

**THE ADOPTION OF MOBILE LEARNING INTO HIGHER EDUCATION:  
INFLUENCING STUDENTS' SKILLS ATTITUDES AND GLOBAL  
COMPETENCE**

by

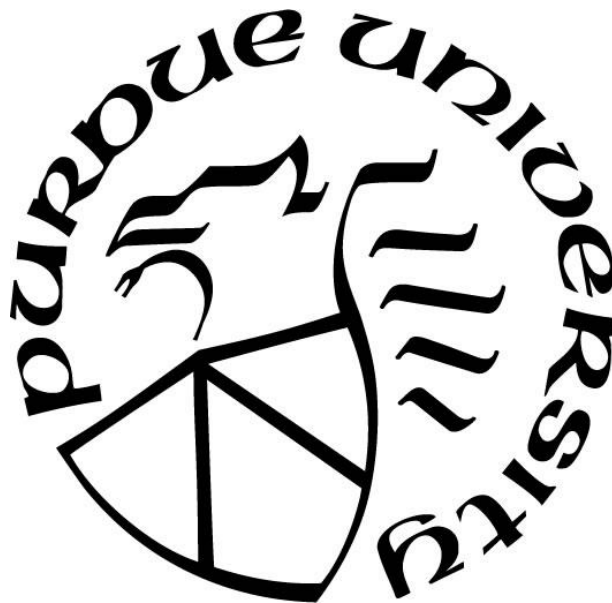
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*To Providence*

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## **ABSTRACT**

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Title: The Adoption of Mobile Learning into Higher Education: Influencing Students' Skills, Attitudes, and Global Competence

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An era of vast digital advancements has given way to emerging technologies capable of transforming the educational experience. Personal learning technologies are increasingly pervasive and becoming more central to human interaction. Among university students, these devices often include mobile phones and tablets. The ubiquity of these technologies among college students has caused researchers to study their effective use in the higher education environment. The upcoming field of mobile learning recognizes mobile devices as tools capable of putting students at the center of learning. Currently, a large body of mobile learning literature highlights how students perceive the adoption of mobile devices in their college courses. Factors such as student skill level, attitude, and practicality have been identified as critical elements to adoption. As a result, multiple studies suggest that students be trained in a way that impacts these factors. Yet, literature is silent on how this can be successfully done. The following research articles experiment with how training students impacts their skills and attitudes toward mobile learning. It also proposes how mobile learning can be used in a practical manner to improve a present issue, namely students' lack of global competence.

## CHAPTER 1. INTRODUCTION

In contrast to the fixed landlines and computers used just a few decades ago, an increasingly mobile and connected society has led to the igniting of a mobile technology revolution (Pew Research Center, 2018). The popularity of palm sized mobile devices such as tablets, smartphones, and wearables has blossomed across the globe as more people rely upon these tools over aging technologies. Improved wireless network coverage expands the capabilities of users to both retrieve information through increased Internet access and improve communication via text, email, and social media. The spectacular growth of mobile broadband internet has led to decreasing prices for Internet access and wider network coverage at a global level (ITU, 2017). The popularity of mobile devices was more fully recognized in 2016 when Internet browsing on desktop computers was overtaken by mobile web browsing for the first time (Statcounter, 2016). In the midst of this dynamic digital environment, young people are at the forefront of connecting via Internet and mobile technology. Often named “digital natives”, the rising generation headlines using mobile technologies for digital interactions and ubiquitous access to online resources. As researchers and practitioners explored how to use these mobile technologies to support student-centered learning, the educational field of mobile learning was developed.

Mobile learning has progressed in higher education as a result of the vast number of students who possess a device and the unique affordances mobile devices can provide. Mobile technology possesses the ability to blend formal and informal learning because it lacks time restraint, encourages personalized learning, and can be used in any context (Crompton, 2013b). Furthermore, educational applications available through mobile devices can help increase student collaboration, engagement, and interactivity within coursework (Cochrane & Narayan, 2017). Nonetheless, despite the strengths offered by these devices, there are still numerous challenges to

integrating mobile learning across the higher education landscape. For instance, a lack of student support, negative attitudes towards new technology, and a lack of pedagogical knowledge on mobile learning from instructors are a few factors influencing the adoption of mobile technology in university settings.

Therefore, the general purpose of this dissertation was to advance the field of mobile learning forward through the contribution of reputable and scholarly research. This task was accomplished by identifying specific problems from mobile learning literature, empirically examining each issue in the research process, and proposing solutions to each challenge. The result of this dissertation was three academic papers that were published or submitted for publication.

## **Overview of Mobile Learning**

### **Defining the Field**

The rapidly evolving and young field of mobile learning (i.e., m-learning, mlearning) yields no absolute definition. Considered by some to be a branch of e-learning or distance education, it has been previously defined according to the learning pedagogies, device, context, or interactions taking place (Crompton, 2013b). Though mobile learning could simply be considered as “using mobile technologies to facilitate learning” (Hwang & Tsai, 2011, p. 65), this vision may fail to distinguish other components such as the mobility of technology, the mobility of the learner, and the mobility of learning (El-Hussein & Cronje, 2010). One critical component of mobile learning is that it includes a handheld device capable of being easily transported, such as a mobile phone and devices with similar uses (De-Marcos et al. 2010; Wang, Wu, & Wang, 2009; Traxler 2007). Importantly mobile learning is not synonymous with mobile phones as it can also include tablets or wearable technologies. A second element of mobile learning is its ability to recognize

context and provide education at any time and place (Traxler, 2007; Wong, Wu, & Wong, 2009; De-Marcos et al., 2010). The portable nature of the learning process is a transforming feature of mobile learning. Wu et al. (2012) add a third dynamic stating first that it is learner-centered and involves learners working through educational experiences with their wireless mobile technologies as a mediating tool. Consequently, a complete definition may propose that mobile learning be defined as wireless learning that incorporates the movability of a learner, the portability of a palm-sized device, and the mobility of the learning environment.

### **Adoption in Higher Education**

The 2017 NMC Horizon Report in Higher Education boldly declared that because of the pervasiveness of mobile technologies among university students, mobile learning was a year or less away from universities adopting their use (Adams Becker et al., 2017). The ubiquitous nature of mobile devices and their integration into popular culture has changed the way they are viewed in higher education (El-Hussein & Cronje, 2010). Thus, the increased availability of mobile learning is changing how people view these devices as useful tools for accomplishing educational tasks. For instance, an institution such as Daystar University in Kenya sees value in using mobile platforms to provide distance education courses and broaden access to open educational resources (Waruru, 2016). Other organizations such as Purdue University use applications like Hotseat to increase student engagement within course lectures. In the United States alone, 19 out of 20 university students own a smartphone and an increasing number desire that their instructors adopt more technologies into the classroom that engage their students (Brooks & Pomerantz, 2017).

Current research surrounding the adoption of mobile learning into higher education highlights how students perceive the pedagogical, personal, and social affordances of learning with mobile devices. For example, university students often see the integration of mobile devices as a

positive approach if they perceive the mobile technology is both useful and easy to use (Wang et al., 2009; Cheon, Lee, Crooks, & Song, 2012; Abu-al-aish & Love, 2013; Iqbal & Bhatti, 2015; Hao, Dennen, & Mei, 2016; Sarraf, Shibli, & Badursha, 2016). Students also agree that they are more willing to adopt mobile learning if they can interact and collaborate in creative ways using their mobile devices (Koole, McQuilkin, & Ally, 2009; James, 2011; Gikas & Grant, 2013). Additional factors such as social status and teacher influence also play a role in student adoption (Hao et al., 2016; Wang et al., 2009). However, in the midst of adopting these technologies many students still express concern about associated costs, obsolete technologies, and slow internet speeds with the use of these devices in higher education (Brown & Mbatia, 2015; Iqbal & Qureshi, 2012; James, 2011). Overall, the adoption of mobile learning is most effective when it considers the strengths unique to these devices (Cochrane & Narayan, 2017; Rushby, 2012).

### **Affordances and Issues**

Cochrane and Narayan (2017) posed three universal principles concerning mobile learning explaining that it is uniquely effective at enabling student-generated content, student-generated context, and authentic learning experiences. Traxler (2011) further explained that mobile learning affords situated, authentic, contingent, context-aware, and personalized learning. These learning experiences are possible because of the variety of built in tools and downloadable features a mobile device can provide. Students can become content creators in their coursework through the use of audio and video recording, multimedia production tools, and access to a wide range of applications. Mobile devices provide unparalleled communication avenues for student to collaborate on projects at any time or place via phone, social media, email, text messaging, and chat applications. Students at a Japanese university effectively used their mobile phones to learn a language by producing weekly videos for their instructor to watch (Gromik, 2012). Internal contextual sensors including



GPS positioning, accelerometer, and gyroscope make it possible for virtual and augmented reality applications to excel in a classroom. One university found that mobile augmented reality facilitated effective learning for electrical engineering students as they superimposed 3D models over their training equipment (Martín-Gutiérrez, Fabiani, Benesova, Meneses, & Mora, 2015). Furthermore, contextual based learning through mobile gaming is gaining popularity as students constructively learn within or without the classroom walls (Bressler, Oltman, & Vallera, 2018). This portable nature of a mobile device provides authentic learning experiences in education because it can be used to actively work on assignments in the very environment where what is learned can be transferred to use (Crompton, 2013a).

One example of many successful mobile learning initiatives in higher education was described by Carmean, Frankfort, and Salim (2013), who explained how mobile personalized learning at University of Washington-Tacoma (UWT) effectively supported at-risk students. Their article described how UWT recognized students in introductory online mathematics classes were at risk for completion and then collaborated with Persistence Plus to provide unique mobile application tailored to support individual student needs. Here mobile phones were used throughout the semester to send online students personalized daily nudges that were adapted based upon course data, grades, and student inputs. Messages came in the form of text messages or app notifications and drew upon research to increase engagement and achievement. By encouraging more a positive attitude and resilient mind-set, results of the study showed that the students participating in the mobile learning program performed better academically than those who did not. Furthermore, students felt more supported and displayed improved study habits such as earlier preparation for tests and use of support groups. They were even less likely to contact faculty to

other campus resources. Using mobile learning to support students via personalized learning is just one of many aspects being empirically investigated in the mobile learning field.

Educators, researchers, and administrators may question if mobile learning shows enough promise in higher education and why its adoption should be considered. This may be especially true in areas such as the United States where university students often own a personal computer in addition and prefer its use over their mobile device. First, these often-shortsighted concerns fail to understand that globally the likelihood of owning a personal mobile device now outweighs that of computers (Ahonen, 2011; Statcounter, 2016). Hence worldwide organizations, such as UNESCO, continue to encourage mobile learning research because currently these devices are penetrating vast areas and groups previously unreachable (West, 2012). Second, mobile learning is most effective when its unique affordances are considered rather than being viewed as simple replacement to traditional classroom approaches. The vision of mobile learning fails to be complete if these devices are only seen as a replacement to computers or paper and pencil.

Mobile learning should have full consideration in higher education because it promises to transform the quality, equality, and opportunity of learning when properly used. The quality of learning in university setting can be enhanced as these devices are used to do what computers cannot, such as engage mobile virtual reality, augmented reality, GPS locating, video filming, and photography (Cochrane & Narayan, 2017). Mobile devices also improve equality in education by empowering underprivileged groups, such women and refugees, toward improved literacy rates, skills, and ultimately livelihood (Belalcázar, 2015; United Nations Educational, Scientific and Cultural Organization, 2018). As mobile learning addresses learning equality it also works to increase educational opportunity by reaching one more. Educational administrators continue to present at mobile learning conferences explaining that, although many of their students cannot

physically make it to a classroom, a mobile device is able to extend educational opportunities to them (United Nations Educational, Scientific and Cultural Organization, 2018). For example, farmers in the mountains of Peru may not be able to make it to their class on agriculture, nevertheless, mobile technology has effectively taught and improved farming education at a distance. When used correctly, mobile learning can assist in improving the quality of life for many people.

However, over the past two decades, there is still relatively little empirical evidence on the effect mobile learning is having in higher education settings (Pimmer, Mateescu, & Gröbhiel, 2016). The relative novelty of the mobile learning field yields many areas for future research that bid for a clearer understanding. One current problem is that, although university students have high levels of ownership, it does not mean they are proficient at using these technologies. Recent literature suggest that students have a problem with using mobile technology for formal educational purposes (Ozdamli & Uzunboylu, 2015; Tabor, 2016). A second challenge is that student intentions to use technologies are tied closely with the personal attitudes and experiences of university students (Brooks, 2016). Student attitudes are significantly influential in the adoption of mobile technology and further research should examine those students who have been exposed to mobile learning in their coursework (Cheon et al., 2012). A third issue lies in that more now than in previous years, university students are reporting faculty who are banning or discouraging the use of mobile technologies in class (Brooks & Pomerantz, 2017). The introduction of new technologies can be challenging and instructors have indicated they lack the knowledge on how to implement the practical use of mobile phones in their teaching and learning (Kafyulilo, 2012). After a multi-year study, Chen, Seilhamer, Bennett, and Bauer (2015) explained that both “students

and instructors need technical, logistical, and pedagogical support for integrating mobile devices and apps” (p. 1).

Therefore, the purpose of this dissertation is to provide support for researchers and practitioners in the adoption of mobile learning into higher education by providing three publishable articles on training, attitudes, and practical implementation. The first paper addresses the problem surrounding a lack of student experience using mobile devices for educational purposes. This is accomplished by investigating how training university students on the effective use of mobile devices impacts their perceptions of skill level and adoption. The second paper addresses the need for increased knowledge on student attitudes by examining the changing attitudes of students who have been exposed to mobile learning in their coursework. The third paper aids university instructors in the implementation of mobile learning by providing a practical example of how mobile devices may assist in overcoming a growing challenge among graduating students today, specifically a lack in global competency.

### **Philosophy and Worldview**

Creswell and Plano Clark (2011) state that, “all research has a philosophical foundation, and inquirers should be aware of assumptions they make about gaining knowledge during their study” (p. 38). Furthermore, it is critical that the researcher clearly identifies in the beginning of the dissertation the theory and philosophy that govern their studies (Grant & Osanloo, 2014). The theoretical frameworks applied in this dissertation, described individually in chapters two through four, were overall influenced by the pragmatic worldview of the researcher.

Briefly described, pragmatism as a worldview focuses on the importance of answering the questions posed in the research rather than concentrating on the methods used (Creswell, 2011). Morgan (2007) notes that critics who view paradigms as epistemological stances often challenge

the legitimacy of a pragmatist approach. This is primarily because quantitative and qualitative paradigms have historically challenged one another by viewing the purpose of research and the discovery of knowledge from opposing perspectives. However, as proposed by Morgan (2007), this dissertation adopts a different system which views pragmatism as an approach focused on how much shared understanding can be accomplished and what joint action between humans with different beliefs can be taken.

Pragmatism allows for diverse theories and approaches, such as mixing methods, in an effort to find what works most effectively in answering the questions being examined. For instance, social constructivist principles provided a worthy theoretical lens in chapter two's study because participants were working with peers more knowledgeable in mobile learning. Additionally, an explanatory sequential mixed methods design was implemented in the study because the limited research on mobile learning and training necessitated an investigation at a greater breadth and depth. In subsequent chapters, student attitudes and global competence were targeted and therefore these chapters adopted a theoretical lens the researcher assumed most helpful in answering the posed questions.

### **Dissertation Organization**

This dissertation follows the journal paper format and consists of three articles that either have been published or will be submitted for publication. These three articles comprise chapters two through four and build upon each other to solve the above-mentioned issues. The fifth and final chapter presents a discussion of the conclusions and implications drawn from the dissertation. Chapters two through five are summarized as follows:

## Chapter Two

- **Title.** The Impact of Training on Student Perceptions of Mobile Learning: A Mixed Methods Approach
- **Problem of study.** Students are skilled with using mobile technology for social activities but lack skill using them formal education. There is a lack of information about the impact of training students on the use of mobile devices and the results of their use throughout coursework.
- **Purpose.** Investigate what happens to students' perceptions of skill and adoption as result of being trained on their effective use and participating in mobile learning activities throughout their coursework.
- **Research questions.** Is there an increase or decrease with students perceived skill level in using mobile devices to complete educational assignments as a result of training? Amongst students reporting major differences in skill level as a result of training, what positive or negative factors could explain their change? Why do these students either praise or criticize the use of mobile devices in coursework?
- **Theoretical framework.** Social constructivist learning theory (i.e., Vygotsky's Zone of Proximal Development) focusing on the learning process through the guidance of more capable peers.
- **Research design.** Mixed methods explanatory sequential research design implemented containing a quantitative phase of data collection and a follow up qualitative phase. Quantitative phase emphasized.
- **Methods.** Pre and post survey questionnaire used for quantitative data collection with a training intervention in between. Pre-survey included 127 responses and post-survey

included 109 responses. Convenience sampling used. A total of 97 responses were matched at a 75% return rate. Quantitative results informed interview protocol development and semi-structured interviews were carried out. Extreme case sampling was used for five interview participants.

- **Analysis.** Frequency analysis and paired samples inferential analysis using SPSS. Differences in how students perceived skill before and after training intervention were analyzed. Multiple case study analysis for five participants analyzed using Nvivo software.
- **Trustworthiness.** Pilot testing of previous students, feedback from outside researchers, member checking.
- **Results.** Statistically significant differences revealed for 8/12 skills after training. Interviews revealed three primary themes: device and preference, experience and familiarity, training.
- **Discussion.** Training students helped increase perceived skills and confidence in specific areas. Familiarity with device was a factor influencing perceptions and confidence. Device challenges influenced praise or criticism.
- **Conclusion.** Implications include students should be trained on how to use mobile technology in the classroom. Students should be given experiences to learn with mobiles. Educators should take device challenges into account.
- **Note.** This article has been submitted for publication in Internet & Higher Education

### Chapter Three

- **Title.** The Impact of Instructional Training on University Student Attitudes and Skills with Mobile Learning

- **Problem of study.** Literature is limited on how educators can specifically instruct university students in a manner that improves attitude and skill with mobile learning
- **Purpose.** To investigate the impact that instructional training based upon complex learning and attitudinal change principles has on student attitudes and perceived skill toward mobile learning in coursework
- **Research questions.** How does instructional training using complex learning principles influence students perceived skill level using mobile devices in coursework? What are learners' perceptions of attitudinal learning outcomes using mobile learning with the course? How do students perceive the effectiveness of the instructional training using complex learning principles?
- **Theoretical framework.** Complex learning and attitudinal learning
- **Design.** Mixed methods explanatory sequential research design implemented containing a quantitative phase of data collection and a follow up qualitative phase.
- **Methods.** Quantitative pre-survey was administered to 127 participants followed by an attitudinal post-survey to 109 participants after a three-month training intervention. Surveys were matched for a total of 97 participants. Interview protocol developed and participants selected. Multiple case study approach carried out with semi-structured interviews.
- **Analysis.** For quantitative data, descriptive and inferential analysis carried out for significance in skill and attitude. For qualitative data, data was coded and analyzed using pattern matching technique.



- **Trustworthiness.** Survey instruments were piloted with previous students of the class with feedback implemented. Multiple outside researchers reviewed the instruments and suggested changes were made.
- **Results.** Most positive response rates on average by group found within the cognitive (3.76) and social (3.59) attitudinal components, while the affective component exhibited the lowest average scores (2.99). Eight out of twelve mobile learning skills analyzed showed significant difference after training.
- **Discussion.** Instructional training that used complex learning principles positively influenced students' perceived skill level by increasing confidence and familiarity with a mobile device. Complex learning principles also positively influenced student perceptions of attitudinal learning outcomes by increasing awareness and experience. Lastly, learners perceive that instructional training using complex learning principles is effective in general
- **Conclusion.** Implications include how students could be trained using complex learning and attitudinal principles in order to positively impact student attitude and skill.

