EFFECTS OF SELF-REGULATORY STATUS AND PRACTICE TYPE ON STUDENT PERFORMANCE IN THE MOBILE LEARNING ENVIRONMENT

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

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ABSTRACT

The next generation of computer-based learning environments has arrived. This generation of technology is characterized by mobile and portable devices such as smartphones and tablet computers with wireless broadband access. With these devices comes the promise of extending the online learning revolution. The purpose of this study was to investigate the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance within the context of mobile instruction. Results indicated that the inclusion of practice activities in mobile instruction has a positive effect on student performance. Study participants who received either assessment aligned or reflective practice significantly outperformed participants who did not receive practice. The results indicated that self-regulatory status does not have a significant effect on performance in mobile instruction. Further, the study results also indicated that the inclusion of practice activities in mobile instruction have a positive effect on student attitude. Through the systematic consideration of a specific element of instruction, while considering the affective elements of self-regulation, this study began the process of building the framework for the effective design and implementation of mobile learning.

Dedication

"Blessed is the one who finds wisdom, and the one who gets understanding, for the gain from her is better than gain from silver and her profit better than gold" (Proverbs 3:13-14, English Standard Version).

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CHAPTER ONE: INTRODUCTION

The capabilities of using the Internet to deliver instruction have been well documented over the past 15 years with perhaps the key characteristic being access (Anderson, 2009; Barritt, 2002; Puzziferro, 2008; Roblyer, 2005; Schwieren, Vossen & Westerkamp, 2006). As Anderson (2009) states, "Online learning, as a subset of all distance education, has always been concerned with providing access to educational experience that is at least more flexible in time and in space than campus based education" (p. 41). The capacity of the Internet to support responsive content, linking, and synchronous interaction make it an ideal platform for distributed, anytime anywhere learning (Puzziferro, 2008). Using the Internet to deliver instruction allows students to participate whenever and wherever they want (Schwieren, Vossen & Westerkamp, 2006).

The next step in the evolution toward ubiquitous instructional delivery is the mobile computing device (de Marcos, Hilera, Gutierrez, Pages, & Martinez, 2006). The notion of the anytime, anywhere computing paradigm is a reality. Recent projections show that by the year 2020, mobile phones will be the primary connection device to the Internet (Norris & Soloway, 2010). According to Hadhazy (2010) the number of smartphone users is projected to eclipse the number of traditional computer users in 2014. The year 2012 alone was projected to see the shipment of 450 million smartphones. This quantity is more than laptop and desktop computers combined (Schonfeld, 2010). Couple the number of new smartphones with the fact that Apple has sold more than 55 million iPads since its debut in 2010 (Seghers, 2012), and the proliferation of mobile computing technology has reached an epic scale.

In preparation for its 2012 Horizon Project Report, the New Media Consortium (2012) identified the following key trends.

a) The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators.
b) As the cost of technology drops and school districts revise and open up their access policies, it is becoming increasingly common for students to bring their own mobile devices.
c) Education paradigms are shifting to include online learning, hybrid learning, and collaborative models.
d) People expect to be able to work, learn, and study whenever and wherever they want to.
e) Technology continues to profoundly affect the way we work, collaborate, communicate, and succeed (p. 4).

Situated squarely within these trends is the mobile computing device and the concept of mobile learning. “The anytime, anywhere availability of mobile devices has potential to promote a seamless 360-degree learning experience that breaks down the barriers between formal and informal educational environments” (Ching, Shuler, Lewis, & Levine, 2009, p. 28).

It stands to reason that educational institutions would seek to leverage this technology in an effort to diversify and improve instructional opportunities for students. The widespread use of mobile computing certainly offers new and exciting possibilities for learning and increasing motivation among students due to the nature of the devices (McManus & Rossett, 2006); however, mobile or mobile learning brings with it a host of

both new and familiar challenges. The perpetual improvement in technology routinely calls for the re-conceptualization of learning theory and change in the design of instruction and pedagogy. The challenge remains to ensure that the mobile environment is that which best facilitates learning (Solvberg & Rismark, 2012).

