stage the students in both the groups were given a pretest achievement test on chapter 3 (Appendix D) and van't Hooft's (2005) HCAS modified survey (Appendix C) was administered. The pretest scores on chapter 3 were used to investigate the student learning outcomes and the survey data was used to examine the student attitudes towards using MWT.

The second stage of data collection took place after the instruction on Chapter 3 for both the groups. In this stage the students in both the groups were given a posttest achievement test on Chapter 3 (Appendix D) and the HCAS modified survey (Appendix C) was administered. The data from the posttest scores were used to investigate if there was any significant difference in student learning outcomes between the experimental group and the control group. And the data from the survey was used to examine for any significant changes in preservice teacher attitudes towards using MWT between the two groups and also to examine for any significant changes in preservice teacher attitudes within the experimental group and also the control group.

Students in the experimental group and the control group took a traditional pen and paper test on both achievement tests on the chapter and also the survey. The scores and the survey data were then transferred to SPSS for data analysis.

The participants were provided with all the required information including the informed consent that allowed them to participate in the study and they also had the freedom to choose not to participate. The participants who chose not to participate in the study were not taken into consideration for the study. However, the participants who did not choose to participate were required to take the achievement test along with their other classmates but their scores for the test will not be collected from the instructors. A research assistant was assisting with compilation of achievement test scores to ensure participant anonymity. All the information that was gathered from the participants as well as the participant recruiting process was done following the approval from the Instructional Review Board at Indiana State University.

Data Analysis

The independent variable for the study was the use of MWT in the classroom. The dependent variables for this study were (a) preservice students' learning outcomes, the

achievement test scores and (b) preservice student attitudes: anxiety, liking, usefulness, and training. To test the null hypothesis $H0_{1,}$ where the dependent variable is the achievement test scores and the independent variable is the use of MWT in the teacher education classroom; the achievement test scores that were collected before the treatment from the experimental group and the control group were compared using a *t* test to examine equivalence in student learning outcomes between the two groups. If equivalence exists between the two groups then another *t* test was administered on the posttest test scores that will be collected after the treatment. ANCOVA was used to test for equivalence between the two groups to check for relationship between the experimental and control groups. Spearman Brown coefficient and split-half reliability measures were used to test for the reliability of the Chapter 3 achievement test.

To test the null hypotheses $H0_{2,}$ $H0_{3,}$ $H0_{4}$, where anxiety, liking, usefulness and training from the HCAS were the dependent variables and the use of MWT in the teacher education classrooms was the independent variable, split-plot analysis of variance (ANOVA) was used to analyze the data collected from the pretest and posttest surveys for the experimental group and the control group in the teacher education classrooms. A series of four split-plot ANOVAs were administered for each of the dependent variables to investigate for significant difference in student attitudes towards using MWT. The split plot ANOVA is used to test for significant difference between classroom groups, between time of testing, and for a significant interaction between group and time of testing. This 2 x 2 split plot ANOVA was used to test two main effects and one interaction effect. The main effect for group tests for significant differences between the experimental and control groups across both pretest and posttest. The main effect of time of testing tests for significant differences between pretest and posttest across both groups. Finally, the interaction effect tests for a differential change from pretest to posttest across groups.

These comparisons provided insights in investigating the student attitudes within the two groups and also between the groups at any given time of the testing.

Data was also collected for the LTI, which was used to examine if prior classroom technology experience influenced student attitudes towards using MWT for this study. A series of *t* tests were used to analyze the data that was collected for the LTI question in the survey to all the dependent variables in the study; student learning outcomes, anxiety, liking, usefulness and training.

Summary

The main purpose of this study was to investigate if there was a significant change in student attitudes by using MWT for classroom activities. This study also examined if there was a significant difference in preservice student learning outcomes on the achievement test in using MWT in their teacher education classes.

CHAPTER 4

DATA ANALYSIS

The purpose of this study was to investigate the effects of integrating mobile wireless technologies (MWT) on preservice teacher attitudes and learning outcomes in teacher education classes. This exploratory study was a quantitative investigation that compared student performances and student attitude survey responses to see if there was any significant impact of MWT on their attitudes. LTI was a factor that was also examined to inquire if prior use of classroom technology had an impact on student attitudes.

The primary objective of this exploratory study was to compare outcomes between the experimental group and the control group. Both groups participated in traditional class sessions with instructor's lecture. However, the experimental group used iPads during the treatment period for classroom activities such as (a) online inquiry of class content materials when and as instructed by the instructor and (b) in-class group discussions based on their exploration of the particular topics through a virtual chatroom (CIMT200E) that was created and used specifically for the purposes of this class study. The chats were monitored and inspected by the instructor to access insight into student progress on the chapter content. The control group only relied on instructor lectures, Blackboard course materials, and traditional in-class group discussions with their peers for content knowledge. One of the plausible advantages for the students in the

experimental group might have been that they could review more materials online in addition to the provided course materials.

The following research questions were addressed to achieve the objectives of the study:

1. Does the integration of mobile wireless technologies in the classroom affect student learning outcomes?
2. Does the integration of mobile wireless technologies in the classroom change student attitudes towards learning?

The corresponding hypotheses of the study were as follows:

$H0_1$: The use of Mobile Wireless Technologies in the classroom produces no significant difference in students' learning outcomes between the experimental group and the control group.

$H0_2$: There is no significant difference in students' attitudes between the experimental group and the control group at the time of testing.

$H0_3$: There is no significant difference in students' attitudes for the time of testing, pretest-posttest, across both the experimental and the control groups.

$H0_4$: There is no significant interaction in students' attitudes between the two groups and the time of testing.

Several statistical analyses were utilized to interpret and report the data. A series of *t*-tests were used to compare student test scores and attitude responses. ANCOVA was utilized to examine the equivalence of test scores. Cronbach's alpha was computed to determine the internal consistency of the Chapter 3 achievement test that was used.

Participants

Participants of this study were undergraduate preservice teachers who enrolled during the 2014 spring semester for CIMT 200, Introduction to Teaching, in the Bayh College of Education, Indiana State University. Students enrolled for this course were all over 18 years of age. A total of 48 students participated in the study, 26 in the control group and 22 in the experimental group. All the students in both the groups took the achievement tests as part of the class but the attitudes survey was only taken by students who agreed to participate in the study.

Students in the experimental group used iPads for their in-class activities such as group discussions through todaysmeet. Todaysmeet (https://todaysmeet.com/) is a secure back channeling chat platform that can be used as a resource tool to enhance classroom teaching and learning. Chat room CIMT200E was created for the students to join and participate equally in class discussions. Students in the control group, however, participated in traditional group discussions with their peers. Both groups participated in traditional class sessions with instructor's lecture.