## Chapter Four

- **Title.** Mobile Technology: A Tool to Increase Global Competency Among Higher Education Students
- **Problem.** Mobile technology is not being used to effectively solve global issues. One problem is with growing global interdependence college students are not prepared for international challenges that await them (e.g., jobs, different ideologies, social disagreements, cultural diversity).
- **Purpose.** To describe how mobile devices are uniquely positioned to nurture global competence and give practical implications for instructors looking to do so.

- **Theoretical framework.** The 2018 PISA framework for global competence was adopted.

The four stages of the framework and implications given are outlined as follows:

- Examine issues. Students need to effectively examine issues of local and global significance
  - Instructors can strengthen student's ability to examine issues by effectively using mobile devices with Internet search engines, synchronous or asynchronous communications, digital books, and news applications
- Understand perspectives. Students need to understand and appreciate the perspectives of others from different backgrounds and across the world.
  - Instructors can strengthen student's ability to understand perspectives by effectively using mobile devices with polling applications, reflection tools, and collaborative tools.
- Effective communication. Students need to engage in appropriate interactions across cultures and contexts.
  - Instructors can strengthen student's ability to communicate effectively by successfully using mobile devices with social networking and distance learning tools
- Take action. Students need to effectively act for the collective well-being of a global society
  - Instructors can strengthen student's ability to take action by effectively using mobile devices in a way that supports active learning, authentic contexts, and language learning

- **Note.** This article has been accepted for publication in the International Review of Research in Open and Distributed Learning (IRRODL).

## **Chapter Five**

This chapter summarizes the implications drawn from the three articles in the dissertation. A discussion is provided explaining how the chapters assisted the progression of mobile learning in higher education.

### **Significance**

The significance of this three-paper dissertation lies in its ability to provide a research-based foundation that illuminates understanding on the effective integration of mobile devices in higher education. Morris, Ramsay, and Chauhan (2012) declared the importance that “higher education institutions develop institutional strategies for the effective use of technology enhanced learning and the integration of mobile devices” (p 106). Universities need to provide students with training on the basic functions of mobile learning as they pursue adoption (Cheon et al., 2012; Tabor, 2016) and chapter one explains the results of that endeavor. University students’ positive attitudes toward new technologies are linked to positive experiences and increased likelihood of adoption (Brooks, 2016). Therefore, as the attitudes of those students who have had experiences using mobile learning in the classroom are better understood in chapter three, researchers and practitioners can better understand factors that impact successful adoption. Lastly, there is a lack of direction and training for instructors on the use of mobile learning (Ekanaya & Wishart, 2015; Mocofan & Huber, 2015) and they must learn how mobile devices can support them in their teaching (Lacey, Gunter, & Reeves, 2014). Chapter four adds significance to the field because it

sheds light on one problem in higher education and gives examples of how instructors can use mobile technology as part of a solution.

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## **CHAPTER 2. IMPACT OF TRAINING ON STUDENTS PERCEPTIONS OF MOBILE LEARNING: A MIXED METHODS APPROACH**

### **Abstract**

Mobile phone ownership among college-aged students and educational studies surrounding mobile learning in higher education have dramatically increased. Previous research reveals that college students often positively perceive use of mobile devices in school but lack the understanding and skill to use them proficiently in accomplishing tasks as part of their coursework. The objective of this study is to examine how training students on the use of mobile devices in their coursework impacts their perceived skill level and perceptions of mobile adoption. A sequential explanatory mixed methods research design was implemented. Results from quantitative surveys and qualitative interviews demonstrate that training significantly increases students perceived skill level with multiple skills and strengthens confidence in using the device. Students appear unfamiliar with using mobile devices for educational assignments. Past experiences and mobile device features are influential in determining whether students praise or criticize their adoption in a course.

### **Keywords**

mobile learning, higher education, mobile applications, training, technology adoption, student perceptions

## Introduction

Mobile phone ownership levels among college-aged students in the United States continue to rapidly escalate toward a point of complete saturation (Brooks, 2016; Pew Research Center, 2018). As a result, research focused on the implementation of mobile learning in higher education has steadily increased (Hwang & Tsai, 2011; Wu et al., 2012). Informal and formal learning is becoming progressively blended and mobile devices are viewed as a critical tool because of their unique characteristics, such as ubiquitous access to information (Cochrane & Narayan, 2017; Hao, Dennen, & Mei, 2016; Pimmer, Mateescu, & Gröbhiel, 2016; Traxler, 2007). Today, college students take advantage of universal access by relying upon their mobile technology for social interaction (e.g., text, email, social media), entertainment, and news (Roberts, Yaya, & Manolis, 2014).

However, while university students are highly experienced with using mobile technology for everyday social activities, a growing body of empirical research contests their lack of skill and understanding of using their device as an effective educational tool (Ozdamli & Uzunboyulu, 2015; Tabor, 2016; Vasquez-Cano, 2014; Woodcock et al., 2012). A main barrier to the effective use of mobile learning in classes is the absence of training, which inhibits students from understanding how to effectively use their mobile devices in class (Du, 2015). For the successful student adoption of mobile learning in higher education, educators must focus on enhancing student skills through training (Iqbal & Bhatti, 2017). Therefore, it was necessary to investigate the impact of training students on how to effectively use mobile devices to facilitate learning (Du, 2015; Iqbal & Bhatti, 2015; Sarrab, Shibli, & Badursha, 2016; Vázquez-Cano, 2014). The purpose of this mixed methods study was to examine the impact of training had on students' perceived skill level in using mobile devices to accomplish educational tasks in their coursework.

## **Literature Review**

The following review briefly defines mobile learning, identifies current student perceptions of mobile device use, and describes the limited research on mobile training.

### **Defining Mobile Learning**

In its simplest form, mobile learning is using mobile technology to facilitate learning (Hwang & Tsai, 2011) and often includes small portable handheld devices such as mobile phones or other devices with similar functionalities (De-Marcos, Hilera, Barchino, Jiménez, Martínez, Gutiérrez, & Otón, 2010; Traxler 2007; Wong et al., 2009). A common feature of mobile learning is its ability to recognize the location of user and deliver anytime, anywhere education (De-Marcos et al., 2010; Traxler, 2007; Wang, Wu, & Wang, 2009). The most helpful factor for delivering anytime learning is the ability of the mobile device to provide portable internet connectivity (Shraim & Crompton, 2015). Mobile devices provide access to text messaging, email, and social media, delivering opportunities for students to actively collaborate and interact (Gikas & Grant, 2013; Pimmer, 2016; West, 2012). Brown and Mbatia (2015) further added that mobile learning offers students' support via text message, audio visual access, GPS location awareness, augmented reality, and personalized learning environments. Traditional class settings are being transformed as mobile learning gives rise to contextual, situated, and real-world scenarios that enable students to be immersed in authentic learning environments. (Cochrane & Narayan, 2017; Traxler 2007; West, 2012). For example, mobile devices have been used to provide augmented learning that supports families being educated about tree characteristics and life cycle phases while outdoors in nature (Land & Zimmerman, 2015).

## **Student Perceptions of Mobile Learning**

Current research identifies numerous positive and negative student perceptions influencing their acceptance of mobile learning. For example, students negatively perceive adopting mobile learning for reasons such as connectivity and the cost of device ownership (James, 2011; Brown & Mbatia, 2015). Though college students often view the use of mobile devices as a positive element in higher education when certain conditions are met (Brooks, 2016; Woodcock, Middleton, & Nortcliffe, 2012). Multiple studies illustrate that student adoption is frequently affected by how students perceive the practicality of mobile learning (Abu-al-aish & Love, 2013; Briz-Ponce, Pereira, Carvalho, Antonio Juanes-Mendez, & Jos García-Pe, 2017; Du, 2015; Hao et al., 2016; Iqbal & Bhatti, 2015; Liu, Li, & Carlsson, 2010; Sarrab et al., 2016; Vázquez-Cano, 2014; Wang et al., 2009). When students recognize the usefulness and functionality of learning with mobile technology they are more likely to consider its practice in their college coursework. A closely related aspect impelling the acceptance of mobile learning is the students' viewpoint of how easy the mobile technology is to use (Briz-Ponce et al., 2017; Cheon, Lee, Crooks, & Song, 2012; Hao et al., 2016; Iqbal & Bhatti, 2015; Sarrab et al., 2016; Wang et al., 2009). Abu-al-aish and Love (2013) supported this principle, stating that when mobile learning applications were easy to use student performance increased and student acceptance toward mobile learning was enhanced.

However, research studies on mobile learning often involve impressions of students who have not yet used mobile devices in their courses and consequently there is a lack of information that exists on actual experiences and applications of mobile learning in formal and informal higher education (Abu-al-aish & Love, 2013; Cheon et al., 2012; Gikas & Grant, 2013; Park, 2011; Pimmer et al., 2016; Wang et al., 2009). The existence of a supporting infrastructure for students

is a critical influential factor (Brown & Mbatti, 2015; Sarraf et al., 2016). As part of this sphere of support, students feel their instructors play an influential role in the operation of mobile learning technology (Brooks, 2016; Cheon et al., 2012). How college instructors approach the use of technology can change the classroom environment and influence whether students positively or negatively perceive mobile device use (Gikas & Grant, 2013). Overall, there is a need for the employment of optimal policies, trainings, and facilitating conditions that are foundational for students' use of mobile devices in coursework.

### **Mobile Training**

Research on training in the use of mobile devices often targets instructors, rather than students (e.g., Ekanayake & Wishart, 2015; Gloria & Oluwadara, 2016; Kafyulilo, 2012; Mocofan & Huber, 2015; Power, Cristol, Gimbert, Bartoletti, & Kilgore, 2016). Instructors frequently feel inadequate with the practice of mobile technology in the classroom and can benefit from ongoing training as it can strengthen self-efficacy (Gloria & Oluwada, 2016). Ekanayake and Wishart (2015) found that carrying out multiple teacher trainings via workshops and seminars positively changed attitudes toward the use of mobile devices in teaching and learning. Nevertheless, there is a need for continuous and proper training to be implemented for both teachers and students (Ishtaiwa, Khaled, & Dukmak, 2015).

For successful student adoption and increased usefulness of mobile learning in higher education, formal training from instructors must focus on enhancing practical mobile skills, functions, and applications in education (Cheon et al., 2012; Iqbal & Bhatti, 2015; Moran, Hawkes, Gayer, 2010; Tabor, 2016; Yeap, Ramayah, & Soto-Acosta, 2016). Morris, Ramsay, and Chauhan (2012) discussed the critical need that “higher education institutions develop instructional strategies for the effective use of technology enhanced learning and the integration of mobile

devices” (p. 106). As universities provide students with training on the basic functions and applications of mobile learning technology in their coursework, student confidence increases and they are more likely to embrace its use (Cheon et al., 2012).

The purpose of this mixed methods study was to address how training impacts student perceptions in using mobile devices to accomplish educational tasks in their coursework. In order to understand any changes as a result of training, the study then sought to further explain possible factors associated with changes in skill level and student perceptions of mobile learning adoption. This explanatory sequential design will collect quantitative data on student perceptions and explain those feelings in more depth through qualitative interviews. The following primary research question is proposed: Is there an increase or decrease with students perceived skill level in using mobile devices to complete educational assignments as a result of training? The ensuing sub-questions are offered: Amongst students reporting major differences in skill level as a result of training, what positive or negative factors could explain their change? Why do these students either praise or criticize the use of mobile devices in coursework?

## **Methods**

### **Theoretical Framework**

Mobile learning has multiple theoretical underpinnings. This article looked at the learning process primarily through the lens of Vygotsky’s zone of proximal development (ZPD) and social constructivist learning theory. Vygotsky’s ZPD posits that, under the direction and guidance of more capable peers, learners can move from the skills they have mastered to those not yet grasped (Vygotsky, 1978). These principles were applied in this study as students were provided with guided training and scaffolding to help them develop mobile learning skills in coursework. Social constructivist learning theory highlights that knowledge is co-constructed from experiences

between the learner and their community. Ertmer and Newby (2013) described that learning today has become both a social and personal process driven by learners who have instant access to information and desire high levels of interaction and activity. They further add that because of the needs of these modern learners, interest in theoretical perspectives in areas such as mobile learning and social constructivism has increased. Social constructivist principles were critical for the present study because they guided analysis of how students interacted with peers, instructors, and teaching assistants using mobile technology. For example, observing how student perceptions were influenced by past social experiences such as those with instructors in grade school.

## Research Design

In order to answer the research questions, an explanatory sequential mixed methods design, as described by Creswell and Plano-Clark (2011), was implemented. Quantitative data collection phase was emphasized and further informed by qualitative data (see Figure 1 for visual model). Creswell and Plano-Clark (2011) explained that this design is useful in assessing general trends and relationships through quantitative data but also provides a means to explain in more depth the motives behind those developments with qualitative data.

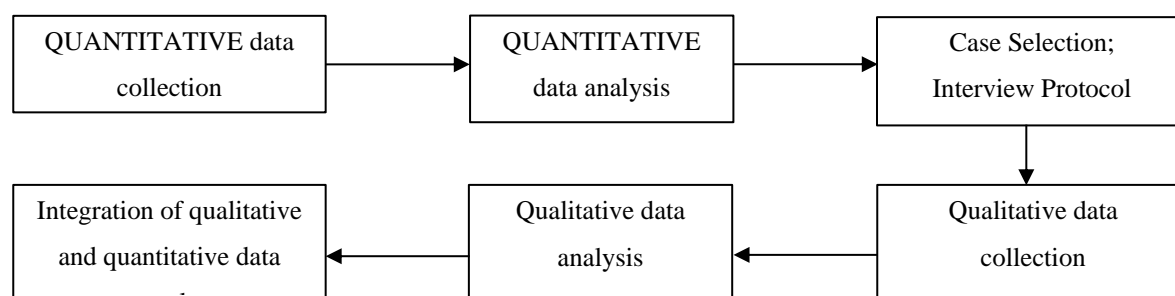


Figure 1 Visual model for mixed methods explanatory sequential design

Additionally, Yeap et al. (2016) proposed that student evaluation of mobile learning needs to be examined through pre and post survey methods. Therefore, quantitative data was gathered through a pre and post survey questionnaire and qualitative data collected through interviews. Data collection took place in two phases.

## **Context**

The study was carried out at a large midwestern research university in an introductory educational technology course for pre-service teachers. The course registered on average between 150 - 200 students per semester and focused on integrating technology into education through the use of competency-based digital badges (e.g. credentialing) as assignments. The primary platform used in the course was Passport, an application available through computer and mobile phone where students can complete digital badge activities such as iMovie and Mendeley. Students were required to complete some assignments using their phone and others were left to student choice. Students used Passport to work on, submit assignments, and receive constructive feedback from teaching assistants, who were considered experts on the badges. Students were formally trained at two campus computer labs on how to use mobile technology to complete digital badges.

## **Participants**

For the quantitative phase, one hundred and twenty-seven students (95 female; 32 male) participated in the pre-survey in January, 2018 and one hundred and nine participated in the post-survey in April the same year. A total of 97 ( $n = 97$ ) responses were matched between pre-test and post-test constituting a 75% return rate. All students enrolled in the semester long course were invited to participate in both surveys as part of evaluating the course. Therefore, convenience sampling (Hatch, 2002) was used for the pre and post survey because students were already divided



into six lab classes of between 15-25 students in each. Participants were predominately between the ages of 18 – 20 and in their freshman or sophomore year at the university (71 freshman; 44 sophomores; 12 other). For the qualitative phase, students willing to participate in a more in-depth interview submitted their name. Extreme case sampling (Patton, 2002) was used to select five total participants for interviews, purposefully constituting either those with the greatest positive or negative change in perceived skill after the training. Students who were interviewed were given a small gift card for their time.

## **Procedure**

The training intervention between pre and post surveys consisted of using eight structured presentations and associated activities over a three-month time period. Training interventions occurred during class time in a computer lab instructed by teaching assistants. Each presentation first gave a written description of the what the mobile application was and what it could do for the student. Participants were then encouraged to download the application from the app store. Once participants downloaded the application, the teaching assistant proceeded to show a video screencast demonstrating the different features of the app. For example, participants first learned information about the Passport digital badge app and then watched a video displaying how to use the application for accomplishing the assignment that week in an effective manner.

Upon completion of the video tutorial, participants were invited to apply what they learned by using their mobile phones to complete a digital badge assignment. A total of eight trainings were implemented focusing on the following: tracking digital badges with Passport, note taking with Microsoft OneNote, making presentations with PowerPoint, social bookmarking with Mendeley, assessing with PollEverywhere and Quizlet, web development with Weebly, movie production with iMovie, and virtual reality with Google StreetView.

## **Quantitative Phase**

### ***Data collection***

A pre-test and post-test survey instrument was used for the quantitative phase of data collection (see Appendix A). The survey items were developed by the researcher and informed by related literature (e.g., Mahat, Fauzi Mohd Ayub, & Luan, 2012; Moran, Hawkes, & Gayar, 2010; Tabor, 2016). Surveys were pilot tested on four students who took the course the semester before in order to increase validity. Additionally, two outside researchers assessed the survey items for validity and provided feedback. The pretest included 34 items possessed inquiries about demographic background and mobile learning experience such as type of mobile programs being used and time spent using the device for educational purposes. Twelve core questions, based on a five-point Likert scale, targeted how participants perceived their skill level when using a mobile device to accomplish educational tasks and how they perceived adopting mobile learning. The posttest survey omitted demographic and experience inquiries but replicated the original expectation and core skill questions found on the pretest. Surveys were administered through Qualtrics online software as part of the course. Of the 127 pretest participants and 109 posttest participants, 97 ( $n = 97$ ) were matched. The participant data unable to be matched between pre and posttests, due to course drop and absence, were used for frequency analysis but excluded from the inferential analysis of the skill items.

### ***Data analysis.***

A paired samples t-test and repeated measures design was carried out because of its effectiveness at examining statistical differences in pre and post treatment (Privitera, 2015). Frequency analysis was first performed to give background knowledge on the survey participants.

Inferential paired samples t-test methods were then used to analyze exclusively the twelve core skill questions on pre and post test looking for statistical significance. SPSS statistical software was used to compare significant differences in pre and post data focusing on changes in how students rated themselves on the twelve core skill questions. The statistical tests performed were two-tailed with a .05 level of significance. Tests of normality and estimated Cohen's *d* effect size were completed to inform normal distributions and practicality of results.

## **Qualitative Phase**

### ***Data collection.***

During the second phase, qualitative, a multiple case study approach to data collection was used (Yin, 2014). A case study method is effective when seeking to answer explanatory questions such as why or how (Yin, 2012). Therefore, this approach was used to explain the factors influencing the changes that took place in student perceptions of skill and adoption. Each case, or unit of analysis, was bound to one individual student enrolled in the semester long course for a total of five cases. Based upon a preliminary analysis of the quantitative data, an interview protocol was developed that could provide added detail for the overall research questions (Creswell & Plano-Clark, 2011). Secondary open questions were integrated and effective at eliciting further information in follow-up to the quantitative survey questions (Stewart & Cash, 2000). Questions focused on why students perceived their skill level as high or low after receiving training and overall experiences using their mobile device with coursework (see Appendix B). To improve validity, outside researchers were asked to assess the interview questions and provide feedback. Interviews were semi-structured and took place for 15-30 minutes at a location determined by the participant. Interviews were recorded with audio recording software and transcribed verbatim.