Background

Researchers differ on the definition of mobile learning; a prevailing opinion is that mobile learning is simply receiving instruction via mobile (i.e. portable, lightweight) computing devices (Al-Fahad, 2009; Chuang, 2009; Evans & Johri, 2008; Johnson, 2010; Kukulska-Hulme, 2009; Stockwell, 2008). For example, Valk, Rashid, and Elder (2010) defined mobile learning as, "learning that is mediated through a mobile device" (p. 2). Dissenters argue that focusing solely on the device ignores other unique aspects of the learning environment (Chapel, 2008; Eisele-Dyrli, 2011; Traxler, 2010). Corbeil and Valdes-Corbeil (2007) define mobile learning as, "the intersection of mobile computing and e-learning" (p. 52). Further, Mottiwalla (2007) adds that mobile learning combines individualized learning with ubiquitous learning.

For the purposes of this study, a three part definition as suggested by Traxler (2010) was used to operationalize mobile learning. Traxler's (2010) definition specifies that mobile learning is (a) learning delivered and supported by handheld, mobile computing devices; (b) comprised of formal and informal components; and (c) authentic and situated in context for the learner.

Mobile Learning Research. Research in mobile learning is in its infancy (Cavus & Ibrahim, 2009; Peng, Su, Chou, & Tsai, 2009; Pollara & Broussard, 2011). The vast majority of literature addressing mobile learning has focused on student perception (Al-

Fahad, 2009; Clarke, Keing, Lam, & McNaught, 2008; Garrett & Jackson, 2006; Kim, Mims, & Holmes, 2006; Maag, 2006; Maniar, 2007; Uzunboylu, Cavus, & Ercag, 2009; Wang, Shen, Novak, & Pan, 2009). Due to the emergent nature of mobile learning and its requisite technology, the quantity of empirical studies in the mobile environment is small. The theoretical foundations for mobile learning are largely in the formational stages, and a single unifying theory has yet to emerge (Solvberg & Rismark, 2012). Subsequently, researchers are left to apply the theories and standards of e-learning when approaching the mobile realm (Cavus & Ibrahim, 2009).

Instructional Design for Mobile Learning. The mobile learning environment presents a number of design similarities to the regular online learning environment. For example, universal design principles remain a key consideration to ensure that the systems remain useful to people with diverse abilities (Arrigo & Cipri, 2010). Principles of sound multimedia integration must also be followed (Motiwalla, 2007). And, the time-tested principles of systematic instructional design still apply such as Gagné's Nine Events of Instruction (Gikas, 2011). There are, however, a number of constraints in the mobile environment that are unique to mobile learning. In a meta-analysis, Kukulska-Hulme (2007) identified inadequate memory, short battery life, slow data speeds on cellular networks, and small screen size as challenges when implementing mobile learning.

de Marcos et al. (2006) state, "In this framework [constrains of mobile learning environment] it is crucial to define an architecture for supporting the whole training process, including the repository where the learning objects are stored in order to be delivered to the mobile devices" (p. 1). These authors propose that the learning object

model (Wiley, 2000) provides the flexibility to chunk and store well-designed instructional content that can be accessed by devices independent of individual features of the device (de Marcos et al., 2006).

Affective Considerations for Mobile Learning. Researchers and practitioners have recognized the challenges associated with the changes in student demands and responsibilities present in online learning. These challenges extend to the mobile environment (Cavus & Ibrahim, 2009). In recent years, a number of studies have emerged identifying the influence of self-regulatory learning strategies in online course success (Whipp & Chiarelli, 2004; Winnips, 2000; Zimmerman, 2008). Yukselturk and Bulut (2007) and Puzziferro (2008) have shown the efficacy of using self-regulatory behaviors as predictors of student success in online courses. The void now exists in finding ways to identify and address deficiencies in the self-regulatory strategies of students in all e-learning modalities, including mobile, so that they may be more successful.