Preservice Teachers' Learning Outcomes

The first research question examined the differences in preservice teachers' learning outcomes in using MWT by comparing pretest and posttest achievement scores among the experimental and control groups. Students from both experimental and control groups participated in the pretest and the posttest. All of the preservice teachers took a pen and paper achievement test on Chapter 3 provided by the publisher, which was used to test for differences in student learning outcomes. An independent-sample *t* test was performed to compare the test scores of the experimental group and the control group. ANCOVA was conducted to check for equivalency between the two groups. An independent sample *t* test on the pretest achievement

scores indicated that the scores were significantly higher for the experimental group ($M = 30.77$, $SD = 8.7$) than the control group ($M = 21.33$, $SD = 10.28$), $t(44) = 3.35$, $p = .002$, two-tailed. Also, the t test performed on the posttest achievement scores indicated that there was a significant change in test scores between the experimental group ($M = 36.62$, $SD = 10.23$) and control group ($M = 30.13$, $SD = 8.42$), $t(43) = 2.38$, $p = .024$, two-tailed.

Significant change in achievement scores at pretest indicates that the two groups were not equal at the time of testing. Hence, univariate analysis of variance was performed by equalizing the pretest scores to check for a relationship between the two groups. There was no significant change in posttest achievement scores after equalizing on the pretest achievement scores. Table 1 demonstrates the relationship between the experimental group and the control group when equalized on the pretest.

Table 1

Relationship Between Pretest and Posttest Achievement Scores for the Two Groups

Source	df	Mean Square	F	Sig	Power
Corrected Model	2	594.84	8.89	.00	.96
Intercept	1	2471.40	36.92	.00	1.00
Pretest	1	839.39	12.54	.00	.93
Group	1	9.86	.14	.70	.06
Total	43				
Corrected Total	42				

This shows that there was no significant difference in pretest and posttest achievement scores between the control group and the experimental group. Therefore; the null hypothesis,

that there was no significant difference in students' learning outcomes between the experimental group and the control group was accepted. The small sample size resulted in low power and effect size which did not have a negative impact on the statistical tests. This affirms that there was no significant difference between the two groups thereby adding to accepting the null hypothesis.

Additionally, statistical analysis was performed to check for reliability of the achievement test on chapter 3 that was used in this study. Split-half reliability was used to check for reliability of the achievement test on Chapter 3. Split-half reliability is a reliability test used to measure the consistency of a test, a test is split into two parts and each part is compared with the other. Split-half reliability was appropriate as the achievement test couldn't be repeated enough number of times to test for reliability during the experimental period. Spearman-Brown coefficient was used as it estimates the combined reliabilities for both the halves of the test in a split-half reliability. The Spearman-Brown coefficient for the achievement test was .632 which was not a high accepted reliability level. Hence, the test proved to be more valid than reliable.

Preservice Teachers' Attitudes

The second research question investigated changes in preservice teachers' attitudes in using MWT in their classroom. van't Hooft's (2005) HCAS survey results were used to determine if there were any changes in student attitudes. The survey was categorized into four factors; anxiety factor, liking factor, usefulness factor and training factor. After collecting the data it was ascertained that the analysis of said data analysis would be better served by utilizing a series of independent sample *t* tests as opposed to a split-plot ANOVA.

Four independent sample *t* tests were performed to test the null hypotheses associated with the second research question, they are (a) a comparison of control group and experimental

group at pretest, (b) a comparison of control group and experimental group at posttest, (c) a comparison of pretest and posttest for control group, and (d) a comparison of pretest and posttest for experimental group.

The *t* test comparisons show that there was no significant change in students' attitudes between the pretest and the posttest in the experimental group. Therefore; from the above analysis, the null hypothesis, there is no significant difference in students' attitudes for the time of testing, pretest-posttest, across both the experimental group and the control group was accepted. Table 2 represents the summary of means and standard deviations of the four factors of the control group and the experimental group at pretest and posttest.

Table 2

Summary of Means and Standard Deviations of Four Factors for the Two Groups at Pre/Posttest

Pre/Post	Factor	Experimental/Control	*n*	Mean	SD
Pretest	Confidence/Anxiety	Control	28	2.89	.27
		Experimental	22	2.83	.21
	Liking	Control	28	3.04	.26
		Experimental	22	3.00	.20
	Usefulness	Control	28	2.97	.22
		Experimental	22	2.92	.29
	Training	Control	28	3.55	.60
		Experimental	22	3.37	.40
Posttest	Confidence/Anxiety	Control	26	2.87	.26
		Experimental	21	2.95	.32
	Liking	Control	26	2.91	.23

Table 2

Summary of Means and Standard Deviations of Four Factors for the Two Groups at Pre/Posttest (continued)

Pre/Post	Factor	Experimental/Control	*n*	Mean	SD
		Experimental	21	3.04	.29
	Usefulness	Control	26	2.95	.26
		Experimental	21	3.08	.32
	Training	Control	26	3.51	.58
		Experimental	21	3.39	.52

After collecting the data, and without identifying information on individuals to match up the pretest-posttest results, it was ascertained that there was no ability to test for interaction in students' attitudes between the two groups and the time of testing without using split-plot ANOVA. Therefore, the null hypothesis, there is no significant interaction in students' attitudes between the two groups and the time of testing was untestable with independent sample *t*-tests.

Laptop Technology Initiative

The LTI data that were collected as part of the survey to determine if prior experiences of students using classroom technologies at the high school level had any effect on preservice teachers' learning outcomes and attitudes in using MWT in their teacher education classroom. A series of *t* tests were performed to compare LTI results between and among the two groups at pretest and posttest. The LTI was a simple yes/no question which was administered as part of the attitudes survey for both the groups at pretest and posttest.

There was no significant change in preservice teachers' attitudes within the experimental group in the pretest for the confidence/anxiety factor, the liking factor, the usefulness factor and

the training factor based on whether the students had a LTI in their high school or not. Table 3 represents the means and standard deviations of prior technology use for each factor for the experimental group at pretest.

Table 3

Summary of Laptop Technology Initiative for Experimental Group at Pretest

Factor	Laptop Initiative Program	*n*	Mean	SD
Confidence/Anxiety	No	13	2.82	.21
	Yes	3	2.90	.17
Liking	No	13	2.97	.20
	Yes	3	3.17	.21
Usefulness	No	13	2.89	.22
	Yes	3	3.26	.46
Training	No	13	3.40	.39
	Yes	3	3.72	.09

There was no significant change in preservice teachers' attitudes within the experimental group in the posttest for the confidence/anxiety factor, the liking factor, the usefulness factor and the training factor based on whether the students had a LTI in their high school or not. Table 4 represents the means and standard deviations of prior technology use for each factor for the experimental group at posttest.