### ***Data analysis.***

Coding schema development began by deductively creating codes based upon current research literature and the interview questions. Yin (2014) explains that a deductive “from the ground up” data analysis strategy can effectively start a new research path that leads to additional insights, patterns, and relationships (p. 137). For example, a code was created based upon student perceptions of mobile learning adoption. The researcher then used these codes as a framework and NVivo coding software to identify relevant information on a paragraph level. During this process the researcher also inductively created emergent codes based upon what was found in the data. Recurring words and phrases informing the research questions were recorded as codes (Creswell & Plano-Clark, 2011; Saldaña, 2009). A codebook was formed with deductive codes and updated with emerging codes. The researcher then combined similar codes together to begin theme development for each case. A cross case thematic analysis, aggregating findings across each study (Yin, 2014), was then carried out. This provided an opportunity to compare and contrast findings in relation to themes and research questions. To increase credibility the researcher performed member checking, triangulated findings with quantitative results, and provided detailed descriptions of the cases (Creswell, 2007; Lincoln & Guba, 1985).

## **Results**

### **Quantitative Phase**

#### ***Frequency analysis.***

One hundred and twenty-seven participants took the pre-test survey ( $n = 127$ ). Participants first reported demographic and mobile usage information. Results showed that all participants owned a mobile phone capable of downloading applications (see Table 1). Every day use of

mobile phones by participants predominately included text messaging (97.7%), social networking (90.7), and making phone calls (79.8%). Participants were least likely to use their phone for daily shopping (24%) and exercising (14.7%). When asked to estimate the daily time they spent on their phone, approximately 40 percent of participants reported spending between three to five hours a day on their phone. Regarding the time spent using mobile devices to help with educational assignments, participants most often reported everyday use (40.9%).

Table 1 Current Mobile Phone Usage of Survey Participants

Characteristic	Frequency (n = 127)	Percentage (%)
Ownership of mobile phone with apps		
Yes	127	100.0
No	0	0
Daily uses of mobile phone (all that apply)		
Phone Calls	103	79.8
Text Messaging	126	97.7
Shopping	31	24.0
Banking	66	51.2
Emailing	100	77.5
Exercising	19	14.7
Social Networking	117	90.7
Navigation	78	60.5
Entertainment	81	62.8
Approximate time spent using phone daily		
Less than 1 hour	3	2.4
Between 1 hour and 3 hours	45	35.4
From 3 – 5 hours	51	40.2
From 5 – 7 hours	23	18.1
Above 7 hours	5	3.9
Approximate time spent using phone for course assignments help weekly		
One time a week	16	12.6
Two times a week	13	10.2
Three to four times a week	34	26.8
Five to six times a week	12	9.4
Every day	52	40.9

Participants next reported past experiences using mobile phones within their university coursework (see Table 2). Generally, participants reported having a wide range of activity when using mobile phones in their coursework. Most often mobile phones were used to either text classmates (96.0%) or look up information (96.0%). A higher percentage of participants reported having received formal training in past (41.3%). However, few had experience with Passport (15.1%) or digital badges on their mobile phone (15.9%).

Table 2 Past Experiences Using Mobile Phone for Course Assignments

Experience	Frequency of Yes Reponses	Percentage (%)
Read assignments	95	75.4
Taken photo/video	111	88.1
Looked up information	121	96.0
Taken notes or used calendar reminders	87	69.0
Accessed learning management system	120	95.2
Texted classmates	121	96.0
Been formally trained	52	41.3
Completed digital badges	20	15.9
Used passport application	19	15.1

Comparing posttest frequencies with pretest data was also informative concerning participants expectations about mobile learning. After the training intervention, approximately 69 percent of participants reported above average (i.e., somewhat agree, strongly agree) posttest ratings saying that using a mobile phone was essential to their learning process as compared to 58 percent on the pretest. About 49 percent of participants reported above average posttest ratings agreeing that using mobile phones in coursework would increase their chances of getting a better grade in the class as compared to 46 percent on the pretest.

### *Inferential analysis.*

Data from ninety-seven matched participants were analyzed using paired samples t-test. Results demonstrated statistically significant differences between pre-test and post-test for eight skills and insignificant results for four skills (see Table 3). Following training, participants reported significant improvements and large effect sizes when completing a digital badge,  $t(96) = -9.08, p < .001, (d = .93)$ , and course assignments using virtual reality,  $t(96) = -8.88, p < .001, (d = .91)$ . Data further displayed significant post-training results and medium effect sizes concerning participants skill in using a mobile device to produce videos,  $t(96) = -6.59, p < .001, (d = .67)$ , and create a website,  $t(96) = -5.06, p < .001, (d = .51)$ . Participants also reported significant improvements and small effect sizes after the training when asked about their skill in using a mobile phone to creating presentations,  $t(96) = -4.74, p < .001, (d = .48)$ , research and social bookmark,  $t(96) = -3.93, p < .001, (d = .40)$ , recognize success with a mobile phone,  $t(96) = -3.50, p = .001, (d = .36)$ , and complete assessments,  $t(96) = -3.13, p = .002, (d = .32)$ .



Table 3 Paired Samples T-Test

Skill	Pre		Post		$t(96)$	$p$	Cohen's $d$
	$M$	$SD$	$M$	$SD$			
Identify when mobile phone would be helpful	4.23	.84	4.33	.86	-1.11	.272	.11
Recognize when I have been successful	4.11	.95	4.42	.73	-3.50	.001	.36
Identify the right program	4.07	.91	4.13	.91	-.58	.563	.06
Access and read assignments	4.03	1.13	4.20	1.05	-1.40	.165	.14
Collaboratively complete assignments	4.10	1.11	4.12	1.05	-.16	.871	.02
Complete assessment	4.18	1.13	4.50	.834	-3.13	.002	.32
Film edit and produce video	2.87	1.30	3.94	1.26	-6.59	< .001	.67
Create a presentation	2.62	1.25	3.33	1.38	-4.74	< .001	.48
Create a website	2.32	1.14	3.12	1.39	-5.06	< .001	.51
Research and social bookmarking	3.41	1.32	3.98	1.08	-3.93	< .001	.40
Complete a digital badge	2.61	1.28	3.93	1.08	-9.08	< .001	.93
Use virtual reality to complete assignments	2.59	1.29	3.86	1.14	-8.88	< .001	.91

Though mean scores did improve for the following skills after training, participants reported insignificant statistical differences when using a mobile phone to access and read assignments,  $t(96) = -1.40$ ,  $p = .165$ , identifying when a mobile phone would be helpful,  $t(96) = -1.11$ ,  $p = .272$ , identifying the right mobile program to use,  $t(96) = -0.58$ ,  $p = .563$ , and collaboratively completing assignments on a mobile phone,  $t(96) = -0.16$ ,  $p = .871$ .

## **Qualitative Phase**

An analysis of five cases generated three themes explaining what positive or negative factors may have influenced statistically significant skill ratings and how participants perceived using mobile learning in their course. The themes revealed after qualitative analysis were as follows: device and preference, experience and familiarity, and training.

### ***Abbi***

#### *Device and preference*

When asked about her overall experience using her mobile phone in class, Abbi was quick to state that she rarely used her mobile device for coursework. She was critical of her miniature device with problems such as a small screen and limited storage space: “I don’t typically use my phone for a lot of homework just because the webpages always look weird on my end.” The awkwardness of a small phone in her hands and minimal screen size led her to prefer the computer over her mobile phone: “I just like using a computer better cause it feels more official I guess . . .”. Abbi rarely downloaded apps because of the storage space and always ended up deleting the program and using a computer with more space. In frustration she mentioned that transferring files between different mobile phones was too difficult: “I just don’t particularly like using cell phones in class. . . I guess I’m old fashioned. I’m one of those people who like typically phones are distracting.” Abbi favored computers because every time she was asked to get out her phone she felt like it was an interruption and was overall not productive. Moreover, she was critical of adoption because a lack of relevancy with her English undergraduate studies.

### *Experience and familiarity*

When addressing why she believed her perceived skill level ratings went down over the semester Abbi described her experience in high school and lack of using her phone in class: “My high school was just a giant dead spot so I could hardly use my phone anyway.” This experience affected her negative feelings about mobile devices. She described never seeing much of a use for mobile phones in class and therefore did not feel comfortable adopting its use. In comparing her past experiences and currently learning new skills she quoted:

So, it's like by the time I get to college it's like everyone, maybe a lot of kids might have used their phone for classes or school work or different things, but we never really did. So, it's just sort of like I never got the practice or to do it. And so, I guess you can't teach an old dog new tricks and so I'm sort of like used to putting my phone away and not using it in class.

Abbie explained she never actually used virtual reality for educational tasks nor new about applications such as passport and admitted that mobile devices probably could be helpful in accomplishing course projects.

### *Training*

Abbi responded optimistically when asked how the mobile phone trainings and activities impacted her skills. She praised the screen recording video trainings because they showed her applications she had not seen before and helped her feel more confident in using them: “The passport video was good though because I didn't know there a password app and I was sort of a little skeptical. . . whatever the video showed, I was like okay that's not too bad.” Abbi explained that when she needs to learn how to do something she watches a YouTube video and therefore the

videos were impactful on her: “I think just personally I’m just sort of like a watch someone do it and then do it myself type thing rather than like get in groups to try and figure it out yourself.”

## *Claire*

### *Device and preference*

Claire began the interview sharing that she only used her mobile phone when it was absolutely necessary because the software was glitchy and her battery frequently died. She was also critical of doing homework on such a little device. However, Claire explained that the mobile phone was preferential when it came to filming videos, having all information in one place, or checking assignments when wi-fi was not available. She was inclined to using the devices in courses as long as students were given the option of which technology to use and there was a balance provided by instructors

### *Experience and familiarity*

When asked what factors caused her to report higher skill level ratings after the training, Claire shared that knowing what to use and how to use it made a major difference. She admitted that she hadn’t heard of many of the applications used in the class: “I guess just finding the right technology was a big factor.” The process of understanding how to use her mobile phone and actually using it in the lab impacted how she perceived its use for assignments: “Just being more familiar with it [mobile phone] in the labs when we were going over stuff and how to use stuff and so that made it a little bit easier to use.”

### *Training*

Claire further explained that another reason her perceived skill level increased was because of the demonstration videos and assignments implemented. She confessed that there was so much she didn't know about these technologies: "Probably all of them I didn't know, but just getting familiar with all those really helped and having them available on my phone I guess helped. . .". Claire described herself as not being tech savvy but explained how downloading the app and following along with the training video demonstration was critical in helping her learn the skill: "I am watching a video on how something works and I can actually like physically play by play and watch myself do it and do it on the video. That helps a lot." Claire hinted that going out and doing personal research on how to use mobile devices did not sound effective but that watching and doing made it much easier for her: "It [the video] impacted it quite a bit because if I was just given like an app and you say go ahead and do this I would have no idea."

### *David*

#### *Device and preference*

David began the interview by explaining his subpar experience using mobile phones in class. He carefully described how he felt many mobile applications were in their infancy in terms of development and consequently, using them was not a worthy endeavor. Though some programs were helpful in his eyes there was much room for improvement in comparison to computers: "I prefer using my computer because I think you have a lot more capabilities with your computer. It's a lot easier to handle a lot more processing power than a phone can offer you."

### *Experience and familiarity*

David attributed the rise in his perceived skill level ratings to his lack of previous experience with the programs on the mobile phone: “The reason I probably ranked myself low I'm just guessing because I just never use them. And the reason I was so high this time was because I'm just opening up and using them.” David was critical of mobile learning adoption in class because he said in high school it is majorly frowned upon to pull out your mobile phone: “And since everyone's coming in with that mentality, like I really shouldn't have my phone out right now, maybe that's why we're trying to not.” David then described an experience he had around eight years ago when he received a tablet from his parents and was asked to edit videos using mediocre software. He shared that the videos and experiences he now had in this class helped him realize that the same movie making program had come a long way in its development and could now be effectively used.

### *Training*

When asked about what was helpful to increasing skill level, David described, “The biggest helpful portion at least from the mobile side was iMovie and the videos that my TA showed in recitation. Those were really nice.” He further praised the video trainings for their effectiveness at providing a good foundation to jump off and make learning the skill easy for him. After being asked to expound upon this concept in more detail he explained:

It's great when essentially you demonstrate everything to someone. And then from there the student can take off with that... In Scouts we use the EDGE method. Explain Demonstrate Guide Enable. That demonstrate stage I've told countless people while I was in charge is the most critical step because once they see it for themselves you're way more confident going into it and you don't feel so lost. You've seen someone else do it.

For David the assignments and videos effectively demonstrated how to get started and he could continue learning skills on his own.

### ***Emma***

#### *Device and preference*

Emma explained that she chose not to use her mobile phone most often because of problems with battery life, screen-size, and storage space. She further described how tedious it was to constantly zoom in on a mobile device screen and how this leads to preferring a computer: “My preference just makes me think that oh it must be easier on a computer. I like my computer better so that’s what makes it easier in my head probably.” As for storage on her phone, Emma declared how troublesome it was to constantly delete to make room for things on her phone. It was also challenging to submit course projects such as the video assignment because it proved to be difficult with the learning management system.

#### *Experience and familiarity*

Emma believed that a factor contributing to her change in skill level was her lack of knowledge regarding mobile learning and software available: “I would have never known about a lot of these things so I think not necessarily wanting to use the new tools but like knowing about the new tools so that I can use them.” Her perceptions weren’t based so much about not wanting to use the tool but learning what tools were available. In reference to these programs she added, “I would have never known about Ed puzzle, or I would have never known about PiktoChart, or just having iMovie on your phone.” As she learned about the tools and how to use them she was surprised at how easy they were to use on her phone. In reference to her skill level, she declared, “I think it was really just not completely understanding how easy doing mobile like tasks were.”

### *Training*

Emma believed training videos and activities were impactful on her perceived skill level. She shared that having tasks to complete with her phone helped her understand the details of mobile learning and how to use the applications. When asked about the demonstration videos and activities Emma exclaimed how immensely helpful it was for someone to show the app, explain what it can do, walk through it, and then invite students to explore it with foundation under them: “Just because I was able to see it and you introduced me to it too. I would have never I don't know thought to utilize that or to even look at it probably.” Emma described one experience of being hesitant to use iMovie but when she watched the video she realized how simple it was and opened the app to try it out: “I think having as much information as I can before doing something makes me feel more confident going into it.”

### *Lucy*

#### *Device and preference*

Lucy began describing her mobile learning experience by sharing that her new mobile phone was difficult for her to learn how to use. She declared that using mobile devices for coursework was preferable when computer internet access was not available: “When you're on the go you can look and make sure you turned something in.” For her, mobile learning was helpful when recently camping with her family and she had to check on her course assignments.

#### *Experience and familiarity*

Lucy shared that, as a result of her past experiences in high school, she didn't know much about certain mobile tools and felt awkward using her phone in class. She explained:



I actually never knew screencast. I didn't know that existed. I went to a small high school. We didn't like to branch out and we used like Kahoot and like your common Quizlet Kahoot stuff, but this other stuff I've never heard of it.

Lucy further described how policies in her school had an effect upon her perceptions of using mobile technology in class: “It's different because like in high school they are like don't take those out don't use those in class. And now they are like take your phones out we're going to use them.” This experience impacted her current views on usage in the classroom.

### *Training*

Lucy believed that the training activities and videos were impactful on her perceptions: “I think they helped a lot not realizing what you could do on them or more of an explanation of how to do it or telling you what you should do and to proceed with it.” She remembered feeling apprehensive about one activity making a group video, but after they did it they realized it was not as difficult as they thought. Lucy shared that overall the videos were effective in helping her use tools she had never used before because they explained what the program was and demonstrated how to use it.

### *Cross Case Analysis*

The following cross case analysis briefly reports the similarities and differences across the cases regarding changes in skill level ratings and perceptions about the use of mobile devices in coursework.

### *Device and preference*

Each case presented similar results explaining that their mobile learning experiences in the course were based highly upon device challenges (e.g., hardware, software) and personal

preferences. Four out of five cases reported preferring computers because of challenges surrounding a mobile device including storage space, screen size, battery life, and program quality. The principal difference between the case with the highest negative change in perceived skill level on the survey and the other four cases was that this highlighted additional negative perceptions such as awkwardness of the device in hands, major distraction of the phone in class, and lack of relevancy in her academic discipline. Two cases stated that mobile devices were preferred when the phones were more advantageous, such as filming a video or accessing internet while traveling.

### *Experience and familiarity*

Case participants unanimously reported that they lacked a knowledge or familiarity of the mobile programs available and how to effectively use them. Two cases reported that as they gained experience using their mobile phone in the course, they came to understand how easy the programs were. Three participants, including both those with positive and negative change in skill level, reported having been influenced by past high school experiences, where policies required them to keep their mobile devices stored at all times.

### *Training*

Participants universally shared that video demonstrations, explanations, and assignments were effective at helping them gain more knowledge about mobile learning. All reported in some way that watching the video and doing something afterward was helpful to them. Three cases, including those with both positive and negative change in skill level, specifically shared increased confidence in their ability to use their mobile device as a result of the video demonstrations. Lastly, there were two cases that specifically shared that the videos provided a good foundation from which they could jump off moving forward on their own.

## Discussion

The purpose of this study was to observe how training impacted students perceived skill level using a mobile device in their coursework. The study further sought to understand what factors influenced the change in perceptions during the intervention period and highlight why students praise or criticize the use of mobile learning in their coursework. A mixed methods explanatory design was adopted, enabling quantitative results to be further explained by qualitative data, thereby providing a more holistic understanding of the research questions. The following discussion will focus on answering research questions by summarizing quantitative results, qualitative data, and connections to the literature.

Training students on how to use mobile technology in their coursework helped increase their perceived skill level and build confidence with particular skills. Quantitative results revealed that training students helped their perceived ability specifically to produce videos, create presentations, develop websites, research and social bookmark, complete digital badges, and use virtual reality in their coursework. The multiple case study further confirmed that the video demonstrations and applied activities were effective at influencing how they perceived completing assignments such as movies and digital badges. The principle that formal training and skill development can positively impact students and their perceptions is consistent with limited literature (Du, 2015; Iqbal & Bhatti, 2017; Vázquez-Cano, 2014). A higher percentage of participants did report having received training on their mobile device before the intervention, however, skill ratings on the pretest imply this is doubtful and suggest students might not have understood the meaning of formal training.

The improvement in ability could be further explained by qualitative insights where a most case participants reported feeling increasingly confident using mobile devices after they watched

the training videos. Student ability and confidence with mobile learning are closely related and can be improved by incorporating simple activities or training demonstrations that illustrate how using mobile devices for learning is empowering (Cheon et al., 2012; Yeap et al., 2016). Almost all cases reported that having opportunities to actively use their mobile devices for course assignments facilitated change in perceived skill level.

Students' unfamiliarity with using mobile devices and associated programs in their coursework was a primary factor contributing to changes in perceived skill level. Interestingly, quantitative data showed that even before training, students perceived they could identify the right mobile phone programs to use with assignments and when using their mobile device in class would be helpful. However, the same presurvey data showed this initial confidence in skill level decreased asked about specific tasks. Students had far less experience using their mobile devices to complete various educational tasks such as creating a quality movie, developing a presentation, or using virtual reality. All qualitative case participants detailed that they were almost completely unaware of many helpful educational programs for their mobile phone and did not understand how to use their devices for course assignments. This lack of familiarity is supported by literature suggesting students scarcely understand how to use mobile devices for educational purposes (Ozdamli & Uzunboylu, 2015; Tabor, 2016; Vasquez-Cano, 2014; Woodcock et al., 2012). Qualitative data sheds additional light on this matter suggesting that this deficiency of knowledge concerning mobile learning in the classroom could have been influenced by prior experiences. This is specifically supported by those who explained the restrictive nature of high school mobile phone policies and how subsequent consequences for its use resulted in lasting impressions.