Problem Statement

The next generation of computer-based learning environments has arrived. This generation of technology is characterized by such mobile and portable devices as smartphones and tablet computers with wireless broadband access. With these devices comes the promise of extending the online learning revolution, by placing ubiquitous learning in the hands of students. Yet, "If education is to have any place in this niche, we must acknowledge that the research must constantly evolve with the technology" (Pollara & Broussard, 2011, p. 7).

Empirical data is needed to determine the framework for and optimal characteristics of mobile instruction for learning, particularly in the higher education environment. The problem is the impact of instructional design considerations and other factors in mobile learning on student performance has yet to be quantified (Pollara & Broussard, 2011; Rushby, 2012; Solvberg & Rismark, 2012). As stated previously, the vast majority of literature addressing mobile learning has focused on student perception. "These studies do not move us significantly beyond what is already known and widely published in the field" (Rushby, 2012, p. 355). Further, even among studies that considered factors such as motivation (Karim, 2008; Millard, 2007); it was not empirically linked to performance.

Purpose Statement

The purpose of this quantitative, quasi-experimental, pretest-posttest design with nonequivalent groups study was to investigate the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance and attitude within the context of mobile instruction. The participants for this study were students enrolled in one of four preservice teacher technology courses at a state university in the southeastern U.S. The study focused on the efficacy of differing practice types to influence participant performance and attitude in an instructional module developed for the mobile environment. Participant self-regulatory status was determined using a subset of the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991). Participant attitude was measured using a questionnaire based on the Technology Acceptance Model (TAM) (Venkatesh & Davis, 1996).

Significance of the Study

An urgent need exists for ubiquitous learning opportunities (Pollara & Broussard, 2011). This research has the potential to inform the possibilities for implementing mobile computing devices in higher education. As noted by researchers such as Rushby (2012) and Solvberg and Rismark (2012), there remains a void in the literature of sound experimental research that empirically addresses optimal instructional design characteristics to ensure the best possible facilitation of learning in the mobile environment. Through the systematic consideration of a specific element of instruction, practice, while considering the affective elements of self-regulation, this study begins the process of building the framework for the effective design and implementation of mobile learning not yet developed in the literature (Arrigo & Cipri, 2010).

Research Questions

The research questions for this study are:

RQ1: What is the effect of practice type (assessment aligned, reflective, none) on participant performance and attitude in the mobile learning environment?

RQ2: What is the effect of self-regulatory status (high and low) on participant performance and attitude in the mobile learning environment?

Hypotheses

Null hypothesis H_{01}: There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Null hypothesis H_{02}: There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student attitude as measured by an

attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Null hypothesis H_{03}: There is no significant difference between groups for self-regulatory status (high or low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Null hypothesis H_{04}: There is no significant difference between groups for self-regulatory status (high or low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Identification of Variables

The two independent variables in this study are practice type and self-regulatory status. There are three levels of the practice type variable in this study: no practice, assessment aligned practice, and reflective practice. Practice is identified as one of Gagné's Nine Events of Instruction (Gagné, Briggs, &Wager, 1992). Further, practice is the elicitation of performance from learners prior to assessment (Gagné, Wager, Golas, & Keller, 2005). Assessment aligned practice is one in which the format, modality, and objectives are the same as the final assessment (Merrill, 2002). Reflective practice is a learning exercise in which students express their understanding of, response to, or analysis of an event, experience, or concept (Knowles, Tyler, Gilbourne, & Eubank, 2006).

The second independent variable is self-regulatory status. There are two levels of self-regulatory status, high and low. Self-regulation is defined as the active process by which learners monitor and adjust their motivation and behavior (Cho & Jonassen, 2009; Matuga, 2009; Puzziferro, 2008; Rakes & Dunn, 2010). Self-regulatory status was determined by student responses to a subset of the Motivated Strategies for Learning Questionnaire (Pintrich, et al., 1991).

The dependent variables in this study are student performance and student attitude. Student performance was determined by scores on a posttest covering the instructional content controlling for pretest performance over the same content. Student attitude was determined by analysis of responses to the Technology Acceptance Model (Venkatesh & Davis, 1996).