Table 4

Summary of Laptop Technology Initiative for Experimental Group at Posttest

Factor	Laptop Initiative Program	*n*	Mean	SD
Confidence/Anxiety	No	10	2.82	.19
	Yes	2	3.20	.28
Liking	No	10	2.99	.30
	Yes	2	3.10	.14
Usefulness	No	10	3.10	.31
	Yes	2	2.88	.15
Training	No	10	3.66	.50
	Yes	2	3.16	.23

There was no significant change in preservice teachers' attitudes within the control group in the pretest for the confidence/anxiety factor, the liking factor, the usefulness factor and the training factor based on whether the students had a LTI in their high school or not. Table 5 represents the means and standard deviations of prior technology use for each factor for the control group at pretest.

Table 5

Summary of Laptop Technology Initiative for Control Group at Pretest

Factor	Laptop Initiative Program	*n*	Mean	SD
Confidence/Anxiety	No	23	2.88	.28
	Yes	4	2.91	.29

Table 5

Summary of Laptop Technology Initiative for Control Group at Pretest (continued)

Factor	Laptop Initiative Program	*n*	Mean	SD
Liking	No	23	3.02	.24
	Yes	4	3.15	.42
Usefulness	No	23	2.97	.24
	Yes	4	2.94	.21
Training	No	23	3.52	.65
	Yes	4	3.79	.16

There was no significant change in preservice teachers' attitudes within the control group in the posttest for the confidence/anxiety factor, the liking factor, the usefulness factor and the training factor based on whether the students had a LTI in their high school or not. Table 6 represents the means and standard deviations of prior technology use for each factor for the control group at posttest.

Table 6

Summary of Laptop Technology Initiative for Control Group at Posttest

Factor	Laptop Initiative Program	*n*	Mean	SD
Confidence/Anxiety	No	17	2.84	.28
	Yes	3	2.82	.03
Liking	No	17	2.89	.25
	Yes	3	3.13	.05

Table 6

Summary of Laptop Technology Initiative for Control Group at Posttest (continued)

Factor	Laptop Initiative Program	*n*	Mean	SD
Usefulness	No	17	2.92	.31
	Yes	3	3.07	.12
Training	No	17	3.37	.57
	Yes	3	3.61	.63

Pertaining to the *t* test analyses; prior use of classroom technologies did not have a significant effect on overall students' attitudes. However, the analysis showed significant change in the usefulness factor in the experimental group in the pretest and the confidence/anxiety factor in the experimental group posttest. Due to a relatively small *n*, these results might not be the exact reflection of how students' experiences in using prior classroom technology experiences affected their attitudes for this study. However, the impact of prior experiences in high school on students' learning was untestable due to lack of identifying information on individuals between the survey and the achievement test scores.

Given the experimental parameters; one of the drawbacks of the study was that, even though the number of students who participated in the pretest and the posttest were almost equal for both the groups there were cases where some students just took either the pretest or the posttest as the achievement test and the survey were administered inclass during the normal class hours which required their physical presence to participate. This limitation did not affect the survey data due to anonymous data collection. However, the achievement test scores were identified by student names. The research assistant removed the scores of those students who did not want to participate in the study and therefore, those scores were not included in the analysis.

There were a few instances where certain students participated in either the pretest or posttest but not both. In those instances, the non-participant scores were entered as blanks into the software indicating no data. Furthermore, as mentioned earlier, the small sample did not have a negative effect on the effect size and the power of the statistical tests; the statistical power and effect size were low with respect to the sample size. This low power shows that there is no significant effect between the groups given the smaller sample size.

Summary

The statistical analysis used in this study demonstrated that there was no significant difference in preservice teachers' learning outcomes and attitudes towards using MWT in their teacher education classrooms. The modifications in data analysis of students' attitudes were due to the anonymous data collection process. Additionally, this study also found that prior use of classroom technologies had no effect on students' attitudes.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS, AND RECOMMENDATIONS

The current study investigated the effect of MWT on preservice teachers' attitudes and learning outcomes by using van't Hooft's (2005) HCAS survey, and achievement test scores on Chapter 3 of the adopted textbook of a college preservice teacher education class. This study also investigated if prior academic use and experiences with classroom technologies had an impact on student attitudes and learning outcomes.

This experimental study was conducted over a period of two weeks during the 2013 spring semester between the experimental group and the control group in a pretest-posttest design model. The participants of the two groups were preservice teachers who were enrolled in the two sections of Introduction to Teaching, CIMT 200 at the Bayh College of Education. The research questions of this study were

1 Does the integration of mobile wireless technologies in the classroom affect student learning outcomes?

2 Does the integration of mobile wireless technologies in the classroom change student attitudes towards learning?

The accelerated use and impact of mobile wireless devices in higher education have raised questions as to how these MWT affect student performance, productivity, and attitudes towards learning. As discussed in Chapter 2, van't Hooft's (2005) study used handheld

computers to determine preservice teachers' attitudes. The present study broadened the investigation by incorporating iPads, a mobile device with wireless capabilities, as a technological tool for classroom activities for the experimental group. The control group however was engaged in more traditional activities.

The survey and achievement tests were administered twice in both the classes; first, before the instruction of the assigned chapter and then later upon the completion of the chapter which was also the duration of the experiment. The quantitative data was analyzed using a series of independent samples *t* tests and ANCOVA which was used to check for equivalency between the two groups at the time of the pretest. A Spearman Brown coefficient in association with split-half reliability was used to examine the reliability of the achievement test. Following the analysis of gathered data in chapter four, this chapter discusses the research implications, findings of data analysis, and provides further recommendations for future research.

The initial proposal of the study was to use a split-plot ANOVA to determine preservice teachers' attitudes towards using MWT. Split-plot analysis of variance was not used due to anonymous survey data where there was a lack of identifying information for individuals to associate with their respective pretest-posttest data to test for changes in students' attitudes between the two groups and the time of testing. Hence, appropriate statistical modifications were necessary post-hoc to effectively analyze the data. Accordingly, a series of independent sample *t* tests were performed to compare the survey results between the two groups and also within each group. In addition to the above mentioned adjustment, the effect of prior classroom technology experiences on student learning outcomes was also untestable without individual identifying information.