Device challenges and features influenced how students whether students praised or criticized the use of mobile phones in class. Research suggests students support the use of mobile

phones in higher education (Brooks, 2016; Woodcock, Middleton, & Nortcliffe, 2012), but when interviewed about their overall experiences using a mobile phone in the course, all five case participants immediately reported a lack of desire for its use due to specific device challenges. This is in contrast to the 70 percent of post survey participants who confirmed using their mobile device was essential to their learning process and nearly 50 percent who agreed that using mobile learning would help them improve their grade in the course. A few case participants praised the use of mobile technology when unique features of the mobile phone were used, such as internet connectivity and video production. This could be explained by the principle that mobile learning is most effective when its unique features are used to transform teaching and learning rather than replace old practices (Cochrane & Narayan, 2017). Interview participants declared a small screen size, limited battery life, insufficient storage, and inadequate program development as negative aspects of their mobile phones. Technology issues with mobile learning were supported in literature (Brown & Mbat, 2015; Gikas & Grant 2013; James, 2011). Moreover, mobile hardware and software challenges are tied to how users perceive the usefulness of the device and perceptions of usability will decrease if students are unfamiliar with the device (Koole, McQuilkin, & Ally, 2009).

In an environment saturated with mobile technology, this study provides implications for practice and research for scholars looking to understand mobile learning in higher education. For practice, video demonstrations and applicable activities are effective approaches to boosting perceived skill level for certain tasks among students. Moreover, these formal training strategies assist students in both increasing familiarity with available technologies and building confidence in their ability to use them for educational purposes. It is also significant that mobile learning approaches and activities should take into account specific device challenges and features

associated with mobile technology if students are to be more willing to use them in their coursework. Implications for research primarily support that there is a possible relationship between training and increasing perceived skill and confidence with mobile learning. Also, university students may not fully understand the educational uses of their mobile devices and therefore future research should further examine what mobile device skills students possess or are lacking. Additionally, future research should look at how training impacts student outcomes using mobile technology or how past experience, such as that in high school, impacts student willingness to adopt mobile learning in university coursework.

Limitations to this study included the convenience sampling of students in a single university course. Students were not required at all times to use mobile technology and only perceptions were measured rather than student outcomes. The study took place in an introductory educational technology course which may have influenced participants perceptions.

### **Conclusion**

This study uniquely contributes to research that has called for examining the impact of training students on mobile learning skills (Iqbal & Bhatti, 2017) and the perceptions of students who have actual experience using mobile devices in their coursework (Abu-al-aish & Love, 2013; Cheon et al., 2012). An explanatory sequential mixed methods design was used to find that formal training and activities had a positive impact upon students perceived skill level with certain tasks, familiarity and confidence with mobile learning, willingness to adopt its use, and perceived device challenges.

University students today can benefit from being formally instructed on how to use their mobile devices to support course assignments. As students become more familiar with using current mobile technologies they become more confident in their skills. This confidence in

knowing the available mobile programs and how to use them is essential for adoption. Device challenges and past experiences with stifling school policies may leave lasting impressions on students and their understanding of using mobile devices in the classroom. With high mobile device ownership among university students, mobile learning is positioned as an effective facilitation tool for learning and students must be trained on their proper use in education.

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## Appendix

### Survey Questionnaire

Q1 Please fill in the blank below with your account email. This is confidential and will only be used as your respondent ID. (For example, if your email is john123@school.edu then only type "john123" into the box)

---

**Demographic Information and Current Mobile Phone Usage** This section asks about your background as well as your current habits of mobile phone usage.

Q2 What is your age?

- ☐ 18-20 (1)
- ☐ 21-23 (2)
- ☐ 24-26 (3)
- ☐ 27 and above (4)

Q4 What is your gender?

- ☐ Male (1)
- ☐ Female (2)
- ☐ Other (3) \_\_\_\_\_

Q5 You are currently a \_\_\_\_\_ at the University.

☐ Freshman (1)

☐ Sophomore (2)

☐ Junior (3)

☐ Senior (4)

☐ Other (5) \_\_\_\_\_

Q6 Do you own a mobile phone?

☐ Yes (1)

☐ No (2)

Q21 Can your mobile phone download applications? (e.g., Netflix, Instagram, Facebook)

☐ Yes (1)

☐ No (2)

Q7 Which of the following do you use your mobile phone for **daily**? (Check all that apply)

- ☐ Phone calls (1)
- ☐ Text messaging (2)
- ☐ Shopping (3)
- ☐ Banking (4)
- ☐ Emailing (5)
- ☐ Exercising (6)
- ☐ Social Networking (e.g., Instagram, Snapchat, Facebook) (7)
- ☐ Navigating (e.g., Google Maps) (8)
- ☐ Entertainment (e.g., movies, games) (9)
- ☐ Other (10) \_\_\_\_\_

Q8 Approximately how much time do you spend using your mobile phone **each day**?

- ☐ Less than 1 hour (1)
- ☐ Between 1 hour and 3 hours (2)
- ☐ Between 3 hours and 5 hours (3)
- ☐ Between 5 hours and 7 hours (4)
- ☐ Above 7 hours (5)

Q9 How often do you use your mobile phone to assist with homework or course assignments each week? (e.g., Googling answers to a question, accessing blackboard, responding to an instructor's email)

- ☐ One time a week (1)
- ☐ Two times a week (2)
- ☐ Three to four times a week (3)
- ☐ Five to six times a week (4)
- ☐ Every day (5)

**Mobile Phones and Your Educational Experience** This section asks about your experiences using mobile phones to accomplish any tasks or assignments as part of your college coursework.

Q10 Has the use of mobile phones been incorporated by your instructors into any of your college course assignments **prior to this current semester**? (e.g. iClicker, Hotseat, PollEverywhere)

- ☐ Yes (1)
- ☐ No (2)

Q11 Have you ever read an assignment or article on your mobile phone related to your college courses?

- ☐ Yes (1)
- ☐ No (2)

Q12 Have you ever taken a picture/video with your mobile phone for a college course assignment?

- ☐ Yes (1)
- ☐ No (2)



Q13 Have you ever used your mobile phone to look up something that you didn't know or didn't understand for a college course?

☐ Yes (1)

☐ No (2)

Q14 Have you ever accessed a learning management system (e.g., Blackboard, Canvas) for a college course from your mobile phone?

☐ Yes (1)

☐ No (2)

Q15 Have you ever taken notes or used a calendar on your mobile phone to remind you of a college course assignment?

☐ Yes (1)

☐ No (2)

Q16 Have you ever texted a classmate about a college course assignment?

☐ Yes (1)

☐ No (2)

Q17 Have you ever been formally trained on how you can use your mobile phone to complete your college course assignments **prior to this current semester**? (e.g. iClicker, Hotseat, PollEverywhere)

☐ Yes (1)

☐ No (2)

Q18 Have you ever received or completed a digital badge on your mobile phone **prior to this current semester**? A digital badge is a digital indicator of an accomplishment, skill, quality of talent awarded by an organization.

☐ Yes (1)

☐ No (2)

Q19 Have you ever used the Passport program to complete digital badge assignments for a college course **prior to this current semester?**

☐ Yes (1)

☐ No (2)

Q20 Have you ever used the Passport program application on your mobile phone to complete digital badge assignments for a college course **prior to this current semester?**

☐ Yes (1)

☐ No (2)

Q31 You will now be asked to answer questions on a five point scale ranging from strongly disagree to strongly agree.

**Your Expectations About Mobile Learning** This section asks about your expectations for using mobile phones as part of your college coursework.

Q22 Using my mobile phone is an essential part of my learning process.

☐ Strongly disagree (1)

☐ Somewhat disagree (2)

☐ Neither agree nor disagree (3)

☐ Somewhat agree (4)

☐ Strongly agree (5)

Q23 Using mobile learning as part of coursework would increase my chances of getting a better grade in class.

- ☐ Strongly disagree (1)
- ☐ Somewhat disagree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat agree (4)
- ☐ Strongly agree (5)

**Perceived Skill Using Mobile Phone Within Coursework** This section asks about how you perceive your own skill at using your mobile phone to complete college course assignments

Q27 Currently, I can...

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
identify when my mobile phone would be helpful for completing a course assignment. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
recognize when I have been successful using my mobile phone to complete course assignments (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
identify the right educational program, application or tool on my mobile phone to help me in completing a course assignment. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone to access and read assignments given in the course. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone to collaboratively complete course assignments with other classmates. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone to complete an assessment or a poll as part of a course assignment. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone film, edit, and produce a professional video as a course assignment. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

use my mobile phone  
to create a  
professional  
presentation as a  
course assignment.  
(8)

☐☐☐☐☐

use my mobile phone  
to create a website as  
a course assignment.  
(9)

☐☐☐☐☐

use my mobile phone  
to perform research  
or social  
bookmarking for a  
course assignment.  
(10)

☐☐☐☐☐

use my mobile phone  
to complete a digital  
badge as a course  
assignment. (11)

☐☐☐☐☐

use my mobile phone  
to complete course  
assignments  
requiring virtual or  
augmented reality  
(12)

☐☐☐☐☐

## Interview Protocol

### Impact of Training on Student Perceptions of Mobile Learning

#### **Interview Protocol**

Thank you for agreeing to participate in the interview and for completing the previous surveys. I appreciate you taking the time out of your busy schedule! Also, I do need to collect a signed consent form from you if I have not already.

As a reminder, the purpose of this evaluation is to determine: The effects of training on student perceptions of mobile learning.

Just to let you know, participation is voluntary and you are free to withdraw at any time.

Do I have your permission to record this session (once permission is granted then turn on recorder and verify so they are on “tape” granting permission).

#### **Questions:**

The following questions will be based upon your experience using your mobile phone for educational assignments in the intro to ed tech course.

- Can you describe for me your experience using your mobile phone in your intro to ed tech coursework during this semester?
- You indicated a major (increase or decrease) in your skill level using a mobile device between the first survey at the beginning of the semester and the second one you took this last week. Could you explain what factors promoted this change?
  - Could you identify specific experiences in class?
- How do you perceive the training videos and application activities in the course impacted your skill with a mobile phone?
  - How could the trainings and activities be improved?
  - What elements of the trainings were or were not helpful?
  - Could you give an example of a time that you (were or were not) helped by the training and activities?
- Looking forward, what role do you feel mobile phones should play in college courses?
- Is there anything else you would like to share that may be related to using mobile phones for completing course assignments that we have not discussed?

*Thank you again for your time in participating in this interview. Please feel free to reach out to us by email or phone if you have any questions or concerns. Thank you!*

### **CHAPTER 3. THE IMPACT OF INSTRUCTIONAL TRAINING ON UNIVERSITY STUDENT ATTITUDES AND SKILLS WITH MOBILE LEARNING**

#### **Abstract**

The integration of mobile devices in higher education is advancing as ownership levels increase among students. Mobile learning literature has repeatedly asserted that university students might not fully understand how to use their mobile devices for educational purposes, such as completing course assignments, and that there is a need for students to be trained on their effective use. However, research neglects to shed light on how students can be trained in a way that has a positive impact upon their perceptions of mobile learning adoption in higher education. Two key elements influencing how student adoption of mobile learning are attitude and skill level. This study adopted an explanatory mixed-methods design to examine how a training based on complex learning principles impacted student attitudes and perceived skill toward mobile learning in coursework. Results showed that instructional training that uses supportive information, procedural information, and authentic learning tasks had a positive impact on student attitude and skill.

#### **Keywords**

mobile learning, higher education, training, complex learning, technology adoption, student perceptions

## **Introduction**

Mobile learning uses portable handheld technologies to facilitate education at any time and place (Traxler, 2007). Recently, the NMC Horizon report identified mobile learning as a key emerging technology on the brink of full adoption in higher education due to convenience and pervasiveness (Adams Becker et al., 2017). Research literature and initiatives concerning the integration of mobile learning into higher education continue to increase (Hwang & Tsai, 2011; Krull & Duarte, 2017; Wu et al., 2012). Various studies have suggested that students have increasingly positive attitudes toward adoption (Al-Emran, Elsherif, & Shaalan, 2016; Liaw, Hatala, & Huang, 2010; Raza, Umer, Qazi, & Makhdoom, 2018), yet lack the skill to effectively use mobile technology in educational settings (Tabor, 2016; Vasquez-Cano, 2014; Woodcock, Middleton, & Nortcliffe, 2012). To facilitate adoption, higher education institutions should provide training and support for students to help them become more familiar with using their mobile devices for formal educational purposes (Chen, Seilhamer, Bennett, & Bauer, 2015; Cheon, Lee, Crooks, & Song, 2012; Raza et al., 2018). However, literature is limited on how educators can specifically instruct university students in a manner that improves attitude and skill with mobile learning.

Student intentions to adopt mobile devices have been found to be heavily influenced by confidence in ability (Cheon et al., 2012; Yeap, Ramayah, & Soto-Acosta, 2016) and attitude (Al-Emran & Shaalan, 2015; Raza et al., 2018; Thomas, Singh, & Gaffar, 2013). Successful adoption of mobile learning requires educators to target improving students' skills through instructional training (Iqbal & Bhatti, 2017). Moreover, as university students are instructed on the features and advantages of their mobile devices they have more positive attitudes and are more likely to use these technologies meaningfully in their courses (Raza et al., 2018). Therefore, the purpose



of this study was to investigate how an instructional training, which applied complex learning principles, impacted student attitudes and perceived skill toward mobile learning in coursework. This exploration provides valuable insight for university educators looking to influence two essential factors of mobile learning adoption, namely student attitude and skill.

## **Literature Review**

### **Mobile Learning in Higher Education**

Mobile devices are central to the lives of university students and academic institutions should consider the roles these technologies play as they plan for the future (Reinitz, 2017). As global mobile ownership grows to near 67 percent (Statista, 2018), a recent report showed that in areas such as the United States, approximately 100 percent of those between the ages of 18-29 own a cellphone (Pew Research Center, 2018). Another study of over 71,000 college students across twelve countries revealed that over 96 percent of students now owned a smart device (Brooks, 2016). The ubiquity and convenience of mobile devices is dramatically changing the way students learn from their surroundings and increasing the demand for new educational strategies to help adoption (Adams Becker et al., 2017).

The integration of personal handheld devices such as mobile phones into education has led to the creation and evolution of the mobile learning field (Crompton, 2013). Mobile learning literature yields no supreme definition but most often describes the use of small portable palm sized devices (De-Marcos et al. 2010; Wang, Wu, & Wang, 2009) being used to deliver anytime, anywhere education (Cochrane & Narayan, 2017; Traxler, 2007; Wang et al., 2009). El-Hussein and Cronje (2010) broadly explain that mobile learning is “any type of learning that takes place in learning environments and spaces that take account of the mobility of technology, mobility of learners, and mobility of learning” (p. 20). Consequently, this study views mobile learning as

wireless learning that incorporates the movability of a learner, the portability of a palm-sized device, and the mobility of the learning environment.

Mobile learning is becoming an increasingly vital element for university students because of its unique benefits (Chen et al., 2015; Gikas & Grant, 2013). Taking advantage of distinct affordances, such as improved communication, collaboration, content creation, and knowledge construction, increases the ability of mobile learning to be transformative in education (Cochrane and Narayan, 2017; Quinn, 2013). For instance, easy access to text messaging, email, and social media, have been advantageous for students looking to improve collaboration (Gikas & Grant, 2013; Pimmer, Mateescu, & Gröhbiel, 2016; West, 2012). Others have found that multifunctional tools on mobile devices, such as GPS positioning, gyroscope, accelerometer, virtual, and augmented reality (Brown & Mbat, 2015; Sevillano-García & Vázquez-Cano, 2015), were able to improve attention, motivation, comprehension, and overall academic performance for higher education students (Ferrer-Torregrosa, Torralba, Jimenez, García, & Barcia, 2015; Harley, Poitras, Jarrell, Duffy, & Lajoie, 2016; Redondo Domínguez, Fonseca Escudero, Sánchez Riera, & Navarro Delgado, 2014). In general, mobile learning can effectively facilitate contextual, situated, and real-world education (Brown & Mbat, 2015; Traxler 2007; West, 2012).

### **Attitude and Skill**

One factor deeply influencing student intentions to adopt the use of mobile technology in higher education is student attitude toward mobile learning (Al-Emran & Shaalan, 2015; Raza et al., 2018; Thomas, Singh, & Gaffar, 2013). Much of the current research surrounding mobile learning in the university setting targets student perceptions or attitudes (Hwang & Tsai, 2011) and often features positive attitudes toward mobile learning (De-Marcos et al., 2010; Liaw et al., 2010; Woodcock et al., 2012). For example, students positively evaluate mobile learning when they feel

it is a practical way to learn (Abu-al-aish & Love, 2013; Briz-Ponce, Pereira, Carvalho, Antonio Juanes-Mendez, & José García-Peñalvo, 2017; Hao, Dennen, & Mei., 2016; Iqbal & Bhatti, 2015; Liu et al., 2010; Sarrab, Shibli, & Badursha, 2016). Students are similarly optimistic toward mobile learning when they feel like the mobile device or program is easy to use (Briz-Ponce et al., 2017; Cheon et al., 2012; Hao et al., 2016; Iqbal & Bhatti, 2015; Wang et al., 2009). These two common perceptions of mobile learning, ease of use and practical usefulness, are closely associated with and may influence attitude and intention. (Sarrab et al., 2016). Furthermore, when students can use their devices to create and interact with course content, collaborate with fellow students, and learn at locations outside of class they tend to have positive attitudes toward mobile learning (Gikas & Grant, 2013; James, 2011; Koole, McQuilkin, & Ally, 2009)

Nevertheless, student attitudes toward the overall use of mobile learning in coursework are not entirely positive. Students have revealed negative attitudes about using their devices in class is because they feel it is a distraction to their learning (Brooks, 2016; Chen & Yan, 2016). Others identify the cost for mobile ownership and availability of Internet connection as negative factors (Alrasheedi, Capretz, & Raza, 2015; Brown & Mbati, 2015; James, 2011). Brett (2011) discovered that students felt mobile learning was an intrusion into personal time and that learning with text messaging lacked pedagogical benefit. Isaacs (2012) described that undesirable attitudes toward mobile phones grew out of inappropriate conduct such as cheating and cyber-bullying. Some students have expressed negative opinions about separating personal lives on their mobile phones from academics (Tabor, 2016). Lastly, negative viewpoints toward the use of mobile devices have developed in some students because of the lack of support they receive from their higher education institutions (Brown & Mbatti, 2015; Sarrab et al., 2016).

A similar factor largely influencing student acceptance of mobile learning is level of skill using their personal device (Tabor, 2016; Vázquez-Cano, 2014). Yeap et al. (2016) found that much of student readiness to use mobile learning is based upon their perceived abilities and confidence. These studies suggest that students require more help on how to use mobile technologies in for educational practices, perhaps, in part, because it is new to them (Woodcock et al., 2012). A lack of ability using mobile devices in education requires students be provided with the skills necessary to increase confidence with mobile learning (Sevillano-García & Vázquez-Cano, 2015; Yeap et al., 2016). Though mobile devices are pervasive, and carry unique tools, this does not translate to proficiency in using them for education (Chen et al., 2015).

### **Mobile Learning Training**

In order to promote the adoption of mobile learning through the improvement of attitudes and abilities, student training must be targeted (Cheon et al., 2012; Iqbal & Bhatti, 2015; Moran, Hawkes, Gayer, 2010; Raza et al., 2018; Sevillano-García & Vázquez-Cano, 2015; Tabor, 2016; Yeap et al., 2016). University students have shown that they perceive skill development and instructional training on the use of mobile learning as more important factors than the device itself (Vázquez-Cano, 2014). As students become familiar with the functions and features of mobile devices their confidence will increase, attitudes will become positive, and intentions to use mobile learning in their coursework will grow (Cheon et al., 2012; Raza et al., 2018). This could also be because students who are trained and develop skills with mobile technology for educational purposes have enhanced perceptions regarding mobile device usefulness and ease of use, which influences adoption (Iqbal & Bhatti, 2015). Academic institutions will have a greater possibility of success using mobile learning if they implement training for students on how to effectively use their devices (Moran et al., 2010; Sevillano-García & Vázquez-Cano, 2015).