Definition of Terms

E-learning: an instructional method in which instruction is delivered via electronic media, predominantly the Internet (Ryu & Parsons, 2012).

Mobile computing device: a small handheld device that provides computing functions, wireless broadband connectivity, and web browsing (Doe, 2009). These devices include mobile phones, tablet computers, and devices such as the iPod Touch (Tualla, 2011).

Mobile learning: learning that is (a) delivered and supported by handheld, mobile computing devices; (b) comprised of formal and informal components; and (c) authentic and situated in context for the learner (Traxler, 2010).

Motivated Strategies for Learning Questionnaire: a self-report instrument designed to assess college students' motivational orientations and their use of different learning

strategies (Pintrich et al., 1991). The MSLQ is comprised of 81 Likert-type items scored on a seven-point scale (0 – not at all true of me to 6 – very true of me).

Practice: the elicitation of performance from learners prior to assessment (Gagné, Wager, Golas, & Keller, 2005).

Self-regulation: the active process by which learners monitor and adjust their motivation and behavior (Cho & Jonassen, 2009; Matuga, 2009; Puzziferro, 2008; Rakes & Dunn, 2010).

Self-regulatory status: the condition of an individual's level of self-regulation as determined by a subset of the MSLQ (Pintrich, et al., 1991).

Student performance: operationalized in this study as scores on a posttest covering the instructional content controlling for pretest performance over the same content.

Technology Acceptance Model: instrument measuring intent to use a system based upon perceived usefulness and ease of use (Venkatesh & Davis, 1996).

Research Summary

The purpose of this study was to investigate the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance and attitude within the context of mobile instruction. A quantitative, quasi-experimental, pretest-posttest design with nonequivalent groups was used.

Each practice type treatment consisted of a practice activity administered at the conclusion of a mobile-enabled online instructional module. Participant performance was measured by a researcher-developed pretest and posttest. A factorial design is the most widely accepted way to study the effect of two or more independent variables

(Quinn & Keough, 2001). This study used single manipulated variable, practice type (assessment aligned, reflective, none); and a single subject variable, self-regulatory status (high and low). This configuration is commonly referred to as a Person by Environment (PxE) factorial design (Goodwin, 2005).

CHAPTER TWO: REVIEW OF THE LITERATURE

The proliferation of mobile technologies continues to feed global dependence upon handheld communication devices to complete everyday tasks (Ally, 2009). In response, an emerging interest in mobile computing devices for use in teaching and learning is apparent in higher education. The expectation of students, who themselves are adept in the use of mobile devices, drives higher education administrators and instructors to make use of their students' devices (Shuler, 2009). Many educational institutions are also beginning to embrace mobile devices as learning tools outside the classroom (Schachter, 2009). This use of mobile devices as learning tools has the potential to shift the educational paradigm by creating opportunities for enhanced instruction characterized by seamless, ubiquitous learning (Rogers, 2009). This new concept of learning has been dubbed mobile learning (Cavus & Ibrahim, 2009).

Much of the current literature on mobile computing devices and learning in educational settings has yet to extend beyond assessments of technology adoption (Arrigo & Cipri, 2010) or the use of mobile devices as a means to access campus resources (Aldrich, 2010; Arreymbi & Draganova, 2008; & Herrington & Herrington, 2007). Little research has been done to empirically examine educational approaches, specifically the design of instruction, that take into account the robust potential of these devices in teaching and learning (Rajasingham, 2011; Solvberg & Rismark, 2012). There is also a need to examine learner characteristics and their role when mobile technology is used for learning (Rushby, 2012).

The following review of the literature provides an overview of research related to the implementation of practice in mobile learning and the effect of the student

characteristic of self-regulation. Within this construct, mobile learning and the use of mobile computing devices is described. The self-regulatory strategies of successful learners, learning objects, competency-based design, and the considerations and implications of utilizing characteristics of self-regulation as a predictor for students' success on the design of mobile learning content are also explored. A theoretical framework for mobile learning and practice is constructed around Gagné's Nine Events of Instruction, Vygotsky's Theory of Zone of Proximal Development, situated learning, and Bandura's Social Learning Theory.