Discussions and Conclusions

There were two major research questions in this study; they were to determine if there was any impact of MWT on preservice teachers' (a) attitudes and (b) learning outcomes. The study results showed that there was no significant difference in student learning outcomes between the experimental group and the control group. However, the statistical analysis showed that the achievement test scores were significantly higher for the experimental group than the control group at both pretest and posttest phases of the experiment. The pretest mean scores for the experimental group (n = 22) and control group (n = 24) were 30.77 and 21.33, respectively. The posttest mean scores for the experimental group (n = 21) and control group (n = 24) were 36.62 and 30.13, respectively. Hence, univariate analysis of covariance was performed by equalizing the pretest scores to check for a relationship between the two groups at pretest.

The ANCOVA was not significant, $F(1, 40) = 1.47$, $p = 0.70$, showing that there was no significant relation in test scores between the experimental group and control group at pretest thereby nullifying the significance of posttest results. Therefore, the statistical analysis affirms that there was no significant difference in students' learning outcomes in using MWT between the experimental group and the control group.

According to the study by MacDonald, Brimble, and Manning (2014), even though students were enthusiastic about using iPads as effective learning tools, there was no significant change in student learning outcomes by introducing iPads into the classroom. On the other hand, McConatha, Praul, and Lynch (2008), stated that there was a significant positive change in student learning outcomes in students who used cellphones for mobile learning compared to students who used other classroom resources, which contradicts with the results of this study. The results of this study contradicts the findings of Chompu-Inwai (2005) and Hawkes and

Hategekimana (2009) who found that using mobile technologies with wireless capabilities in the classroom had significantly positive improvement in student learning outcomes.

As mentioned before, the initial proposal of using a split-plot ANOVA to analyze preservice teachers' attitudes was altered after data collection. As it was ascertained that the analysis of said data would be better served by utilizing a series of independent sample *t* tests as opposed to a split-plot analysis of variance; four independent sample *t* tests were performed to examine the relationship between the two groups and two phases at any given time of testing. Survey data was compared (a) between the experimental group and control group at pretest, (b) between the experimental group and control group at posttest, (c) between pretest and posttest for control group, and (d) between pretest and posttest for experimental group. The survey that was used for this study was categorized into four factors which were the dependent variables to investigate student attitudes. They included the confidence/anxiety factor, the liking factor, the usefulness factor and the training factor. The results of each of these variables were compared between the two groups at pretest and posttest; and the pretest and posttest results were also compared for each group separately. However, the interaction in students' attitudes between the experimental group and control group and the time of testing was untestable with *t*-tests due to lack of identifying information to associate the pretest-posttest survey data of individuals. The tests indicated no significant difference between the two groups or within the two groups at the time of testing; therefore, the results confirmed that there was no impact of using MWT on preservice teachers' attitudes in teacher education classrooms.

The results of this research conflicts with the findings of Chompu-Inwai and Doolen (2008) who indicated that, in a higher education setting, even moderate use and implementation of MWT along with strong technical support has an impact on student attitudes. Meaningful

integration of classroom technology in preservice education classes also has an impact on student attitudes; but, it is a long-term process which requires including appropriate learning activities that engage students inside and even outside their classrooms according to van't Hooft (2005). In another experimental study by Martin and Ertzberger (2013) findings revealed that student achievement in the CBI (computer based instruction) group had higher scores than the ipod/ipads group; however, students in the ipad/ipod group had more positive attitudes towards using the technology in the classroom than the students in the CBI group. According to Martin and Ertzberger (2013),

> Students enjoyed the authentic learning environment that the mobile technologies allowed them to access. Both the iPad and iPod groups had positive attitudes compared to the CBI group on the items "content presented in a easy to understand manner", "enjoyed the use of technology" "provided precise information" and "viewed this type of learning as effective". This shows that students enjoy learning via this type of delivery method. The iPad group had positive attitudes compared with the CBI treatment stating that the length of the material was appropriate, and it maintained their interest. (p. 84)

Even though the Martin and Ertzberger (2013) study compared student attitudes of the CBI group with the ipad/ipods group, it showed that students developed positive attitudes in using tablets such as ipads/ipods for learning. This shows that appropriate and efficient integration of mobile technologies in classrooms will positively affect student attitudes towards the use of technology for learning and there by hopefully incorporating them into their own classrooms while teaching to meet their students' learning needs.

Apart from the main research questions, additional investigation was done on the influence of prior classroom technology use on students' attitudes and learning outcomes. A

question on prior LTI at the high school level was administered as part of the survey. A series of *t* tests were performed to compare LTI results between and among the two groups at pretest and posttest. The LTI data showed no significant effect on student attitudes and learning outcomes in using MWT in their teacher education classroom based on their prior experiences with classroom technologies. In their study, Chompu-Inwai and Doolen (2008) observed that students with prior MWT were more confident, less anxious, and also firmly liked using MWT in their classrooms more than students without any of the classroom technology experiences. But, there was one obstacle in the current study in examining the effect of prior classroom technology experiences on students' learning outcomes; which was untestable without identifying information to associate the survey results which included the LTI question and the achievement test scores.

Even though the study showed no significant results overall, this study could be the basis for research into preservice teachers' attitudes and learning outcomes specifically in teacher education programs. Additionally, the ubiquitous nature of these wireless devices can diversify the learning process which consequently influences teaching practices. Meaningful integration of mobile technology can foster learning beyond the classroom; according to Burbules (2009), learning is ubiquitous which can occur "anytime, anywhere" (p. 15). Effective ways to accommodate and use MWT in the classroom can cater to the changing preferences and needs of current generation students. Effective integration of mobile technology is not just about how it affects learning it is a combination of the content matter, pedagogy and the technology itself (Davis, 2010).

Limitations

There are crucial limitations to this study. The data did not find any statistical significance. The short treatment duration of two weeks did not allow the students in the

experimental group to get acquainted completely with the circumstances pertaining to the experiment. The experimental group also had to contend with changes in classroom activities, this was the introduction of the iPads that were used for the intervention. The control group had to adjust to the change in instructor for just one chapter and two weeks. The small sample size of 48 participants with 26 students in the control group and 22 students in the experimental group did not have a negative effect on statistical power and hence, proves that there is no significant difference between the two groups. However, student attitudes and learning outcomes might have a significant effect with longer interventions, larger sample size, and prolonged treatment durations. The results of this study cannot be generalized to other institutions with different student populations as the participant sample of this study only included undergraduate students from one Midwestern institution. The sample of this study only included students who were enrolled in the teacher education program in the Bayh College of Education at Indiana State University during the spring semester; therefore the results cannot be generalized to all or any other student programs. Furthermore, this study was evaluated on a single instruction unit and hence the results cannot reflect similar outcomes if the study was performed for an entire course or across various courses or even over a semester(s). Additionally, the control group missed a class during the treatment period for a federal holiday which might have forced the instructor to compress the corresponding teaching material to fit the time allotted for the experiment. The experiment time was also cut short due to in-class administration of the pretest-posttest surveys and achievement tests. On the other hand, both the control group and the experimental group were taught by the same instructor. The instructor may have mitigated some of the limitations in that he was aware of the differences imposed by these circumstances.