However, research detailing how to instruct university students on mobile learning in a way that impacts attitude and skill is deficient. The limited literature on training and mobile learning is primarily concerned with secondary education teachers and their professional development (e.g., Crompton, Olszewski, & Bielefeldt, 2015, Ekanayake & Wishart, 2015, Mocofan & Huber, 2015). For example, Ekanayake and Wishart (2015) described how a workshop approach to training changed teacher attitudes toward the devices and allowed them to share their knowledge and skills with each other. Power, Cristol, Gimbert, Bartoletti, and Kilgore (2016) used a three-week long MOOC on mobile learning to instruct teachers, then observed how self-efficacy with mobile devices increased. Though they provide helpful principles, these studies do not target training for students in higher education.

### **Theoretical Framework**

In order to train university students on mobile learning, this study adopted a framework established by Van Merriënboer and Kester (2014) which focuses on designing complex learning for new skills. This framework was chosen because of its ability to integrate knowledge, attitude, and skill into simple training components with mobile learning. Van Merriënboer and Kester (2014) theorize that an effective instructional model should include supportive information, procedural information, authentic learning tasks, and part-task practice. For the present study the two task sections were combined as one, resulting in three components. First, Van Merriënboer and Kester (2014) explain that the purpose of supportive material is target schema construction by providing students with new information on what is being learned and connecting it with something already known. They further describe that procedural information walks students through how to perform routine aspects of the skill being learned possibly using animations and demonstrations. Lastly, they explain that authentic tasks provide meaningful real-life learning

assignments to practice the skill (Van Merriënboer & Kester, 2014). Authentic learning is also considered a strength of mobile learning environments (Cochrane & Narayan, 2017; Crompton 2013; Traxler, 2007).

In addition, this complex learning training used closely associated principles for attitudinal change. Attitude is defined as a person's psychological evaluation of an object (Zimbardo & Leippe, 1991) and can be influenced through instruction focusing on its multiple components (Kamradt & Kamradt, 1999). These dimensions of attitudinal learning include cognitive, behavioral, affective (Simonson, 1979; Zimbardo & Ebbesen, 1970), and social components (Watson, Watson, & Tay, 2018). The cognitive component targets an individual's knowledge, the affective emphasizes emotions, and the behavioral targets actual behavior toward the object or person (Simonson, 1979). Social learning is also considered another core aspect as peers prove to be heavily influential in shaping attitude in higher education (Milem, 1998). Structured instruction for attitudinal change involves principles closely related with complex learning. For example, gaining new information, knowledge, and experience closely relates to the cognitive attitudinal component (Watson, Watson, & Tay, 2018) and resembles the goal of supportive information in training. Additionally, Mueller, Lim, and Watson (2017) explained that an effective approach to instruction that motivates students to change their attitude about an object is to give a demonstration followed by opportunity to apply the skill. This closely resembles procedural information and authentic tasks. Importantly, in attitudinal instruction learners must not be forced, but rather they should be provided with risk free opportunities so they don't reject attitudinal change (Kamradt & Kamradt, 1999).

## **Methods**

The purpose of this mixed methods study was to investigate the impact instructional training that adopted complex learning principles had upon student attitude and skill for mobile learning for educational purposes. More specifically, the study examined students' attitudinal learning outcomes and perceived skill levels using quantitative survey and qualitative interview methods after they are given supportive information, procedural information, and authentic learning tasks. The specific research questions proposed for investigation were as follows:

1. How does an instructional training based upon complex learning principles impact students perceived skill level using mobile devices in coursework?
2. After receiving training, what are learners' perceptions of attitudinal learning outcomes toward using a mobile device within the course?
3. How do students describe the effectiveness of instructional trainings based upon complex learning principles?

## **Research Design**

A sequential explanatory mixed-methods design as described by Creswell, Plano, and Clark (2018) was carried out to answer the proposed research questions. The data collection phases included quantitative data initially collected via survey questionnaire, and qualitative data subsequently collected through interviews. The limited information on student skills, attitudes, and instructional training in mobile learning necessitate a greater breadth and depth to the field's knowledge base. Thus, a sequential explanatory design, which effectively uses qualitative data to illuminate why significant or non-significant quantitative results occurred (Creswell & Plano Clark, 2018; Morgan, 2014), was selected and implemented.

## **Context**

The study took place at a large Midwestern university within an introductory educational technology course typically enrolling between 150 – 200 students a semester. The course required students each week to attend an hour lecture session and a smaller two-hour lab with between 15 – 25 students each. Though the course was not designed specifically for the use of mobile devices, the educational programs students were learning how to use were available via mobile applications. A single assignment required the use of mobile technology and on all other assignments students were given flexibility for how much they would use their mobile device. Examples of these authentic tasks included developing a website, producing a professional presentation, creating a movie, or effectively using mobile augmented and virtual reality tools (required).

## **Participants**

All students enrolled in this introductory course were participants in the quantitative phase of the study, and thus convenience sampling (Hatch, 2002) was used. There were 127 participants (95 female; 32 male) who completed the pre-survey. After the three-month intervention period, 109 completed the post survey with additional attitudinal questions. Surveys were matched for a total of 97 participants ( $n = 97$ ) which amounted to a 75 percent return rate. Demographics showed that most participants were between the ages of 18 – 20 and in their beginning college years (71 freshman; 44 sophomores; 12 other). Some survey participants indicated their willingness to participate in a follow up interview where extreme case sampling was used (Patton, 2002) to select five participants for case interviews. Interview participants were compensated with a five dollar gift card for their time.



## **Procedure**

The training intervention consisted of instructing participants on how to use their mobile technology to complete the skill-based tasks required in the course. Instruction was carried out in six two-hour lab sessions by teaching assistants who had a full understanding of how to complete each assignment. Each teaching assistant was given identical training materials and all six lab sessions received the same training intervention. The instructional trainings were carefully designed and correlated directly to the three complex learning areas of supportive information, procedural information, and learning tasks.

First, to provide supportive information, teaching assistants presented a PowerPoint that introduced a new mobile application to participants each week and explain what the program was capable of accomplishing. For example, participants were instructed on how Weebly was a website creation program with a mobile application capable of building a web portfolio directly from their mobile device. Second, procedural information was given as teaching assistants displayed a five-minute video demonstration walking participants step-by-step through how to skillfully use the new mobile application to complete the course task. For instance, one video modeled how participants could use iMovie to film, edit, and produce a professional video. Third, an authentic learning task was given to participants to complete using the educational technology programs they had just learned about. These real-world assignments helped participants practice their new skill by completing tasks such as building a e-portfolio website, creating a presentation for a future class they would teach, or filming and editing an educational video for other students.

## Data Collection and Analysis

The following shows provides a visual flowchart for the explanatory sequential design of this study.

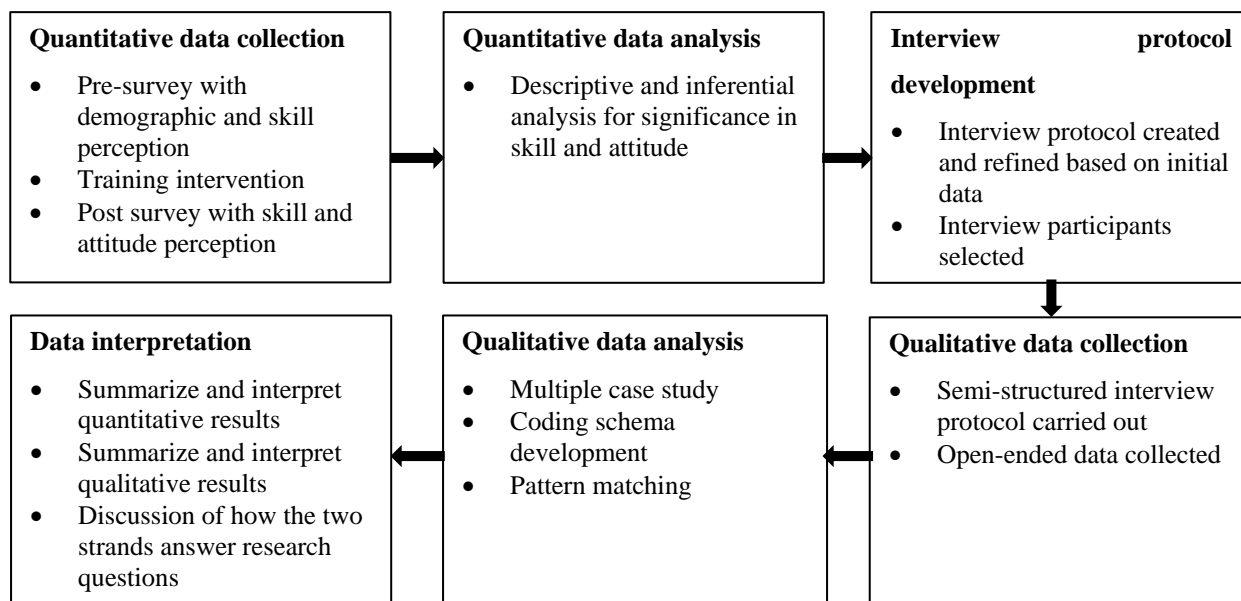


Figure 2 Visual flowchart for current research design. Describes mixed methods explanatory sequential design including data collection, analysis, and interpretation.

### *Quantitative Phase*

#### *Data Collection*

Quantitative data collection focused heavily on two primary clusters of data, the self-reported attitudes and skills of participants. Qualtrics surveys were administered targeting student's past experience with mobile learning, current mobile phone habits, expectations of mobile learning, and how students perceived their level of ability with certain mobile skills (see Appendix A). Items regarding background, experience, and skill as well as some skill data were developed from related literature in mobile learning (e.g., Fox, 2018; Mahat, Fauzi Mohd Ayub, & Luan, 2012; Moran, Hawkes, & Gayar, 2010; Tabor, 2016). The post-survey added fourteen

new items (see Appendix B) based upon the attitudinal learning inventory (ALI) developed by Watson et al. (2018), which specifically targets the impact of instruction on attitudes. The framework focuses on attitude holistically, including cognitive, behavioral, affective, and social components. In order to increase trustworthiness, survey instruments were piloted with previous students of the class and feedback was implemented. Additionally, multiple outside researchers reviewed the instruments and suggested changes were made.

### *Data Analysis*

Descriptive and inferential data analysis both took place in the quantitative phase. Descriptive analysis provided information on the demographics of participants and the frequency of participant responses on each item. The fourteen ALI questions were completed after participants had completed the intervention and showed attitudinal outcomes regarding participants overall use of mobile learning in coursework. Next, inferential analysis was carried out to examine the data on skill level for statistical differences between the pre and post survey questionnaires. Inferential paired samples t-test, effective for pre and post treatment (Privitera, 2015), was run using SPSS software to examine significant differences in perceived skill level before and after the intervention.

### *Qualitative Phase*

#### *Data Collection.*

Following the quantitative data analysis, a multiple case study qualitative approach as was carried out. Yin (2014) describes that a multiple case study effectively examines inquiries into why or how and thus it was used to observe how instructional training impacted participant attitude and skill. Each case was bound to a single individual within the course amounting to five cases in

total selected. The development of the interview protocol was informed by the results from quantitative data analysis (Creswell, 2018) and included secondary open-ended questions to provide more depth (Stewart & Cash, 2000).

### *Data Analysis*

Data analysis for the qualitative phase looked at the impact of instruction from the perspective of attitude and skill. Coding schema development began by deductively creating a priori codes from the current research literature, and in turn, the interview questions. NVivo coding software was used to look for informative sentences and patterns. Yin (2014) explains that a deductive “from the ground up” data analysis strategy can effectively start a new research path that leads to additional insights, patterns, and relationships (p. 137). A pattern matching analytical technique, which compares a beforehand predicted statement with the empirical data in the study (Almatairi, 2014; Yin, 2014), was implemented. The predicted statement was related to the research question and linked prior knowledge and theory to the research data (Almatairi, 2014; Saunders et al., 2009). The result of this analysis aimed to build explanations on whether and why the patterns were matched or not, which eventually results in greater validity and supporting or modifying the theory or conceptual framework underpinning the study (Yin, 2003). Data were organized according to the five cases examined and describe how the resultant data matched with the following proposition:

- Instructional training, which applies complex learning principles, has a positive impact on student attitudes and perceived skill toward using mobile learning in coursework

## **Results**

### **Quantitative Phase**

#### ***Descriptive Analysis***

Survey results on current mobile phone usage showed that all participants reported owning a phone that was capable of downloading applications (see Table 1). Participants most often spent between three to five hours on their phone a day (40%) for daily uses such as text messaging (97.7%), social networking (90.7%), and making calls (79.8%). When considering how often they used their mobile phones to help with assignments, approximately 41 percent of participants reported everyday use.

After the instructional training intervention occurred, descriptive data on attitudes was collected from 107 participants using the ALI framework (see Table 2). A five-point Likert scale was used with responses ranging from “1- strongly disagree” to “5 – strongly agree”.

Table 4 Current Mobile Phone Usage of Survey Participants

Characteristic	Frequency (n = 127)	Percentage (%)
Ownership of mobile phone with apps		
Yes	127	100.0
No	0	0
Daily uses of mobile phone (all that apply)		
Phone Calls	103	79.8
Text Messaging	126	97.7
Shopping	31	24.0
Banking	66	51.2
Emailing	100	77.5
Exercising	19	14.7
Social Networking	117	90.7
Navigation	78	60.5
Entertainment	81	62.8
Approximate time spent using phone daily		
Less than 1 hour	3	2.4
Between 1 hour and 3 hours	45	35.4
From 3 – 5 hours	51	40.2
From 5 – 7 hours	23	18.1
Above 7 hours	5	3.9
Approximate time spent using phone for course assignments help weekly		
One time a week	16	12.6
Two times a week	13	10.2
Three to four times a week	34	26.8
Five to six times a week	12	9.4
Every day	52	40.9

A five-point Likert scale was used with responses ranging from “1- strongly disagree” to “5 – strongly agree”. Participants reported the most positive response rates on average by group within the cognitive (3.76) and social (3.59) attitudinal components, while the affective component exhibited the lowest average scores (2.99). Of all individual questions, participants showed highest ratings on the behavioral item claiming that they did something new related to mobile technology as a result of using their mobile device in the course. Moreover, high ratings expressed that participants cognitively learned new information about mobile devices from their experiences using the technology in class and were confident socially discussing the topic with others. The highest individual affective response was slightly above average and came when participants responded about feeling eager to learn more about using mobile devices in their course.

Table 5 Attitudinal Learning Inventory

Attitude	<i>M</i>	<i>SD</i>
Cognitive		
Using my mobile device in this course provided me with new information	3.67	1.14
Using my mobile device in this course helped me become more knowledgeable	3.79	1.10
I picked up new ideas from using my mobile device in this course	3.75	1.14
I learned new info about mobile devices from the experiences using the mobile device in this course	3.82	1.17
Average	3.76	1.14
Affective		
I feel excited about using a mobile device in this course	3.02	1.31
I feel eager to learn more about using my mobile device in this course	3.10	1.24
I feel passionate about using my mobile device in this course	2.84	1.36
Average	2.99	1.30
Behavioral		
My behavior changed as a result of using my mobile device in this course	3.01	1.22
I did something new related to mobile technology as a result of using my mobile device in this course	3.90	1.11
I do things differently now as a result of using my mobile device in this course	3.01	1.09
I talk to others about using a mobile device in this course	2.93	1.32
I educate others about using a mobile device in this course	2.79	1.29
Average	3.13	1.21
Social		
I am confident discussing the topic of using a mobile device in this course with other	3.82	0.89
I connect with other people regarding the use of a mobile device	3.35	1.17
Average	3.59	1.03



### ***Inferential Analysis***

A paired samples t-test was used to analyze 97 matched pairs concerning their perceived skill level with mobile devices before and after being trained. Out of the twelve skills investigated, results exhibited statistically significant differences for eight of the skills (see Table 3). Subsequent to the training intervention, participants reported significant improvement in skill level and large effect size when using a mobile phone to complete a digital badge,  $t(96) = -9.08, p < .001, (d = .93)$  and augmented reality assignments,  $t(96) = -8.88, p < .001, (d = .91)$ .

Table 6 Paired Samples T-Test

Skill	Pre		Post		$t(96)$	$p$	Cohen's $d$
	$M$	$SD$	$M$	$SD$			
Identify when mobile phone would be helpful	4.23	.84	4.33	.86	-1.11	.272	.11
Recognize when I have been successful	4.11	.95	4.42	.73	-3.50	.001	.36
Identify the right program	4.07	.91	4.13	.91	-.58	.563	.06
Access and read assignments	4.03	1.13	4.20	1.05	-1.40	.165	.14
Collaboratively complete assignments	4.10	1.11	4.12	1.05	-.16	.871	.02
Complete assessment	4.18	1.13	4.50	.834	-3.13	.002	.32
Film edit and produce video	2.87	1.30	3.94	1.26	-6.59	< .001	.67
Create a presentation	2.62	1.25	3.33	1.38	-4.74	< .001	.48
Create a website	2.32	1.14	3.12	1.39	-5.06	< .001	.51
Research and social bookmarking	3.41	1.32	3.98	1.08	-3.93	< .001	.40
Complete a digital badge	2.61	1.28	3.93	1.08	-9.08	< .001	.93
Use virtual reality to complete assignments	2.59	1.29	3.86	1.14	-8.88	< .001	.91

Results further showed statistical significance and medium effect size when creating videos on their phone,  $t(96) = -6.59$ ,  $p < .001$ , ( $d = .67$ ) and developing a website,  $t(96) = -5.06$ ,  $p < .001$ , ( $d = .51$ ). Lastly, participants reported significant difference and small effect size when creating mobile phone presentations,  $t(96) = -4.74$ ,  $p < .001$ , ( $d = .48$ ), using social bookmarking,  $t(96) = -$

3.93,  $p < .001$ , ( $d = .40$ ), recognizing success with mobile learning,  $t(96) = -3.50$ ,  $p = .001$ , ( $d = .36$ ), and finishing assessments,  $t(96) = -3.13$ ,  $p = .002$ , ( $d = .32$ ). Results were insignificant regarding the ability to identify when using a mobile phone would be helpful, recognize the correct mobile program to use, collaboratively complete assignments, and access and read assignments.

### **Qualitative Phase**

The following results explain how the resultant data from the five cases matched the stated proposition, or how training impacted attitudes and perceived skill toward using mobile learning in coursework. Each case is presented individually followed by a cross case comparison of similarities and differences.

#### ***Caden***

When asked about how he perceived the effectiveness of the training, Caden mentioned that the beginning instructional portions of the training were helpful in figuring out where to get started and move forward with the mobile technology. However, the most helpful portion to him were the demonstration videos. He declared, “They were a great jumping off point because it’s great when you essentially demonstration everything to someone. And then from there the student can take off with that.” He then related how during his time in the Scouts program he had to use demonstration to teach other scouts. “That demonstration stage, I’ve told countless people, is the most critical step, because once they see it for themselves you’re way more confident going into it and you don’t feel so lost,” he added. In addressing the authentic learning tasks, Caden first shared how nice it was not be forced on using mobile technology. He claimed that understanding the basics of using mobile technology was one result of just opening up the app for the activity and starting to use it. “The activities themselves are really great introductions and really great uses

of the apps” he said. As a result of getting into the technology, he shared the learning came very fast for him.