Conceptual or Theoretical Framework

As Roblyer (2005) noted, researchers in the field of educational technology do not possess a single clear theoretical foundation as a framework for research. Research in educational technology is often grounded in theory from both the technical and pedagogical realms and Rushby (2012) suggests the mobile learning research agenda follow this model. Researchers have relied upon a number of theories from which to construct a framework for their mobile learning investigations, these include: Cognitive Load Theory, Conversional Theory, Social Constructivist Theory, Scaffolding, Zone of Proximal Development, Social Learning Theory, and The Law of Effect (Arrigo & Cipri, 2010; Coens, Reynvoet, & Clarebout, 2011; Motiwalla, 2007; Pocatilu & Pocovnicu, 2010; Redd, 2011; Solvberg & Rismark, 2012).

The idea of Informal Learning also serves as a common theoretical basis for much of the research in contemporary environments. Originally intended to contrast formal learning environments, Informal Learning is frequently associated with investigations of Web 2.0 tools and studies of various forms of social media (Cox, 2013; Dabbagh &

Kitsantas, 2012; Downes, 2010; Ebner, Lienhardt, & Rohs, 2010; Madge, Meek, Wellens, & Hooley, 2009; Marty, et al., 2013; Sanchez-Navarro & Aranda, 2013; Schwier & Seaton, 2013; Yoo & Kim, 2013). However, reliance on Informal Learning as a theoretical basis is problematic. While Informal Learning may be viewed as an important component of contemporary educational environments, as Ebner, Lienhardt, and Rohs (2010) describe, "despite, or even due to the mass of publications about informal learning, the term is being absorbed into different pedagogical contexts and is becoming more and more unclear" (p. 93). Ebner, Lienhardt, and Rohs (2010) continue,

> A continuum of understanding of formal and informal learning has become accepted. Crucial criteria for the distinction between formal and informal learning are dimensions such as the environment, motivation and pedagogical influence. However, most forms of learning are mixtures of formal and informal learning. According to this understanding, informal learning can also take place in education institutions, when motivation is focused on solving (real) problems with little pedagogical guidance (p. 93).

Researchers have proposed that the departure of mobile learning from the traditional classroom and even online learning demands a new learning theory (de Marcos et al., 2006; Rushby, 2012; Solvberg & Rismark, 2012); whereas, Shih and Mills (2007) question whether mobile learning is a new pedagogy or simply a new delivery system.

In light of the inconclusive state of the literature in defining a single theory for mobile learning, this study will rely on a combination of the following learning and motivational theories and instructional models to support the implementation of mobile

computing devices in teaching and learning. These are (a) Gagné's Nine Events of Instruction, (b) Vygotsky's Zone of Proximal Development, (c) situated learning, and (d) Bandura's Social Learning Theory.

Gagné's Nine Events of Instruction. The Nine Events of Instruction were derived from Gagné's original Conditions of Learning and have transitioned over time to represent a cognitivist approach to learning (Gagné et al., 1992). Cognitivists posit that knowledge is organized by learners into schemata; these themes form the foundation for processing more complex information (Driscoll, 2005). Contemporary developmental psychologists such as Miller (2011) continue to describe this approach in terms of information processing theory. Information processing theory combines cognitive growth through the development of new strategies for storing and processing information, and developing concept recognition or problem-solving (Miller, 2011).

Gagné's Nine Events of Instruction serve as a foundational framework for theories and systematic models of instructional design (Dick, Carey & Carey, 2005; Smith & Ragan, 1999). The events framework provides a cognitive strategy that describes the guidance of learners' thinking and learning. The nine events are: (a) gaining attention, (b) informing learners of the objective, (c) stimulating recall of prior learning, (d) presenting the content, (e) providing learning guidance, (f) eliciting performance, (g) providing feedback, (h) assessing performance, and (i) enhancing retention and transfer (Gagné et al., 1992). This system of events provides a model of design readily adaptable to instruction delivered via mobile computing devices, particularly practice, the instructional element under investigation in this study (Driscoll, 2005; Shih & Mills, 2007).