Implications for Practice

This study did not provide any significant results towards students' outcomes and student attitudes. As previous studies such as van't Hooft's (2005) and Martin and Ertzberger's (2013) showed that it is a lengthy and tricky process to measure student achievement and student attitudes towards integration of mobile technology; efficient classroom practices and effective content delivery methods are crucial for meaningful integration of technology.

The statistical means of the survey depict that the students' attitudes were homogeneous across the four factors in using mobile technology for classroom purposes. When comparing the means of the four factors during the pretest when assessed on the survey, the means of the experimental group were lower than those of the control group for all the four factors. When comparing these same means during the posttest, all the means were higher in the experimental group than those of the control group, except the means for training. Although the differences in means in both pretest and posttest for all four factors were not significant, it is interesting to note that the experimental group had higher means during the posttest than during the pretest. These differences signify that although they are not significant, their mere existence points to a necessity for further investigation. While looking at the achievement tests, the differences in scores between the control and experimental group were significantly different during the pretest and significantly different during the posttest. The significant difference in test scores between the two groups may be due to higher test score means of the experimental group at both the pretest and the posttest; the higher scores may be due to unique teaching approaches of the instructors towards the content prior to the experiment. Therefore, predictably, when looking at a comparison between the pretest and the posttest in both the control and the experimental groups, the differences were not significant. Both these results warrant further investigation

under different conditions, further discussion of which is presented in the recommendations section.

Due to insignificant results in the survey and the achievement test, there are insufficient implications to the current body of knowledge and also to the Burbules (2009) theory of ubiquitous learning. In other words, the final results of this study which were confined to classroom activities that were solely based on the use of iPads as the mobile technology failed to support "anytime, anywhere" Burbules (2009, p. 15) learning that mainly occurs through continuous access to information, interconnectedness with peers, and portability of the devices themselves. Hence, further research in the current methodology with adjusted parameters such as, using different MWTs, larger sample size, longer interventions with well-planned experimental design are required.

Even though the results of this study showed no positive effect on preservice teachers' attitudes, it does not imply that mobile technology cannot be used as an effective tool to foster learning. van't Hooft (2005) stated that one of the major issue in "measuring attitudes towards handheld computers is whether measuring attitudes towards handhelds will provide information related to attitudes towards handheld technology use for teaching and learning, as well as actual use of the technology" (p. 93). Further, efficient and effective ways to integrate mobile technology into the curriculum in addition to just classroom activities might also have a significant effect on student learning. The Oz (2015) study stated that, appropriate use of mobile technology as an effective tool can enhance learning beyond the classroom.

Student learning outcomes measured using the achievement test scores on just one specific chapter which was offered as part of the text book from the publisher might have been too long and time consuming. Given the length of this experimental study, the chapter content

might have been rushed through to fit the time duration of the study and also students might have been flustered with the sudden changes in incorporating MWT in the classroom for such short times. Understanding the objectives and ramifications of the study, taking the achievement test prior to any instruction on the chapter as part of the pretest phase of the study, getting used to the changes in classroom setting, and the technology in itself might have had an impact on the test results. Chu's (2014) study revealed that students in the mobile learning group did not score as well as the students in the traditional group; the mobile learning setting was a combination of digital and traditional resources for teaching and learning. However, this does not imply that using mobile technology has a negative effect on student achievement. Despite the insignificant statistical evidence, the information obtained in this experimental study could be used for further research on mobile technologies and their impact on teacher education. In this context, the Chompu-Inwai (2005) study showed that using MWT can have both a positive and negative impact on student learning. In order to better understand the effectiveness of MWT on student learning outcomes further research with a more reliable achievement test along with longer and multiple interventions with continuous use of mobile technology in the classroom is crucial.

Furthermore; the means and standard deviations of the two groups depicts low effect size ($d = 0.32$) which supports that there was no significant change in students' learning outcomes. However, even if the learning outcomes were significantly different between the experimental group and the control group, the low effect size of less than half a standard deviation would not have allowed the conclusion of statistical significance in students' learning outcomes in using MWT. Taking this into consideration, it would be interesting to focus on the learning environment by itself to understand how it influences students' learning outcomes and attitudes. Thus, it seems important to understand how the MWT classroom environment influenced the

student learning process when compared to the traditional classroom setting in terms of knowledge acquisition, personalization of content matter, and content retention. According to Kent (2009), behaviors and perceptions of individuals in a classroom are influenced by how the classroom environments are arranged. Kent's study showed that students in the coffee-house style classroom (a) fared better in personalizing the environment by establishing individual connections with the instructor, and (b) were extremely task oriented when compared to the students in the traditional classroom. In light of Kent's study, the current research could be extended further to investigate students' and instructors' perceptions of how the mobile learning environment influences student engagement and experiences when compared to traditional classroom settings.

Additionally, it should also be considered that, apart from all the conveniences of using MWT as tools and incorporating them effectively into the curriculum to enhance teaching and learning, there are also multiple barriers in adapting them in the higher education setting. Baran (2014) stated that a "number of challenges related to mobile technology integration were reported, including ethical issues, lack of support, accessibility and technical limitations, insufficient experience, mobile phone bans in schools, and curriculum adaptations" (p. 25). Despite their advantages as effective tools to foster learning, mobile devices also pose a number of disadvantages that are technical as well as personal. Lack of infrastructure and support by the technical team, wireless connectivity issues on campus, and also a dearth of technology workshops for faculty and administrators are some of the critical technical challenges that account for effective integration of mobile technologies into higher education classrooms. Apart from the technical barriers there also some personal issues such as ownership cost, constantly upgrading devices, inadequate experience with different devices, and distraction from one task to

another that needs to be considered for incorporating mobile devices into the classrooms. Hence, the technical and personal challenges have to be addressed for successful integration of mobile technology for academic purposes.