### ***Eve***

When recounting the training she received, Eve felt that supporting information had made an impact. She described that she had never heard of most of the programs and having examples explained to her helped in learning the right software to use. Furthermore, knowing what the software was and how to use it helped increase her familiarity with the device and made it easier to use. In addressing the use of demonstration videos and learning activities she stated, “I am watching a video on how something works and I can actually like play by play watch myself do it and then do it like on the video. That helps a lot.” Eve further clarified that she would just take out her phone and mirror the videos actions until she got the point of what to do. “Having something to watch and then doing it myself made it easier for me. I think having all the material that we had like the screencast demonstration was really helpful,” she explained. She added that having a live walk through might further improve the training. Eve then described how the authentic activities also impacted her skill level because the tasks gave her the opportunity to actually use the mobile technology which, in her words, facilitated greater familiarity and understanding.

### ***Kara***

When asked about the impact of training videos and activities, Kara believed they had an impact. “I think they helped a lot not realizing what you could do on them or more of an explanation of how to do it or telling you what you should do and how to proceed with it.” Kara referenced one mobile virtual reality activity and shared that at first, she complained and did not

like that she had to do it. Yet, after she completed the activity she realized the mobile task wasn't actually awful or hard to accomplish. She shared that watching the iMovie demonstration video and how the explanations were given were helpful because she had never used it nor knew how to use it.

### *Noelle*

Noelle claimed that in the course she surprisingly learned a lot about completing assignments on her phone. Addressing the supporting information in the training presentations, she shared, "I think having as much information as I can before doing something makes me feel more confident going into it." She admitted being hesitant to use her mobile phone for tasks such as iMovie yet watching the demonstration videos gave her encouragement and helped her realize using the mobile program wasn't that bad. She loved having someone walk her through using the mobile program before she did and included it should have been done more often with examples of what a final work would look like. She expounded on the impact of supporting information, demonstration videos, and authentic tasks by stating:

I like coming to class and someone is like here is an app. Here's what you can do with it. Here's like these buttons. I'm going to show you a little bit of how to do it. Talk you through it. And then you can go in and explore it yourself because you already have a starting point.

Noelle shared her perception of mobile technology changed because she was uncomfortable not knowing how to do use it. Yet, with the learning tasks and some encouragement, it helped her realize just how easy the tasks really were. She confessed not wanting to use her personal time to learn the mobile programs but repeatedly claimed that just doing the mobile learning activities caused her to realize how easy these mobile programs were to use.

***Reese***

When asked about the effectiveness of the training, Reese chose to highlight the video demonstrations. She mentioned that the video screencasts exhibited apps she had never used and that after viewing the video she realized using the applications were not as bad as she thought. She further claimed that if she had the app and the video as a reference, she could effectively learn how to use the app because normally when she lacks understanding in an area she turns to YouTube videos for help. “I think just personally I’m sort of a watch someone do it and then do it myself type thing...So I think the video was a little bit more helpful,” she said. Reese stated that, when given the opportunity to choose between a variety of applications to complete a task, that she felt more compelled to use the app she previously watched a demonstration video on so she didn’t have to start at ground zero. Therefore, she emphasized the importance of having more demonstration videos to encourage students to choose to use a greater variety of mobile apps. Reese expressed that during some of the learning activities she felt the mobile phones were a distraction and not as practical as other methods such as a computer or book.

***Cross Case Comparison***

All five cases were found to match the stated proposition in some manner. For example, the most common similarity between all five cases was that the training was affirmed to have a positive overall impact upon the participant. Each case claimed that the video demonstrations effectively helped them walk step by step learning how to do something they did not know before. Four out of five cases mentioned not being aware beforehand about what each mobile program could accomplish and how to carry out its use. A few cases described the video demonstrations as providing a good jump off point and transition to practicing their use with activities. In addressing differences, cases did not equally emphasize the various aspects of the training. Some

participants described in detail the value of demonstration videos while others explained the importance of the course activities. Some felt the training was effective as is while others believed they needed to occur more often and with greater variety mobile applications from which to choose.

## **Discussion**

The purpose of this study was to investigate the impact instructional training that adopted complex learning principles had upon student attitude and skill. This explanatory mixed methods research design used surveys to understand students self-reported attitudes and skill levels and then provided additional supporting information through interviews. The following discussion seeks to explain how the resultant data related to current literature and answered the proposed research questions.

First, instructional training that used complex learning principles positively influenced students' perceived skill level by increasing confidence and familiarity with a mobile device. This was exhibited as quantitative results revealed significant changes in eight skills after students received background information, watched video demonstrations on effective mobile device use, and participated in learning activities. Among the highest responses on the attitudinal learning inventory (ALI) was one item showing that students were very confident discussing mobile learning in the course after they received training. Qualitative interview data further supported these findings explaining that students who viewed video demonstrations and participated in activities felt more confident using new skills to do something they had not done before. This could be possible because when students are trained on the development of mobile learning skills they have heightened perception regarding ease of use and usefulness of mobile devices (Iqbal & Bhatti, 2015). By using demonstrations and learning activities to show the effective use of mobile

learning, educators can increase students' confidence and ability with using their mobile device (Chen et al., 2008; Yeap et al., 2016).

Additionally, confidence and familiarity with mobile devices are closely related, and as students are trained on basic functions and skills then confidence with the device will increase (Cheon et. al, 2012). Both the pre-test ratings and interviews indicated that students at first did not have high levels of knowledge concerning the use of their mobile devices for educational tasks. This supports the idea that university students are more familiar with using mobile devices for activities such as gaming and social media rather than educational purposes (Tabor, 2016; Vasquez-Cano, 2014; Woodcock, Middleton, & Nortcliffe, 2012).

Second, instructional training that used complex learning principles positively influenced student perceptions of attitudinal learning outcomes by increasing awareness and experience. Quantitative data revealed positive attitudes toward the use of mobile learning in 12 out of 14 categories on the ALI. Qualitative data supported these results and both suggested that positive attitudinal change occurred because of improved awareness and experience. Various cases explained that the supportive background information provided and subsequent video demonstrations were highly beneficial to their lack of awareness on what mobile programs were available to complete assignments. The cognitive component of the ALI further revealed that, as a result of actively using mobile devices in course assignments, students gained new information, greater knowledge, and novel ideas about mobile learning. Mueller et al. (2017) explain that in attitudinal change, demonstration can provide awareness and exemplary models for target attitudes. Furthermore, modeling is a suggested strategy for attitudinal change (Bandura, 1977) and increasing student awareness on a topic may initiate a change of attitude on the subject (Sinatra, Kardash, Taasooobshirazi, & Lombardi, 2012).



Multiple cases described a hesitancy and uneasiness using mobile devices for their course assignments, yet their attitudes positively changed after watching demonstration videos and gaining experience within learning activities. The highest ALI scores showed that the actual experience of using the mobile device in the course was a new opportunity for most students. Literature supports that attitudinal change can be facilitated by integrating application activities where students can apply their new knowledge in authentic situations (Mueller et al., 2017). A few cases highlighted the importance of not being forced to carry out each assignment on a mobile device. Kamradt and Kamradt (1999) explain that application activities should be a risk free or win-win setting if desired attitudinal change is to be successful.

Third, learners perceive that instructional training using complex learning principles is effective in general. This is supported by all case study participants which emphasized the effectiveness of supportive information, procedural information, and learning tasks. Participants perceived supportive information was effective because it increased knowledge in an area they were not very knowledgeable, mobile learning. Van Merriënboer and Kester (2014) affirm this principle stating that within instruction, supportive information can help learners cognitively organize information and facilitate schema construction on a new topic. Participants perceived procedural information successfully showed them how to use mobile learning by giving a walkthrough demonstration on how to accomplish course tasks. This information is prerequisite to performance and can effectively use audio narration combined with visual demonstration to give direction to learners (Van Merriënboer & Kester, 2014). Lastly, participants perceived the authentic learning tasks effectively gave them new experience using mobile learning in education. Similarly, using authentic learning tasks is helpful in building experience based on real-life tasks (Van Merriënboer & Kester, 2014).

This study provides implications for practice and research that can be beneficial to educators looking to adopt mobile learning in higher education environments. For practice, higher education leadership can use supportive information, procedural information, and authentic tasks to train students in a way that positively impacts their attitudes and skills with mobile learning. More specifically, by using these complex learning principles educators could positively encourage student's confidence, familiarity, awareness, knowledge, and experience using mobile devices in their coursework. This study furthers research as it sheds light on a problem concerning students' lack of understanding on the use of mobile devices for educational purposes, and then proposes a solution on how this can be changed.

Limitations of this study included that the course was already designed for the learning of new educational technologies, which could have affected participants' views on the use of mobile technologies in the course. The theoretical scope of the study only focused on complex and attitudinal learning which narrowed the lens of research. Furthermore, convenience sampling was used and therefore may not be representative of the higher education population. Future research could look more in depth into how students from various disciplines and levels react to being trained and adopting mobile technologies in their unique environments.

### **Conclusion**

Mobile learning research has repeatedly affirmed that universities need to train students on the effective use of their mobile devices for educational purposes. This study uniquely contributes to the literature by detailing how this can be done in a way that impacts two major factors of adoption. Attitude and skill are influential elements that must be understood for the adoption of mobile learning into higher education settings. An explanatory sequential mixed-methods design

was carried out in order to examine how instruction that uses supportive information, procedural information, and authentic tasks impacts student attitude and skill.

This study revealed that mobile training with complex learning principles can impact elements of attitude and skill. By providing students with supportive information, educators can positively influence attitude by increasing awareness about mobile learning programs and facilitate new knowledge gains in areas where students might not be as knowledgeable. Video demonstrations can be used to increase student's confidence in their skills using mobile devices within coursework. In order to increase experience and familiarity, authentic learning tasks can give students real-life practice. As complex learning principles are applied to train university students on the effective use of their mobile devices, attitude and skill will be impacted and students will be more willing and prepared when they choose to use these devices in their coursework.

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## Appendix

### Survey Questionnaire

Q1 Please fill in the blank below with your account email. This is confidential and will only be used as your respondent ID. (For example, if your email is john123@school.edu then only type "john123" into the box)

---

**Demographic Information and Current Mobile Phone Usage** This section asks about your background as well as your current habits of mobile phone usage.

Q2 What is your age?

- ☐ 18-20 (1)
- ☐ 21-23 (2)
- ☐ 24-26 (3)
- ☐ 27 and above (4)

Q4 What is your gender?

- ☐ Male (1)
- ☐ Female (2)
- ☐ Other (3) \_\_\_\_\_

Q5 You are currently a \_\_\_\_\_ at the University.

- ☐ Freshman (1)
- ☐ Sophomore (2)
- ☐ Junior (3)
- ☐ Senior (4)
- ☐ Other (5) \_\_\_\_\_

Q6 Do you own a mobile phone?

☐ Yes (1)

☐ No (2)

Q21 Can your mobile phone download applications? (e.g., Netflix, Instagram, Facebook)

☐ Yes (1)

☐ No (2)

Q7 Which of the following do you use your mobile phone for **daily**? (Check all that apply)

☐ Phone calls (1)

☐ Text messaging (2)

☐ Shopping (3)

☐ Banking (4)

☐ Emailing (5)

☐ Exercising (6)

☐ Social Networking (e.g., Instagram, Snapchat, Facebook) (7)

☐ Navigating (e.g., Google Maps) (8)

☐ Entertainment (e.g., movies, games) (9)

☐ Other (10) \_\_\_\_\_

Q8 Approximately how much time do you spend using your mobile phone **each day**?

- ☐ Less than 1 hour (1)
- ☐ Between 1 hour and 3 hours (2)
- ☐ Between 3 hours and 5 hours (3)
- ☐ Between 5 hours and 7 hours (4)
- ☐ Above 7 hours (5)

Q9 How often do you use your mobile phone to assist with homework or course assignments each week? (e.g., Googling answers to a question, accessing blackboard, responding to an instructor's email)

- ☐ One time a week (1)
- ☐ Two times a week (2)
- ☐ Three to four times a week (3)
- ☐ Five to six times a week (4)
- ☐ Every day (5)

**Mobile Phones and Your Educational Experience** This section asks about your experiences using mobile phones to accomplish any tasks or assignments as part of your college coursework.

Q10 Has the use of mobile phones been incorporated by your instructors into any of your college course assignments **prior to this current semester**? (e.g. iClicker, Hotseat, PollEverywhere)

- ☐ Yes (1)
- ☐ No (2)

Q11 Have you ever read an assignment or article on your mobile phone related to your college courses?

- ☐ Yes (1)
- ☐ No (2)

Q12 Have you ever taken a picture/video with your mobile phone for a college course assignment?

☐ Yes (1)

☐ No (2)

Q13 Have you ever used your mobile phone to look up something that you didn't know or didn't understand for a college course?

☐ Yes (1)

☐ No (2)

Q14 Have you ever accessed a learning management system (e.g., Blackboard, Canvas) for a college course from your mobile phone?

☐ Yes (1)

☐ No (2)

Q15 Have you ever taken notes or used a calendar on your mobile phone to remind you of a college course assignment?

☐ Yes (1)

☐ No (2)

Q16 Have you ever texted a classmate about a college course assignment?

☐ Yes (1)

☐ No (2)

Q17 Have you ever been formally trained on how you can use your mobile phone to complete your college course assignments **prior to this current semester**? (e.g. iClicker, Hotseat, PollEverywhere)

☐ Yes (1)

☐ No (2)

Q18 Have you ever received or completed a digital badge on your mobile phone **prior to this current semester**? A digital badge is a digital indicator of an accomplishment, skill, quality of talent awarded by an organization.

☐ Yes (1)

☐ No (2)

Q19 Have you ever used the Passport program to complete digital badge assignments for a college course **prior to this current semester**?

☐ Yes (1)

☐ No (2)

Q20 Have you ever used the Passport program application on your mobile phone to complete digital badge assignments for a college course **prior to this current semester**?

☐ Yes (1)

☐ No (2)

Q31 You will now be asked to answer questions on a five point scale ranging from strongly disagree to strongly agree.

**Your Expectations About Mobile Learning** This section asks about your expectations for using mobile phones as part of your college coursework.

Q22 Using my mobile phone is an essential part of my learning process.

☐ Strongly disagree (1)

☐ Somewhat disagree (2)

☐ Neither agree nor disagree (3)

☐ Somewhat agree (4)

☐ Strongly agree (5)



Q23 Using mobile learning as part of coursework would increase my chances of getting a better grade in class.

- ☐ Strongly disagree (1)
- ☐ Somewhat disagree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Somewhat agree (4)
- ☐ Strongly agree (5)

**Perceived Skill Using Mobile Phone Within Coursework** This section asks about how you perceive your own skill at using your mobile phone to complete college course assignments

Q27 Currently, I can...

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
identify when my mobile phone would be helpful for completing a course assignment. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
recognize when I have been successful using my mobile phone to complete course assignments (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
identify the right educational program, application or tool on my mobile phone to help me in completing a course assignment. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone to access and read assignments given in the course. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone to collaboratively complete course assignments with other classmates. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone to complete an assessment or a poll as part of a course assignment. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
use my mobile phone film, edit, and produce a professional video as a course assignment. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

use my mobile phone  
to create a  
professional  
presentation as a  
course assignment.  
(8)

☐☐☐☐☐

use my mobile phone  
to create a website as  
a course assignment.  
(9)

☐☐☐☐☐

use my mobile phone  
to perform research  
or social  
bookmarking for a  
course assignment.  
(10)

☐☐☐☐☐

use my mobile phone  
to complete a digital  
badge as a course  
assignment. (11)

☐☐☐☐☐

use my mobile phone  
to complete course  
assignments  
requiring virtual or  
augmented reality  
(12)

☐☐☐☐☐

## **CHAPTER 4. MOBILE TECHNOLOGY: A TOOL TO INCREASE GLOBAL COMPETENCY AMONG HIGHER EDUCATION STUDENTS**

### **Abstract**

The advancement of mobile communication technology has contributed to an increasingly interconnected world; however, these devices are not being used as effectively as they could be to improve global challenges. One challenging issue is the lack of preparation college graduates receive to positively contribute to the needs of an interdependent global society. Organizations such as UNESCO, NAFSA, and the OECD have recently declared the critical need for the rising generation to strengthen their global competence, the capacity to examine societal issues and work alongside those of various backgrounds to make a change. School instructors are crucial to preparing students to thrive in multicultural societies and address present day issues. With a staggeringly high rate of cellular device ownership among college students, mobile devices could be optimally positioned as a multi-functional tool ready to assist students in gaining these skills. This paper proposes that, while mobile devices may have contributed to a growing need for globally competent individuals, they can also be used to expand these capacities within university students. The PISA global competency framework developed by the OECD is used to propose how instructors can use mobile technology and research grounded practices to strengthen global competence in students.

### **Keywords**

global education, global competency, mobile learning, mobile technology, mobile devices, higher education

## **Introduction**

A glimpse at the status of mobile devices in higher education indicates that these devices have a high rate of possession among university students (Krull & Duarte, 2017). The advancement of new communication technologies has contributed to growing interconnectedness and interdependence across the globe (Li, 2013). Handheld mobile technologies may provide anytime and anywhere educational opportunities through a variety of functions (Crompton, 2013). However, as the United Nations Educational, Scientific, and Cultural Organization (UNESCO) declared, mobile devices are not being used as effectively as they could be to improve global issues in education (West, M., 2012).

One current educational concern is the lack of preparation graduating students receive to thrive in an interdependent world. Unpredictable economies, digital advancements, diverse societies, migration, and multicultural work environments demand a graduate with greater capacity to take action (Boix Mansilla & Jackson, 2013). Many people are not prepared to address societal issues in an interconnected world where hate speech, extremist ideas, and perceived misunderstandings are becoming more common (Barrett, Byram, Lazar, Mompoin-Gaillard, & Philippou, 2013). There is great need for students who are more prepared to investigate matters of global significance, understand others perspectives, and live in multicultural societies (Asia Society/OECD, 2018).

Consequently, it is of high importance that educators develop their students' global competence, or "the capacity and disposition to understand and act on issues of global significance" (Boix Mansilla & Jackson, 2013, p. 2). The Council of Europe shared that an "ability to understand and communicate with each other across all kinds of cultural divisions is a fundamental prerequisite for making such societies work" (Barrett et al., 2013, p. 2). Instructors

can achieve global competence through practical approaches and innovative strategies using digital technologies (Li, 2013). Due to the high rate of mobile possession among university students and their lack of global competence, these multifunctional devices are well situated to help instructors with these challenges. Successful use of mobile technology in higher education requires instructors who design learning experiences that harness the affordances of mobile devices (Krull & Duarte, 2017). Therefore, the purpose of this paper is to describe how mobile devices are uniquely positioned to nurture global competence and next give practical implications for instructors looking to expand these capacities within their university students.

## **Literature Review**

### **Mobile Communication Technologies**

Today's interdependent global society is dominated by information communication technologies that facilitate the exchange of ideas and information instantaneously from any location (Suárez-Orozco and Sattin, 2007). Evolving world technologies now surpass over 1.2 billion personal computers, 1.6 billion television sets, and 3.9 billion radio receivers (Ahonen, 2011). Nonetheless, mobile phones exceed all technologies with a network covering 95% of the global population (ITU, 2016) and a staggering seven billion subscriptions (ITU Key Indicators, 2017). College-age students headline mobile phone ownership levels globally (Brooks, 2016), with some countries such as the United States approximating one hundred percent (Adams Becker et al., 2017; Pew Research Center, 2018).

Mobile technology yields vast opportunities for university students to culturally engage with entertainment, news, and music or interact with others through text, social media, and email (Roberts, Yaya, & Manolis, 2014). As a result of these interactions, research focused on the integration of mobile technology in higher education has amplified over the last decade (Hwang

& Tsai, 2011; Wu et al., 2012). However, with a worldwide view of education, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) asserts that mobile devices, as the most ubiquitous information and communication technology, are not being used as effectively as they could be to improve global challenges and assist in education across the globe (West, M., 2012).