A few researchers have explored specific instructional elements in computer-based instruction, test review software, and text messaging (Caverly, Ward, & Caverly, 2009; Kukulska-Hulme & Shield, 2008; Martin & Klein, 2008; Martin, Klein, & Sullivan, 2007). In the case of Martin and Klein (2008) and Martin, Klein, and Sullivan (2007), practice was specifically studied in the context of computer-based instruction.

By adapting this model to instructional development for mobile computing devices, mobile learning environments can provide manageable, chunked information. This information may then guide learning and provide opportunities for practice and assessment either independent or specific to location. The influence of Gagné's theory is evident within the realm of mobile learning.

Zone of Proximal Development. Vygotsky's (1978) theory of the Zone of Proximal Development defines the gap between what a learner can do without help and what the student can achieve with help. The theory describes three stages that account for what the learner can do alone, the desired level of achievement, and the scaffolding or support necessary to reach that level (Barker, van Schaik, & Famakinwa, 2007). The first stage represents a learner's current level of knowledge and skill, a state in which the learner will have success achieving and solving problems independently. The third stage represents a task level that is beyond reach. One at which the student will experience confusion, frustration, or boredom due to the difficulty of the task. It is in-between these stages where the zone of proximal development exists. The learner, with appropriate guidance is able to achieve success at a level that is just beyond that can be completed independently (Murray & Arroyo, 2002; Vygotsky, 1978). During this process, connections between what a student knows and learning can be made. Ultimately,

appropriate support within the zone of proximal development should facilitate the expansion of schema so that the more advanced task can later be performed independently.

The application of Vygotsky's theory translates well to the mobile learning environment. Mobile devices have the ability to support mobile learning applications that engage individual learners while in the zone of proximal development (Kukulska-Hulme, 2009). While using mobile devices, learners progress beyond their current level of knowledge as necessary scaffolding is provided for the acquisition of new knowledge (Powell & Mason, 2012). The theory suggests that as the scaffolds are slowly reduced, the learner is left with the ability to apply the knowledge gained to scenarios without any support (Barker, van Schaik, & Famakinwa, 2007). The location independence and infinite accessibility of mobile devices allows for on-demand scaffolding with a high level of learner control (Hayes, Janetzko, & Hall, 2006). This is a capability that cannot be matched even by the flexibility inherent in traditional online learning.

Situated Learning. Situated learning, often used synonymously with the term authentic learning (Brown, Collins, & Duguid, 1989), refers to a theoretical model in which instruction is learner-centered, where learning takes place in the same context in which it is applied, and in which the learner is an active participant in the learning process (Jonassen, 1991; Lave & Wenger, 1990). Situated learning requires knowledge to be presented in authentic contexts. This is based on the concept of situated cognition, which explains that knowledge cannot be known and fully understood independent of its context (de Graaff & Kolmos, 2007). Herrington and Oliver (1999, p.5) identified

framework of nine key elements of situated learning as applied to the instructional design of a multimedia instruction.

1. Provide authentic contexts that reflect the way the knowledge will be used in real life.
2. Provide authentic activities.
3. Provide access to expert performances and the modeling of processes.
4. Provide multiple roles and perspectives.
5. Support collaborative construction of knowledge.
6. Promote reflection to enable abstractions to be formed.
7. Promote articulation to enable tacit knowledge to be made explicit.
8. Provide coaching and scaffolding by the teacher at critical times.
9. Provide for authentic assessment of learning within the tasks.

The ubiquitous nature of mobile learning allows for the natural extension of instruction into the context of the real (Dede, 2011). Further, "you can tie alternate reality games to location and time, and thus serve as an interesting channel for meaningful embedding of practice in context" (Quinn, 2012, p. 22). Each of the characteristics identified by Herrington and Oliver (1999) are an inherent characteristic of the capability of delivering instruction within a locational context. If the learner's location is known, particular information relevant to the site can be provided. Further, knowing where the user is, in terms of task, relevant information could be provided to scaffold performance and reinforce the learning goal (Quinn, 2012).