Recommendations for Future Study

This research study has shown that there was no significant impact of using MWT on preservice teachers' learning outcomes and attitudes in teacher education classrooms. Despite the findings of the current study, there may be an opportunity for effectiveness to be established in light of other study's findings.

This study only tested outcomes for one chapter in two weeks; it was mostly due to time constraints and availability of the class for the study and also the iPads that were used for the study. Given the short time duration, single intervention, small sample size, and also the use of HCAS which in itself was a modified version of CAS, originally designed to measure student attitudes towards using computers, might not have served the purposes of this study well. The results might not have been the true reflections of preservice student attitudes for the selected sample of the study. It is also possible that the questions on the survey may have been too general and did not cater to the specific sample of preservice teachers in teacher education. The results of this study can be best replicated using a larger sample with a semester(s) long intervention to include the entire course instead of just one chapter and also by using a more detailed / accurate instrument that will help in improved analysis of preservice teachers' attitudes towards using MWT. Looking at the achievement test, the content of the chapter was very cognitively measured; perhaps, a different assessment tool blended with appropriate MWT will help in examining the actual effects of MWT on preservice students' learning outcomes.

Effective learning activities that are best suited to meaningfully integrate MWT into the course curriculum could also contribute to investigation of preservice teachers' attitudes in using MWT. Some of the typical classroom activities that can be used to integrate mobile technology in the classrooms are: creating interactive and collaborative learning environment that can be enabled by mobile technology through text messages and social networking websites, online discussion boards that can be used for peer evaluation and assessment, online debates based on issues related to the course content by dividing the class into teams, video projects, and scholarly research on assigned topics.

This was purely a quantitative study which restricts deeper insights into students' self-perceptions of using MWT in their classrooms. A qualitative component added to a similar study that includes instruments such as, follow-up interviews, open-ended survey questions, and focus group discussions would possibly provide more insights into the impact of using MWT on preservice teachers' attitudes and learning outcomes. Adding this qualitative element would help in examining how individual students perceive the use of MWT inside and outside their classrooms and how it might affect their learning.

Furthermore, this study could also be extended to more than one course for greater understanding of students' attitudes towards use of classroom technology. In addition, it is also recommended to perceive instructors' perceptions of incorporating mobile technology with wireless capabilities in teacher education classes to further analyze effective ways to integrate MWT that accommodates preservice teachers' teaching and learning needs. However, this study can be considered as a base for further research in teacher education programs.

Summary

This quantitative study explored the effects of using MWT on preservice teachers' learning outcomes and attitudes in teacher education classrooms. Achievement test scores were used to determine preservice teachers' learning outcomes and the survey results were used to investigate preservice teachers' attitudes towards using MWT in their classrooms. Based on the statistical analysis the study results showed no significant change in preservice teachers' learning outcomes and attitudes towards using MWT. Due to a small sample size, use of a single intervention, and a limited period for the experiment were some of the major factors for insignificant results of this study. However, the difference in means between the groups shows that there might be significant change in student attitudes with longer interventions, larger sample size, use of different MWT for classroom activities and more accurate instrument to measure students' attitudes. Furthermore, different assessment tool to measure students' learning outcomes that entwines with the mobile devices used would better serve the investigation. The information from this study did not add to the existing body of knowledge but with extended parameters as mentioned above, it can be the basis for further research to determine the impact of using MWT in teacher education classrooms.

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APPENDIX A: ORIGINAL SURVEY (VAN'T HOOFT)

Directions: For each of the following statements, circle the number that corresponds with your answer (5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1 = strongly disagree).

Statement	***SA***	***A***	***N***	***D***	***SD***
1. Handheld computers do not scare me at all.	5	4	3	2	1
2. I would like working with handheld computers.	5	4	3	2	1
3. Learning about handheld computers is a waste of time.	5	4	3	2	1
4. I do not feel threatened when others talk about handheld computers.	5	4	3	2	1
5. It wouldn't bother me at all to take handheld computer classes.	5	4	3	2	1
6. I'm no good with handheld computers.	5	4	3	2	1
7. The challenge of solving problems with handheld computers does not appeal to me.	5	4	3	2	1
8. I expect to have little use for handheld computers in my daily life.	5	4	3	2	1
9. Generally, I would feel OK about trying a new problem on the handheld computer.	5	4	3	2	1
10. I would feel at ease in a handheld computer class.	5	4	3	2	1

11. I think working with handheld computers would be enjoyable and stimulating.	5	4	3	2	1
12. I don't think I would do advanced handheld computer work.	5	4	3	2	1
13. I'll need a firm mastery of handheld computers for my future work.	5	4	3	2	1
14. I get a sinking feeling when I think of trying to use the handheld computer.	5	4	3	2	1
15. I am sure I could do work with handheld computers.	5	4	3	2	1
16. I would feel comfortable working with a handheld computer.	5	4	3	2	1
17. Anything a handheld computer can be used for, I can do just as well some other way.	5	4	3	2	1
18. I am not the type to do well with handheld computers.	5	4	3	2	1
19. I don't understand how some people can spend so much time working with handheld computers and seem to enjoy it.	5	4	3	2	1
20. I am sure I could learn a handheld computer language.	5	4	3	2	1
21. I can't think of any way I will use handheld computers in my career.	5	4	3	2	1
22. I think using a handheld computer would be very hard for me.	5	4	3	2	1
23. Learning about handheld computers is worthwhile.	5	4	3	2	1

24. Handheld computers make me feel uneasy and confused.	5	4	3	2	1
25. If a problem is left unsolved in a handheld computer class, I would continue to think about it afterward.	5	4	3	2	1
26. I could get good grades in handheld computer courses.	5	4	3	2	1
27. I will do as little work with handheld computers as possible.	5	4	3	2	1
28. I feel aggressive and hostile toward handheld computers.	5	4	3	2	1
29. I do not think I could handle a handheld computer course.	5	4	3	2	1
30. I have a lot of self-confidence when it comes to working with handheld computers.	5	4	3	2	1
31. Figuring out handheld computer problems does not appeal to me.	5	4	3	2	1
32. Knowing how to work with handheld computers will increase my job possibilities.	5	4	3	2	1
33. Working with a handheld computer would make me nervous.	5	4	3	2	1
34. Working with handheld computers will not be important in my life's work.	5	4	3	2	1
35. When there is a problem with handheld computer run that I cannot immediately solve, I would stick it out until I have an answer.	5	4	3	2	1
36. I do not enjoy talking with others about handheld	5	4	3	2	1

computers.					
37. Once I start to work with a handheld computer, I would find it hard to stop.	5	4	3	2	1
38. I will use handheld computers in many ways in my life.	5	4	3	2	1
39. It's important for me to do well in a handheld computer class.	5	4	3	2	1
40. Handheld computers make me feel uncomfortable.	5	4	3	2	1

APPENDIX B: PERMISSION TO USE AND MODIFY

RE: PhD Dissertation Research Study Permission to use your Survey Instrument

HOOFT, MARK <mvanthoo@kent.edu>

Sent: Mon 3/4/2013 12:09 PM

To: Anupama Ghattu

Hi Anupama,
Thanks for your inquiry, and yes, you are welcome to use the survey instrument, as long as you cite the source.
Good luck with your dissertation, and let me know if you have any questions about mine.