### **A Global Issue**

One preeminent global problem faced by university-age students today is the lack of preparation they receive for the international challenges that lie ahead of them both as citizens and professionals (Chickering & Braskamp, 2009). The rapidly advancing wave of globalization and global interdependence calls for a rise in the number of students who can recognize global issues and simultaneously engage in effective problem solving in everyday life (Boix Mansilla & Jackson, 2011). These worldwide issues commonly surround environment, development, intercultural relations, peace, economics, technology, or human rights and further emphasize a need for those who are globally educated in interdependence, connections and multiple perspectives (Hicks, 2003).

Foremost, educational associations such as the Center for Global Education at Asia Society, Organization for Economic Cooperation and Development (OECD), Association of International Educators (NAFSA), and the United Nations (UN) have detailed that establishing global competence in students is critical to live and succeed in today's global economy and multicultural societies (Asia Society/OECD, 2018; West, C., 2012). Global competence can be defined in multiple ways, but is often regarded as:

The capacity to examine local, global, and intercultural issues; to understand and appreciate the perspectives and world views of others; to engage in open, appropriate and effective

interactions with people from different cultures; and to act for collective well-being and sustainable development (Asia Society/OECD, 2018, p. 5).

The vital need for these competency skills is confirmed by the latest development of the OECD Program for International Student Assessment (PISA), a global competency framework that assesses these capacities in young people, implemented for the first time beginning in 2018 (OECD, 2018). It is clear that as schools instruct the rising generation on these skills students will be more apt to thrive in local, national, and global civic life (Asia Society/OECD, 2018).

### **The Role of Instructors**

The Association for International Educators affirmed that global competence in students begins with instructors who must learn about existing technologies and how they might be used to enhance international partnerships or cross-cultural learning (West, C., 2012). Furthermore, the Asia Society confirmed that the average instructor can foster global competence in their students by helping them learn how to use present-day technologies (Asia Society/OECD, 2018). It is in part by employing the use of new media technologies as learning tools that teachers can effectively bridge gaps between theory and application and enhance cultural responsiveness and competency (Ntuli, & Nyarambi, 2018). Sussmuth (2007) shared that students need to strengthen their digital skills in order to help them “communicate and gather information from beyond their immediate environment and help them integrate into a global society” (p 204). Therefore, instructors can create a classroom environment with a global vision and culture that expand student experiences through the employment of technology (West, C., 2012). University instructors can use currently available digital technologies to develop these capacities in their students.



## **Purpose of Paper**

Due to the high percentage of mobile ownership among college students and their lack of global competency, mobile technologies are uniquely positioned to enlarge these capacities within students. The multifunctionality of mobile devices could prove to be beneficial to university instructors, regardless of discipline, in preparing their students to thrive in today's diverse societies. Current research literature surrounding mobile technology integration describes numerous successful strategies to transform learning in higher education settings.

Therefore, the purpose of this paper is to address how university instructors can use mobile technology to improve global competence in their students. The adopted OECD four-part framework for establishing global competence is first described. Next, foundational principles for the four parts are discussed in greater detail with practical implications drawn from current mobile learning research provided for university instructors.

## **Global Competence Framework**

In response to the growing need for students who can address global issues, the OECD proposed the 2018 PISA global competence framework (Asia Society/OECD, 2018). The principles in the PISA framework draw upon years of previous research and a variety of successful frameworks. For example, in 2011 the Council of Chief State School Officers (CCSSO) and the Asia Society commissioned a taskforce to define global competence complex skills. This taskforce, made up of numerous educational scholars, worked to build upon foundational research principles and best practices from numerous scholars such as Hanvey and Reimers (Boix Mansilla & Jackson, 2013). A seminal work by Robert Hanvey addressed the need for educators to promote the development of planet and cultural awareness (Hanvey, 1982). He added that as students increase in their knowledge of others and global dynamics they would develop a global

perspective. Reimers (2009) shared that global competence is imperative in that it prepares students to “understand the nature of shared planetary challenges” (p. A29). Overall, this taskforce developed a framework that would help students increase in their “capacity and disposition to act on issues of global significance” (Boix Mansilla & Jackson, 2011, p. xiii). The OECD, recognizing the value of all these principles and previous frameworks, collaboratively constructed an updated framework similarly outlining critical components of global competence. Overall, the PISA framework for global competence draws upon the research of organizations such as UNESCO, Project Zero at Harvard University, the Asia Society, and CCSSO.

The purpose of the PISA framework is to assist in explaining, implementing, and assessing global competence in young people around the globe (Razavi, 2017). The OECD states that global competence includes combining and applying the foundational elements of students’ values, knowledge, skills, and attitudes (Asia Society/OECD, 2018). They further explain that mixing these elements helps young people work with those of differing cultural backgrounds on those global issues that can have a serious impact upon future. The core of the framework is comprised of four dimensions, which when implemented properly, can provide structure for instructors looking to facilitate global competence in their students. The OECD (2018) proposed that global competence is the capacity and disposition to do the following:

- Examine issues of local, global, and cultural significance such as poverty, environmental risk, and conflict
- Understand and appreciate the perspectives and world views of others
- Engage in open, appropriate, and effective interactions with others across cultures
- Take action for collective well-being and sustainable development

Though these four skills appear to be independent they depend highly upon each other as building

blocks in the construction of global competence (Boix Mansilla & Jackson, 2011). Each division of the PISA framework will now be described in greater detail. Following each description will be an explanation of how university instructors can use mobile technologies to support the development of global competence based on current research practices in higher education.

### **Examining Issues**

University students today can benefit by developing the skills to comprehend and appreciate the world outside their own immediate setting (Boix Mansilla and Jackson, 2011). These higher-order thinking skills include effectively weighing evidence on global developments, analyzing information on current events, and arguing a position (Asia Society/OECD, 2018). Students need opportunities to embark on an external investigation of matters beyond their typical classroom environment. They must have learning environments that can facilitate inquiry and encourage them to develop persuasive arguments about issues of the day. As they tackle questions about the world, they will be more prepared for jobs that require them to work and communicate with those of differing perspectives (Boix Mansilla & Jackson, 2013). Students working to understanding global issues also develop a state of the planet awareness where they can actively seek to comprehend prevailing conditions, developments, trends, and problems that are faced worldwide (Burnouf, 2004). Effective pedagogical practices should allow for student discovery and creativity (Cochran & Narayan, 2017) as they use their devices to learn more about global challenges where ever they are. Instructors can provide practical opportunities for students to

investigate the world with mobile devices through the use of Internet search engines, synchronous or asynchronous communications, digital books, and news applications.

### **The Internet**

Increasing access to the Internet continues to be a highlight of advancing technologies across the globe. With the goal of enabling economic and social development and fostering an inclusive global digital economy, the International Telecommunications Union recently published that now over 70% of the world's youth between ages 15-24 have Internet access, with mobile broadband subscriptions growing more than 20% annually the last five years (ITU, 2017). College students believe that the ubiquitous access to Internet information mobile technologies provide is a primary advantage of the device (Gikas & Grant, 2013). Anytime access to databases with audio, video, and text information allow examination of the world beyond classroom walls. Internet access through mobile devices unlocks the opportunities for student-generated content and student-directed projects (Cochran and Narayan, 2017) while they seek to investigate problems in the world. However, teachers must help students critically evaluate the material they encounter because of the vast amounts of information accessible (Buckingham, 2007).

### **Synchronous and Asynchronous Communications**

New communication tools such videoconferencing at any location improve international collaboration and create unprecedented opportunities to examine issues of global significance with others around the globe (Boix Mansilla & Jackson, 2011). Instructors can adopt the use of synchronous and asynchronous communications allowing students to interact immediately with contacts across the globe. Information exchange occurs across borders through video, audio, and text mediums. For instance, students learning Chinese could interact directly with native speaking

individuals in China. Mobile devices improve universal access to inexpensive applications such as Skype, Facebook Chat, WebEx, WeChat, WhatsApp or learning management systems. One worldwide online master's program in development management used a learning management system to facilitate online synchronous and asynchronous collaboration between students in various countries as a core element of a course on global education (Rye & Stokken, 2012). Other areas once isolated are now reachable (Valk, Rashid, & Elder, 2010) and may yield critical insights from those experiencing firsthand global challenges such as human rights, economic development, or poverty. Students could gain greater perspective on global and intercultural issues as they hear personal experiences of those outside the classroom.

### **Digital Books**

Some believe the mobile device may replace the textbook as the learning tool of choice for the future (Yu, Ally, & Tsinakos, 2018). Instructors can use electronic textbooks as an inexpensive and practical way to provide improved global access to information for students in both developing and developed areas (West & Chew, 2014). Mobile devices give students the advantage of a having a digital textbook that can conveniently be taken with them anywhere they go, making better use of time in accessing course materials (Nie, Bird, & Edirishingha, 2013). An example from research in Austria found that mobile encyclopedias can be effective at helping students learn new concepts when the application suggest articles and information about nearby topics based upon GPS positioning of the phone (Yu, Ally, & Tsinakos, 2018). Simple features such as an encyclopedia article sent to a student's phone could help the student develop an inclination to examine their surroundings wherever they are located.

Instructor provided access to literature about differing cultures, countries, and current events could expand student views and awareness with problems faced worldwide. Currently,

hundreds of thousands of people in areas such as Ethiopia, Nigeria, and Pakistan are now reading on mobile devices (West & Chew, 2014). South Korea recognized the power of flexible and inexpensive access and launched a nationwide movement for schools to provide digital textbooks tailored to students' needs (West, M., 2012). As students use mobile devices to increase their knowledge base via international and multicultural sources, they may ask more informed questions and create coherent responses that could answer issues prevalent to the global society.

### **News Applications**

Instructors could also look to global news options and trusted social media sites to provide reliable information on the most current global trends and issues. In a developed country such as the United States, 70% of those aged between 18-29 prefer to, or only use, mobile devices to access the news (Pew Research Center, 2016). Another study in developing Serbia found that over 60% of college students preferred a smartphone for staying informed about current events (Vulić & Mitrović, 2015). A worldwide network of information accessible through personal mobile devices gives students the chance for constant awareness of global issues, trends, and challenges in greater speed than previously possible. However, media is an area where caution needs to be exercised with forming global perspectives (Burnouf, 2004). With access to almost unlimited information on the Internet, students need to develop information literacy skills that will help them discern between truth and error when investigating various sources (Yarmey, 2015). When students

engage these global topics with sophistication they will be more competent and prepared to succeed in college, professional life, and civil society (Boix Mansilla and Jackson, 2011).

### **Understanding Perspectives**

Globally competent students must be taught to look upon issues from different perspectives and encouraged to appreciate the beliefs and customs of others that are dissimilar from their own (Burnouf, 2004; Chickering and Braskamp, 2009). Boix Mansilla and Jackson (2011) state that the ability to recognize the perspectives of others is not an optional skill for students to learn in the 21<sup>st</sup> century because they will encounter those of differing beliefs in multi-cultural work environments, academic studies, or personal relationships. Students need to develop a “perspective consciousness” where they realize their outlook is not universally shared and the ideas of others are fundamentally different (Hanvey, 1982). Chickering and Braskamp (2009) summarized this principle stating that there needs to be an “understanding persons who differ widely in their political, religious, and spiritual orientations; in privilege and social class; and in ethnicity and national origin” (p. 28). As students reflect upon those elements that have influenced their own perspectives, it will give them deeper respect for the different positions or beliefs of others (Asia Society/OECD, 2018). Mobile programs that encourage student interaction, collaboration, and reflection can broaden mutual understanding. Instructors can facilitate an expanded student perspective by using mobile polling applications, reflection tools, and collaborative tools.

### **Polling Applications**

Polling programs allow instructors to propose specific prompts and for students to anonymously submit their thoughts from a mobile phone. An application such as PollEverywhere

could be used to facilitate discussion on difficult issues. Some researchers have found that using PollEverywhere to create discussion with mobile devices was effective for increasing student engagement and interaction in undergraduate psychology courses (Walklet, Davis, Farrelly, & Muse, 2016). These tools provide a variety of discussion-based strategies including word clouds, open ended response, or priority ranking. Students can explain their perspectives without being judged for their response and then easily examine the perspectives of others. Instructors desiring to increase global competence may guide students in discussing how perceptions may have been influenced possibly by culture, technology, quality of life, or even access to knowledge.

### **Reflection Tools**

Mobile devices can help the learner's ability to be more mindful and understanding of their own needs as well as those of others in a learning setting (Yu et al., 2018). Moreover, college students can benefit from and perform better with the inclusion of reflection activities that can be delivered through a mobile medium (Martin, & Ertzberger, 2016). Reflective thinking encourages students to actively chain together their personal ideas with previous knowledge and beliefs (Hatton & Smith, 1994) and could be aided through digital journaling or having students write notes to themselves. Numerous educational applications that promote meditation could aid global competence by encouraging students to embark on the process of better coming to know oneself, one's emotions, and how they experience the world. Fisher and Baird (2006) share that reflection can be an individual or collective process involving technological tools such as blogs, wikis, Flickr, and other social media platforms. Reflective strategies allow students to ponder those elements



that have influenced their views while also allowing them to contemplate the perspectives of others.

### **Collaborative Tools**

A major advantage of mobile technology is the ability to increase the collaborative exchanges of ideas between university students (Gikas & Grant, 2013; James, 2011; Vázquez-Cano, 2014). This is primarily due to built-in collaborative tools such as email, text messaging, audio calls, or downloadable applications that can promote student-to-student conversations. Many countries in Asia are already taking advantage of mobile technology as a collaborative tool to communicate teacher to student or student to student (West, M., 2012). In Taiwan, researchers found mobile phones effective in implementing a voice-based discussion between students on a collaborative web forum (Wei, Chen, & Wang, 2007). Digital collaboration is not limited by time and place; therefore, students can practice interacting and appreciating viewpoints from others across national borders that may be much different than their own. Students who develop the digital skills needed to harness these instant collaborative mobile technologies may be able cultivate relationships across great distances and gain access to opportunities to improve global issues that may have been previously inaccessible.

### **Effective Communication**

Human communication is at the center of teaching and learning experiences across the globe (Warren and Wakefield, 2013). Vast worldwide differences in culture, faith, ideology, and wealth call for globally competent students who understand how to proficiently use of emerging technologies that are vital elements of communicating ideas in today's societies (Boix Mansilla & Jackson, 2011, Boix Mansilla & Jackson, 2013). Globally competent students “understand the

cultural norms, interactive styles and degrees of formality of intercultural contexts, and can flexibly adapt their behavior and communication to suit” (Asia Society/OECD, 2018, p. 10). There is a constant need for students to think about how various audiences will perceive what they communicate and then use appropriate verbal or nonverbal strategies (Boix Mansilla, 2013). Ultimately the ability to communicate openly across cultures and be mutually understanding is vital to helping a society progress (Barrett et al., 2013). Communication is the primary purpose of mobile devices (Warren & Wakefield, 2013) and they are advantageous in improving communication skills and fostering a sense of interdependence between college students (Cinque, 2013). Instructors could facilitate respectful and open interactions among students through the practical use of social networking and distance learning tools.

### **Social Networking**

Social networking is a determining factor for those university students who desire to use mobile technology in the classroom (Liaw & Huang, 2015) and could provide practice grounds for complex communication with others across the world. Communication methods for college students have changed over the years and presently focus on connecting with their peers through social media technologies such as Facebook, Twitter, Youtube, and blogs (Khaddage & Knezek, 2011). Topics on social media often surround current real-world issues, creating an environment where instructors can help students recognize the perspectives of others and productively engage in exchanges with diverse groups. Ozan and Kesim (2013) found that social media on mobile platforms create a major impact on the teaching and learning process because of their ability to “create an atmosphere in which individuals can learn from their peers about communication norms and cultures” (p. 174). Integrating mobile social media into a college classroom can student language skills, literacy, and intercultural competence (Yeh & Swinehart, 2018). Students must

recognize how various audiences can perceive different meanings from the information they share and instructors can even initiate this thinking process beginning with the diversity in their own classroom (Boix Mansilla and Jackson, 2011).

### **Distance Learning**

Mobile technology has consistently demonstrated its ability to extend educational opportunities into areas that once were not possible (Traxler, 2012). One university in Mozambique found mobile devices were easier, more flexible, and quicker at improving communication between rural students involved in distance learning (Isaacs, 2012). Lee and Chan (2007) found it effective and efficient to communicate ideas with distance learning students via podcasting on mobile technology. A study in Mauritius showed the usefulness of delivering a distance education MOOC with audio learning materials capable of communicating in the native language of different learners (Yu et al., 2018). The rise of online learning programs and even MOOCs often provide discussion areas where student exchanges with various audiences are not limited by national borders. De Waard (2013) emphasized that in a MOOC, students can access a variety of mobile enabled social-media tools that allow learners to learn, communicate, and exchange knowledge with people all over the world about a mutual topic of interest. Instructors who facilitate an environment that involves complex interaction with various cultures could provide a needed push for students to communicate at a higher level of sophistication with differing backgrounds.

### **Taking Action**

Globally competent students seek to courageously make a difference in the world as they reflect upon multiple ways to improve situations and place these ideas into action either

individually or collaboratively in real life settings (Boix Mansilla & Jackson, 2011). Students must courageously take steps to have their voices be heard as responsible members of society (Asia Society/OECD, 2018). They do not hesitate to take initiative, work with others, and solve critical issues in a global society in the community (Boix Mansilla & Jackson, 2013). Instructors can improve a student's ability to make a difference in their community by incorporating authentic and active learning contexts into their classroom (Boix Mansilla & Jackson, 2011; Chickering & Braskamp, 2009). Educational programs can also help students to take global action by harnessing technologies that expand student capacity to learn world languages (Boix Mansilla & Jackson, 2011). Instructors can bolster student's abilities to take action by harnessing the power mobile technology to implement active learning, create authentic contexts, and support language learning.

### **Active Learning**

Mobile technologies could be used to implement active learning strategies such as situated, inquiry-based, and case-based learning in order to prepare students to make a difference in a global society. Jarvis et al. (2016) found that using mobile devices for mediascapes, or a location aware multi-media situated in geographical context, were effective for helping undergraduate geography students explore economic, cultural, and social life in Dublin Ireland. In this setting, students developed their observation skills and were encouraged take action through active exploration of the city. Mobile assisted case-based learning effectively helped students synthesize, apply, and integrate knowledge in real-life situations (Taradi & Taradi, 2016). Problem-based strategies could assist students in assessing options and planning actions on global issues. Interestingly, researchers examined how one school that implemented a mobile assisted inquiry-based strategy to facilitate active learning and found that the students better understood a critical issue in the

environment and vowed to make a difference by using their understanding to raise awareness in their community (Leelamma & Indira, 2017).

### **Authentic Learning**

Mobile technology can support authentic learning contexts where students can engage relevant and interesting real-world problems (Traxler, 2007). Authentic learning is possible because mobiles create a direct link between theory and practice (Cochrane, & Narayan, 2017). Harley et al. (2016) stated that “a mobile phone can be used to augment one’s learning about the world around them, creating new and countless potential opportunities for informal learning as well as guided learning that takes place outside of the classroom” (p. 360). The portability of mobile technology allows students to actively learn by working on task and activities authentic to the environment in which they could be used (Crompton, 2013). Mobile virtual reality, augmented reality, digital games are examples of this principle. Mobile augmented reality also empowers real-world learning for students with different abilities in a larger global society (Tesolin, & Tsinakos, 2018). Some researchers effectively used a mobile application to allow students to document and take pictures of trees while learning outside in nature (Land & Zimmerman, 2015). Others used augmented reality to effectively instruct students about the context of past and present historical locations in the world around them (Harley et al., 2016). Mobile digital games can help students learn about intricate situations in dynamic environments by giving students opportunities role play

(Yu et al., 2018). In these authentic settings, students can practice improving given scenarios or a real-world problem.