Mark

Mark van 't Hooft, PhD
Sponsored Programs Administrator
Kent State University
Office of Sponsored Programs
134 Cartwright Hall
Kent, OH 44242-0001
Ph: 330-672-1630
Fx: 330-672-7991
mvanthoo@kent.edu

From: van 't Hooft, Mark <mvanthoo@kent.edu> Sent: Fri 8/2/201
To: Anupama Ghattu
Cc:
Subject: RE: PhD Dissertation Research Study Permission to modify and use your Survey Instrument

Hi Anupama,
That should be fine. I did a similar thing when I did my dissertation research.
Mark

From: Anupama Ghattu [mailto:aghattu@sycamores.indstate.edu]
Sent: Thursday, August 01, 2013 5:41 PM
To: van 't Hooft, Mark
Subject: RE: PhD Dissertation Research Study Permission to modify and use your Survey Instrument

Dr. Van 't Hooft

I am a Doctoral student at Indiana State University and writing my dissertation on the Effect of Mobile Wireless Technologies on pre-service teacher attitudes in teacher education classrooms. I wrote to you before asking for permission to reproduce and use the survey: *Pre-Service Teacher Attitudes Toward Handheld Technology* in your dissertation research *The Effect of Handheld Technology use in Pre-Service Social Studies Education on the Attitudes of Future Teachers Toward Technology Integration in Social Studies*.

I am writing to you again, for your permission to modify the survey instrument by replacing the term "Handheld Computers" to "Mobile Wireless Technologies" to better fit my research questions.

Please be assured that, I would preserve the validity and reliability of the instrument and also include the appropriate citations and acknowledgements.

Thank you for your consideration of this request.

Sincerely,
Anupama Ghattu

APPENDIX C: MODIFIED SURVEY: PRESERVICE TEACHER ATTITUDES TOWARD HANDHELD TECHNOLOGY

Did you ever have any Laptop Technology Initiative in your high school Yes No

Directions: For each of the following statements, circle the number that corresponds with your answer (5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1 = strongly disagree).

Statement	***SA***	***A***	***N***	***D***	***SD***
1. Mobile Wireless Technologies do not scare me at all.	5	4	3	2	1
2. I would like working with Mobile Wireless Technologies.	5	4	3	2	1
3. Learning about Mobile Wireless Technologies is a waste of time.	5	4	3	2	1
4. I do not feel threatened when others talk about Mobile Wireless Technologies.	5	4	3	2	1
5. It wouldn't bother me at all to take Mobile Wireless Technology classes.	5	4	3	2	1
6. I'm no good with Mobile Wireless Technologies.	5	4	3	2	1
7. The challenge of solving problems with Mobile Wireless Technologies does not appeal to me.	5	4	3	2	1
8. I expect to have little use for Mobile Wireless	5	4	3	2	1

Technologies in my daily life.					
9. Generally, I would feel OK about trying a new problem on the Mobile Wireless Technologies.	5	4	3	2	1
10. I would feel at ease in a Mobile Wireless Technologies class.	5	4	3	2	1
11. I think working with Mobile Wireless Technologies would be enjoyable and stimulating.	5	4	3	2	1
12. I don't think I would do advanced Mobile Wireless Technologies work.	5	4	3	2	1
13. I'll need a firm mastery of Mobile Wireless Technologies for my future work.	5	4	3	2	1
14. I get a sinking feeling when I think of trying to use the Mobile Wireless Technologies.	5	4	3	2	1
15. I am sure I could do work with Mobile Wireless Technologies.	5	4	3	2	1
16. I would feel comfortable with Mobile Wireless Technologies.	5	4	3	2	1
17. Anything a Mobile Wireless Technologies can be used for, I can do just as well some other way.	5	4	3	2	1
18. I am not the type to do well with Mobile Wireless Technologies.	5	4	3	2	1
19. I don't understand how some people can spend so much time working with Mobile Wireless Technologies and	5	4	3	2	1

seem to enjoy it.					
20. I am sure I could learn a Mobile Wireless Technologies language.	5	4	3	2	1
21. I can't think of any way I will use Mobile Wireless Technologies in my career.	5	4	3	2	1
22. I think using Mobile Wireless Technologies would be very hard for me.	5	4	3	2	1
23. Learning about Mobile Wireless Technologies is worthwhile.	5	4	3	2	1
24. Mobile Wireless Technologies make me feel uneasy and confused.	5	4	3	2	1
25. If a problem is left unsolved in a Mobile Wireless Technologies class, I would continue to think about it afterward.	5	4	3	2	1
26. I could get good grades in Mobile Wireless Technologies courses.	5	4	3	2	1
27. I will do as little work with Mobile Wireless Technologies as possible.	5	4	3	2	1
28. I feel aggressive and hostile toward Mobile Wireless Technologies.	5	4	3	2	1
29. I do not think I could handle a Mobile Wireless Technologies course.	5	4	3	2	1
30. I have a lot of self-confidence when it comes to working	5	4	3	2	1

with Mobile Wireless Technologies.					
31. Figuring out Mobile Wireless Technology problems does not appeal to me.	5	4	3	2	1
32. Knowing how to work with Mobile Wireless Technologies will increase my job possibilities.	5	4	3	2	1
33. Working with Mobile Wireless Technologies would make me nervous.	5	4	3	2	1
34. Working with Mobile Wireless Technologies will not be important in my life's work.	5	4	3	2	1
35. When there is a problem with Mobile Wireless Technology run that I cannot immediately solve, I would stick it out until I have an answer.	5	4	3	2	1
36. I do not enjoy talking with others about Mobile Wireless Technologies.	5	4	3	2	1
37. Once I start to work with a Mobile Wireless Technologies, I would find it hard to stop.	5	4	3	2	1
38. I will use Mobile Wireless Technologies in many ways in my life.	5	4	3	2	1
39. It's important for me to do well in a Mobile Wireless Technology class.	5	4	3	2	1
40. Mobile Wireless Technologies make me feel uncomfortable.	5	4	3	2	1

APPENDIX D: ACHIEVEMENT TEST

Chapter 3: Student Similarities and Differences

Test Bank

Multiple Choice

1. According to Maslow, which of the following is considered a higher-order need?
    a. Physiological needs
    b. Safety needs
    c. Esteem needs
    d. Aesthetic needs
2. Which of the following characteristics best describes the physical development of middle school students?
    a. Steady increases in height and weight, dramatic changes in appearance and abilities, and rapid brain growth
    b. Onset of puberty leading to reproductive maturity, sudden growth spurts, and exhibition of risk-taking behaviors
    c. Reproductive maturity, large appetite accompanies rapid metabolic rate, and high level of physical risk-taking activities are exhibited
    d. Coordination increases, dexterity improves, and steady growth in height and weight

3. Janice's physical development is characterized by a steady growth in height and weight and an improvement in dexterity. She is also significantly taller than some of her classmates. Janet is most likely in which childhood stage?
    a. Early childhood
    b. Elementary
    c. Middle school
    d. High school
4. According to Piaget's model of cognitive development, which of the following statements best describes a child in the concrete operations stage?
    a. The child is able to make predictions, experience metacognition, and appreciate and use the structure of language.
    b. The child begins to use symbols as his or her grasp of concepts develops rapidly.
    c. The child primarily learns through senses as his or her motor capabilities develop.
    d. The child begins to think logically, and understands the concept of conservation.
5. The level at which a child can almost but not completely grasp a concept or perform a task successfully is called the
    a. zone of proximal development.
    b. formal operations stage.
    c. emotional intelligence quotient.
    d. social cognition stage.
6. Renae has the capacity for adultlike thought. Her reasoning ability is maturing, and she has the capability for abstract reasoning. Renae is most likely in which stage of childhood?

a. Early childhood

b. Elementary school

c. Middle school

d. High school

7. All of the following characteristics describe the cognitive development of middle school students *except*

a. reasoning ability is increasingly more abstract.

b. increased ability to solve complex problems.

c. often in a state of self-absorption.

d. realism plays a more active role in decision making.

8. Jack and Sam are happily playing in the kitchen center at school. They are sharing the same space, but are not communicating. Which of the following types of play are Jack and Sam demonstrating?

a. Social cognition

b. Associative play

c. Cooperative play

d. Parallel play

9. Gabriel has a positive, overconfident self-concept. His self-concept is influenced heavily by family and society, and most of his emotional ties are with his family. Gabriel is most likely in which stage of childhood?

a. Early childhood

b. Elementary

c. Middle school

d. High School

10. Joshua is capable of empathy towards people he doesn't know. Socially, he tends to group with other boys, and he is increasingly concerned with making and keeping friends. Joshua is most likely in which stage of childhood?
    a. Early childhood
    b. Elementary
    c. Middle school
    d. High school
11. A strong sense of fairness, a desire to help those less fortunate, and experiencing roller-coaster emotions are all character development characteristics of which of the following childhood stages?
    a. Early Childhood
    b. Elementary
    c. Middle school
    d. High school
12. Mr. Johnson is the varsity football coach at Carver High School. He believes that girls are too emotional and fragile to play football on his team. Mr. Johnson is engaging in
    a. gender bias.
    b. favoritism.
    c. instrumental aggression.
    d. gender stereotyping.

13. Miss Crenshaw tends to call on her female students more often than her male students. She also tends to give more positive feedback and praise to her female students. Miss Crenshaw is demonstrating
    a. gender bias.
    b. relational aggression.
    c. instrumental aggression.
    d. gender stereotyping.
14. According to the text, what percentage of the student population identifies themselves as gay or lesbian?
    a. Less than 5%
    b. Between 5 and 10%
    c. 20%
    d. Between 30 and 40%
15. The fair and balanced treatment of boys and girls is known as
    a. gender equity.
    b. gender bias.
    c. gender stereotyping.
    d. gender fairness.
16. The categorization of students according to the physical characteristics they have at birth is called
    a. culture.
    b. race.
    c. ethnicity.

d. none of the above.

17. The goals of multicultural education include all of the following *except*

a. the creation of equal opportunities for students of all cultures.

b. the assimilation of minority cultures into the majority culture.

c. the development of knowledge, attitudes, and skills needed to function successfully in a diverse society.

d. the promotion of communication and interaction among groups that work for the common good.

18. The delivery of instruction in two languages is called

a. multicultural education.

b. bilingual education.

c. ESL instruction.

d. ELL instruction.

19. Approximately what percentage of Americans who practice a religion align with Christianity?

a. Less than 25%

b. 50%

c. 75%

d. Over 90%

20. Approximately what percentage of American families live below the poverty line?

a. Less than 5%

b. 10%

c. 20%

d. More than 25%

21. All of the following describe students from low-SES settings *except*

    a. they may enter first grade having been read to about 25 hours, compared to 1,000 hours in middle-class homes.

    b. they may be physically aggressive.

    c. they may be organized and determined to complete assignments.

    d. they very often attend schools with inadequate facilities and less-effective teachers.

22. Tanya is a middle school student. Her strengths include goal setting and self-monitoring. She tends to act as a mediator, and uses self-reflection and self-discipline. According to Gardner, which of the following is most likely Tanya's strongest disposition?

    a. Musical

    b. Intrapersonal

    c. Interpersonal

    d. Naturalist

23. According to Gardner's theory of learning styles, which of the following best describes the bodily-kinesthetic disposition?

    a. Sensitivity to sounds, meanings, structures, and styles of language

    b. Ability to create visually and visualize accurately

    c. Inclination for activities requiring strength, speed, and flexibility

    d. Proclivity for identifying and classifying living things and natural objects

24. Jon, an elementary school student, enjoys arts and crafts. He prefers manipulatives when being introduced to a topic, and is able to literally translate events and phenomena. Jon's learning style is probably
    a. tactile
    b. auditory
    c. kinesthetic
    d. visual
25. According to the text, approximately what percentage of American students receive special education services?
    a. Less than 5%
    b. 12%
    c. 27%
    d. More than 40%

Short Answer

1. What is PL 94-142, and how does it affect students?
2. Describe the characteristics of a student who is gifted and talented.
3. Identify Gardner's nine intelligences, as identified in the multiple intelligences (MI) theory.

Essay

1. In a one- to two-page essay, explain the principles that govern the education of students with disabilities. Make sure to address the requirements of an individualized educational program (IEP).