### **Language Learning**

Instructors can help students become more prepared to take action by making use of technologies that facilitate language learning (Boix Mansilla and Jackson, 2011). Mobile devices supply numerous language learning applications and are impactful for college students in areas such as comprehension of vocabulary and grammar (Alkhezzi, 2016; Dange, 2018). One university in China found the popular social media WeChat to be highly effective at helping students learn English as a second language (Shi, Luo, & He, 2017). University students in Istanbul significantly improved communication skills and vocabulary by collaboratively practicing English using the mobile application WhatsApp (Avci & Adiguzel, 2016). Popular applications like Duolingo gamify the learning process and are effective with mentoring and modeling by instructors (García Botero, & Questier, 2016). Students who explore languages other than their primary language are equipped with essential 21<sup>st</sup> century skills in an interdependent world.

### **Conclusion**

Mobile devices have a high rate of possession among university students, nevertheless they are not being used as effectively as they could be to help solve challenges in education. Currently a notable issue is the lack of preparation students receive on interacting with diverse cultures, ideas, and perspectives in an interconnected global society. The path to increasing these capabilities in students begins with instructors who can harness modern technologies. Instructors can take action to create a classroom environment where global competency is expanded through the use of readily available mobile devices.

More specifically, instructors can help students examine global issues through effective use of the Internet, synchronous and asynchronous communications, digital books, and news applications. A student's ability to understand diverse perspectives can be improved by integrating polling applications, reflection tools, and collaborative tools into course activities. The capacity to communicate effectively with others could be enhanced via social networking and distance learning opportunities. Lastly, instructors can help students take action to improve society by implementing active learning, authentic learning, and language learning approaches. If a goal of higher education is to prepare students to succeed in the world, then strengthening global competency should be a high priority.

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## CHAPTER 5. CONCLUSION

As discussed in chapter one of this research, mobile devices are emerging as significant learning technologies and are on the brink of adoption in higher education. Mobile learning is becoming more prevalent as educators look to capitalize on devices that are increasingly pervasive and convenient among university students. Yet, current research literature identifies multiple barriers that confront their effective use in higher education settings. For example, students often lack the experience and skill when using their mobile devices for educational purposes and assignments, rather than connecting socially with others (Ozdamli & Uzunboylu, 2015; Tabor, 2016). University students have also revealed mixed attitudes toward adoption, noting the high usefulness (Abu-al-aish & Love, 2013; Hao, Dennen & Mei, 2016), but lack of support for mobile technology (Brown & Mbatti, 2015; Sarraf et al., 2016). Moreover, professors are often unaware of how to use mobile technologies to support teaching and learning in a practical way within their courses (Kafyulilo, 2102). These challenges prove difficult for university leaders interested in the integration of mobile learning.

Consequently, the purpose of this research was to support researchers and practitioners in the adoption of mobile learning into higher education by providing three publishable articles addressing these issues. The three articles, comprising chapters two through four, focused on skill training, attitudinal instruction, and practical implementation of mobile learning. This chapter briefly reviews these articles and then explains the suggested implications for research and practice overall. In the conclusion, limitations are provided, as are lessons learned as a researcher .

## **Chapter Summaries**

### **Chapter Two**

This article entitled “The impact of training on student perceptions of mobile learning: A mixed methods approach” focused on training and mobile learning skills among university students. The problem identified in the study was how many university students lack the skills to use their mobile devices to complete course assignments and that this was an impediment to adoption. Thus, the purpose of the study was to examine the impact of training had on students’ perceived skill level in using mobile devices to accomplish educational tasks in their coursework. The primary research question investigated was if there was an increase or decrease with students perceived skill level in using mobile devices to complete educational assignments as a result of training. Furthermore, it looked into what factors could explain their change and do these students praise or criticize the use of mobile devices in coursework. A sequential explanatory mixed methods design was implemented through a social constructivist theoretical lens to answer the proposed questions. Quantitative and qualitative data were collected through surveys and interviews. Data was analyzed using SPSS and Nvivo software and subsequent results found there was a significant difference in perceived skill level in students as a result of training. Students reported unfamiliarity with mobile learning within their course and training increased their confidence using the device. Device challenges such as screen size or battery life were found to influence whether students praised or criticized the adoption of mobile phones in their course.

### **Chapter Three**

The article entitled, “The impact of instructional training on university student attitudes and skills with mobile learning” primarily looked at the design of a mobile learning training



intervention and student attitudes. The study explained the problem that even though research literature has suggested that students be trained on the use of mobile technology, exactly how that training should be carried out was unclear. The purpose of this paper was to investigate how training based upon complex learning principles impacted critical adoption factors of student's attitudes and skills. It further sought to answer what learners' perceptions of attitudinal learning outcomes were toward using a mobile device within the course and they described the effectiveness of instructional trainings. An explanatory sequential mixed methods design was used with a theoretical framework built upon complex learning principles and attitudinal learning. Quantitative and qualitative data were collected through surveys and interviews. Data was analyzed using SPSS statistical software and NVivo coding software. Results showed that using complex learning principles influenced students' perceived skill level by increasing confidence and familiarity with a mobile device. Moreover, using these principles positively impacted student perceptions of attitudinal learning outcomes by increasing awareness and experience. Overall learners perceived that instructional training using complex learning principles was effective.

## **Chapter Four**

The article called "Mobile technology: A tool to increase global competency among higher education students" will be published in the International Review of Research in Open and Distributed Learning (IRRODL) in the first issue of 2019. The article primarily focused on how mobile learning can be practically integrated to support challenges at the university level. This paper describes the problem that current higher education students are ill prepared to face the multi-cultural and international problems that exist today. Global competence was defined as the ability to act on issues of global significance. The purpose of the article was to propose the concept that mobile learning is well positioned to provide practical support for instructors looking to

improve global competency. A theoretical framework for global competence developed by OECD was adopted because of its research-based foundations and use by multiple educational organizations. This framework consisted of four components focused on helping students examine global issues, understand and appreciate others perspectives, engage in effective communication with others, and act to improve worldwide issues. First, this paper suggested that mobile technology could be used to help students examine global issues by effectively using the Internet, synchronous and asynchronous communications, digital books, and news applications. Second, mobile devices could be used to help students understand others perspectives by using polling applications, reflection tools, and collaborative software. Third, mobile technology could help students learn effective communication through social networking and distance learning. Fourth, mobile devices can help students act appropriately on global issues by facilitating active learning, authentic learning, and language learning.

## **Implications**

### **Research**

The examination of mobile learning in these chapters provided implications that confirmed past research, filled holes in current research, and proposed opportunities for future research. Existing research has suggested that there may be a gap between students knowing how to use their mobile phones for social interaction versus for educational purposes (Ozdamli & Uzunboylu, 2015; Tabor, 2016; Vasquez-Cano, 2014; Woodcock et al., 2012). The research in these studies found that even among those often labeled “digital natives”, university students are not as experienced using their mobile devices to support the completion of course assignments. Contemporary attitudes toward the use of mobile devices in higher education are mixed, with some students positively viewing their usefulness yet negatively viewing the absence of support from

leadership and limitations of the device (Al-Emran, Elsherif, & Shaalan, 2016; Brown & Mbatti, 2015; Liaw, Hatala, & Huang, 2010; Raza, Umer, Qazi, & Makhdoom, 2018; Sarraf et al., 2016). This research examined student attitudes toward using mobile technology in their coursework using four attitudinal components. Results indicated that university students had mostly positive cognitive and social attitudes and somewhat average affective and behavioral attitudes toward mobile device use. Additionally, students confirmed positive attitudes toward useful mobile programs and negative attitudes toward device limitations such as screen size, battery life, and storage. Mobile learning literature suggests that in order to help the adoption of mobile learning then students must be trained on their effective use (Cheon et al., 2012; Iqbal & Bhatti, 2015; Moran, Hawkes, Gayer, 2010; Tabor, 2016; Yeap, Ramayah, & Soto-Acosta, 2016). Results from the empirical chapters confirmed this theory indicating that training had a positive impact upon critical factors of university student adoption. Lastly, these studies affirmed current research discussing that there may be practical ways to integrate mobile learning so that it assists with current challenges in higher education.

The information put forth in these studies helped move the current field of mobile learning forward by providing foundational research where it was previously absent. Though literature suggests student training on mobile devices is important, it neglects to give detail on what exactly happens as a result of training and how students respond when they are given opportunities to apply their new mobile skills in coursework. These studies described that when students were trained they reported an increase in skill level, experience, familiarity, awareness, knowledge, confidence, and cognitive and social attitudinal components. As students became more acquainted with their mobile device they were more aware of helpful educational programs and their confidence dramatically improved. Present-day research also fails to explain how mobile learning

trainings can be implemented in order to positively influence critical student adoption factors of mobile learning. This research describes that complex learning instruction that uses supportive information, procedural information, and authentic learning tasks, can have a positive impact on skill and attitude. Specifically, university students reported how their skill and attitude were heavily influenced by video demonstrations on mobile learning and realistic application activities in their coursework. Finally, current literature is limited in explaining how mobile learning can be used in a practical manner that impacts important issues in higher education such as global competence. This research proposes the novel concept that mobile devices may be well positioned to help students overcome their inability to assist with global challenges and work amongst people of different backgrounds.

After confirming past research and presenting new research, this research proposes the following suggestions for future inquiry. The impact that mobile learning training has upon students in a variety of disciplines should be examined. How mobile learning is integrated may vary across disciplines and therefore training should be examined in fields other than education. Researchers should look at those who have strictly used mobile phones to complete course assignments and if there is a difference with those who have used only computers. This would help expound upon how mobile learning impacts university student outcomes. Furthermore, the long-term impact training has upon students should be investigated after they have been given opportunities to integrate the use of mobile technology into practice. More research is underlining the need for faculty understand how to integrate mobile technology before students and therefore the impact of training for instructors should be examined. To greater examine the significance of attitudinal change and mobile learning, research should cross examine attitudinal components with other factors such as gender or final course grade. Finally, in order to know if mobile technology

truly can help with the issue of global competence then researchers could empirically study how using mobile learning can affect the four components of the global competency framework.

## **Practice**

In addition to applications for research, the investigation of mobile learning found within these chapters gives higher education leadership practical implications for practice. First, administrators interested in the adoption of mobile learning have increased knowledge on how to support students in the implementation of these devices. If a goal of leadership is to harness the power of mobile technology among their students, then training should be performed in a way that positively impacts student intention to adopt. Support should focus on increasing confidence and familiarity with proven educational programs on mobile devices. Policy guidelines could move faculty and students toward more effective applications of mobile technology into coursework.

Second, instructors can use the practical ideas recommended in this research to assist students in strengthening their global competence regardless of discipline. These instructors can help university students learn to examine vital global issues by more effectively using the Internet, synchronous and asynchronous communications, digital books and news applications. Doing so would help them more deeply understand the challenges in the world outside their immediate environment. Instructors can direct students toward appreciating the perspectives of others by using polling applications, reflection tools, and collaborative tools. In this way students can be encouraged to seek understanding on viewpoints, beliefs, and customs that are different from their own. To facilitate respectful and open interactions among students, instructors can use mobile social networking and distance learning tools. As students proficiently use emerging technologies they can communicate with those of different cultures, faiths, and ideologies. Lastly, instructors can help students act to improve global issues by using mobile devices for authentic, active, and

language learning settings. Mobile devices can help facilitate environments where students reflect upon how to improve global situations and put ideas into action.

Third, higher educators looking to design training that positively impacts skill and attitude can apply complex learning and attitudinal change principles. By integrating the use of supportive information, procedural information, and authentic learning tasks into training, student's perceived skill level using a mobile device in coursework will improve. Furthermore, employing these three components alters attitudes as consciousness of new mobile programs and experience with the mobile device increases. These three parts of complex learning can be put into action by using presentations that give background information, demonstration videos, and real-life activities for students to practice using their mobile devices. Training that adopts these principles effectively helps students gain new information about using mobile devices in class and accomplish something new that they have not done before. In general, by designing mobile learning training using complex learning principles educators could positively influence student confidence, familiarity, awareness, knowledge, and experience using mobile devices in their coursework. Doing so would ensure that training is focused on critical factors of student adoption.

### **Limitations**

Though this research sought to investigate and explain critical factors of mobile learning adoption in higher education, it was not without research limitations. First, methodological limitations were found in the fact that undergraduate university students were the primary focus in the two empirical studies, when undoubtedly professors and administrators play a prominent role as well. Student participants in these studies were chosen via convenience sampling and were all enrolled in an introductory educational technology course. This may have been influential as almost all students involved were education majors, rather than a sampling a population with more

variety in student background. Also, training in these two studies was limited in duration over the course of one semester and therefore its lasting effects were hard to determine without longitudinal examination.

Second, limitations in the practice of mobile learning were found in how just a few of the many elements influencing the overall adoption of mobile learning were observed. Student adoption factors continue well beyond attitude and skill, which were the dominant focus within this research. Furthermore, the practitioner article included suggested a concept and provided no empirical verification that the practice of mobile learning increases global competence among university students.

### **Reflection**

Nelson Mandela once said that “Education is the most powerful weapon which you can use to change the world” (Ratcliffe, 2017). This philosophy has guided me to decide on an area of research that I perceived could have the greatest impact upon people of any background. Research should be focused on meeting the relevant needs of both the larger educational audiences and the individual. I chose to research mobile learning in higher education because I wholeheartedly believe that these emerging technologies have the ability to transform teaching and learning worldwide. During my world travels I have personally observed thousands of people, regardless of race, culture or background, using these technologies in almost every aspect of their life. Mobile device use seemed to be fueled by the learn-on-the-go, immediate, and high-speed mentality of the day.

Now as I ponder upon the results of this research, I have come to understand that those who are often labeled digital natives are not as knowledgeable as may have been thought. These papers contribute to the field because they target this issue surrounding mobile learning today.

Simply stated, when it comes to meaningful learning with a mobile device, the level of skill, familiarity, confidence, and awareness seem to dramatically decrease among university students. This could be as result of the relative novelty of rapidly advancing mobile technologies. Therefore, it may be that moderately few in education understand how to harness the power of mobile technologies without falling victim to the negative consequences. Over the years, the focus of organizations who design, develop, and sell these devices has fallen more upon trying to improve ownership levels across the globe rather than instructing on safe and effective use. Only now are more organizations starting to target the balance of screen time as research begins to shed light on the dangers of misuse.

In a decade of practice, I have observed in my professional teaching, community service, and social interactions that mobile devices are becoming a ubiquitous aspect of human interaction. The challenge is that often students use these devices for a few routine social tasks and rarely harness the full power of mobile devices for formal and informal learning that is possible. I believe this is primarily because young people may not know how to use their mobile device to meaningfully and deeply learn. While working as a classroom instructor I reflected on the question “who is teaching them how to correctly use their mobile devices?” It was interesting to me that nobody questioned if students were properly using the most pervasive digital tool that provides access to more information than ever before in history. I felt that currently parents and instructors were not focused on correctly using a mobile device, considering many of them did not know how to properly use it for teaching and learning themselves. This caused me to reflect upon the importance of training more than ever and even begin training my current students on the effective use of mobile devices.



Moreover, as I began to research and study literature on the adoption of mobile learning in higher education it became clearer that many of my assumptions concerning the lack of training were likely correct. This research, my ongoing experiences in the classroom, and current worldwide statistical trends boldly confirmed that more effort needs to go into understanding the field of mobile learning. Specifically, these articles give a jump start to training and practical approaches to mobile learning. There has never been a technology in the history of the world that has made its way into more pockets and become intertwined in societies and lifestyles. Mobile device ownership shows no signs of digressing and therefore helping students and instructors understand how to successfully integrate these technologies into learning environments should be a primary concern. When students and instructors learn more about the positive uses of these devices, negative effects such as addiction and distraction may begin to subside. It is because of these challenges and opportunities that I decided to build upon my observations and focus on the examination of training and practical use of mobile technology among college age students. These driving factors led me to devote my research to and complete my dissertation on the study of mobile learning in higher education.

The challenging road to completing a dissertation has forever embedded on my mind the complex nature of learning and the dynamic process of inquiry. During this journey I have learned that my mind is capable of expanding and accomplishing much more than I could have imagined just a few years before. However, it took time to achieve this goal. I found that having exemplary mentors who provided unique learning opportunities and also finding occasions to work on demanding projects were critical to my mental growth and refinement. It seemed that the more I delved into academic literature to increase my understanding, the more I realized how little I knew; observing others, studying countless resources, asking hard questions, getting tutored by others,

and performing through trial and error, were all vital factors to learning during this process. These essential elements helped me better understand the research process of identifying a problem, determining how to find a solution, and then following through. I better understand now that the process of research and learning is not linear, but rather dynamic. Sometimes you move forward or backward and occasionally an interview is needed where a survey is lacking. This principle demonstrated to me that there is no single best approach to research and learning. Overall, there may have been more effective ways to approaching the beforementioned issues of mobile learning in higher education. Yet, most importantly, forthcoming scholars can learn from my research and provide new perspectives to solve rising challenges. The differing perspectives, needs, and beliefs each academic contributes to the field of research are essential in providing the most complete picture. This, I have learned, is the beautiful nature of research and learning.

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## **VITA**

### **Education**

#### **Ph.D. Learning Design and Technology — Purdue University, West Lafayette, IN (2016 — Present)**

- Research specialist on use and integration of mobile tech in higher education
- Researching how mobile devices as a tool can increase global competency
- Performing studies on the change of student attitudes toward mobile tech as result of training
- Scholar in application of advanced instructional design theory and learning sciences
- Superior understanding of quantitative, qualitative, and mixed method research methodology

#### **MS.Ed. Learning Design and Technology — Purdue University, West Lafayette, IN (2014 — 2016)**

- Designed, developed, and presented interactive e-Learning training modules using Adobe Captivate
- Formed instructional plans using ADDIE and Dick & Carey models and Kirkpatrick's levels of evaluation
- Examined motivational, multimedia, and technology integration principles within curriculum

#### **B.S. Exercise Science — Brigham Young University, Provo, UT (2008 — 2011)**

## **Experience**

### **Educator — Seminaries and Institutes, The Church of Jesus Christ of Latter-day Saints, Salt Lake City, UT (2019 – Present & 2011 - 2016)**

- Training faculty and students on the use of educational technology at tri-area symposiums and conferences
- Instructing six seminary classes of 400 high school students each year
- Developing instructional curriculum and lesson plans

### **Instructional Designer — Purdue University, West Lafayette, IN (2014 – 2019)**

- Assisted in design and development of Purdue's new online masters in Curriculum and Instruction
- Designed online graduate courses in Blackboard Learn LMS for LDT program

### **Graduate Research Assistant — Purdue University, West Lafayette, IN (2016 – 2019)**

- Worked on Gifted Education (GERI) research project team
- Developed online teacher training guide for new teachers based upon best practices
- Researched the use of qualitative meta-synthesis in education as part of Spencer foundation grant

### **Graduate Teaching Assistant — Purdue University, West Lafayette, IN (2016 – 2018)**

- Instructed educational tech labs on digital skills and competency based digital badges
- Managed and graded student coursework through Purdue Passport digital badge system

## **Service**

### **Leadership and Volunteer**

- Vice President – Purdue Association for Learning Design and Technology (2017 – 2018)
- Slovakia Teacher Development – Purdue University (March 2018)
- Service Missionary — The Church of Jesus Christ of Latter-day Saints (2006 – 2008)

## Awards and Memberships

- AECT Member – Association for Educational Computing and Technology (2016 – Present)
- Eagle Scout Award – Boy Scouts of America

## Scholarship

## Publications

- Fox, E. (in press). Mobile technology: A tool to increase global competency among higher education students. *The International Review of Research in Open and Distributed Learning*.
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