Social Learning Theory. The use of mobile devices for instruction may also draw upon Bandura's Social Learning Theory. Social learning theory is a theoretical

framework that, according to Bandura (2006), accounts for the internal and external factors that determine a person's ability to learn new things. The focus of the theory is on the interactions between the learner's environment and their behavior. Social learning theory has been used in the investigation of e-commerce as a means to examine the interaction of personal factors and technology (Chan & Lu, 2004; Laukkanen, 2007; Ratten, 2008), and as a way to explore mass technology adoption (Ratten, 2011). "As technological innovations require people to learn and adapt to different things, social learning theory provides a unique way to examine which of these factors is the most influential in explaining the technological adoption process" (Ratten, 2011, p. 41).

The conceptual model of social learning has four key components: attention, retention, reproduction, and motivation (Kirsch, 2010). From this theory, mobile computing devices facilitate peer interaction and serve as a principal tool for learner-learner socialization. Thereby providing an environment in which attention may be called to instruction, retention may be reinforced, reproduction by me elicited, and motivation may be incentivized (Uzunboylu, Cavus, & Ercag, 2009).

At the core of social learning theory is self-efficacy. Bandura (1997) described self-efficacy as one's convictions about their own abilities to perform at a specific level. Cho and Jonassen (2009) indicate that self-efficacy is an important predictor for behavior in all areas of human interaction. Educational researchers have engaged in numerous studies correlating self-efficacy and performance (House, 2000), test anxiety (Pintrich & de Groot, 1990), and ability to search for information (Hannafin & Land, 1997). Self-efficacy is also a key component of self-regulation (Pintrich & de Groot, 1990), a variable of interest in this study.

Related Literature

Defining Mobile Learning. There is some disagreement as to the definition of mobile learning. One prevailing opinion is that mobile learning is simply receiving instruction via mobile computing devices (Al-Fahad, 2009; Chuang, 2009; Evans & Johri, 2008; Johnson, 2010; Stockwell, 2008). Dissenters argue that focus solely on the device ignores other unique aspects of the learning environment (Chapel, 2008; Eisele-Dyrli, 2011; Kukulska-Hulme, 2009; Traxler, 2010). For example, Valk, Rashid, and Elder (2010) defined mobile learning as, "learning that is mediated through a mobile device" (p. 2). Traxler (2010) responds,

> These definitions, however, are constraining, technocentric, and tied to current technological instantiations. We, therefore, should seek to explore other definitions that perhaps look at the underlying learner experience and ask how mobile learning differs from other forms of education, especially other forms of e-learning. (p.13)

According to Ally (2009), mobile devices alter the nature of work, the balance between training and performance, and ultimately the nature of learning. Mobile devices not only provide for new ways of accessing knowledge, but also new forms of knowledge (Traxler, 2010). Corbeil and Valdes-Corbeil (2007) define mobile learning as, "the intersection of mobile computing and e-learning" (p. 52). Mottiwalla (2007) adds that mobile learning combines individualized learning with ubiquitous learning. The concept of here and now, or location-based learning also requires attention in defining mobile learning. Here and now learning is facilitated through instruction that is context-aware (Martin, Pastore, & Snider, 2012). Context-aware instruction gives students the

opportunity to be in the context of their learning, and to have access to information that is related to what they are seeing and experiencing external to the instruction and in the moment (Greer, 2009). Enrichment of context-aware technologies has enabled students to experience instruction in an environment that integrates learning resources from both the real and digital worlds (Chen & Huang, 2012). For example, Wu, et al. (2012) developed a context-aware mobile learning system that guides students to perform a physical assessment procedure on simulants, which included feedback and access to supplementary materials when students made an error.

To account for the spectrum of complexities in defining mobile learning, Traxler (2010) specifies that mobile learning is (a) learning delivered and supported by handheld, mobile computing devices; (b) comprised of formal and informal components; and (c) authentic and situated in context for the learner. As indicated by Peng, et al., (2009) the inability of researchers to arrive at a common definition for mobile learning indicates that there remains much work to be done, particularly in the investigation of factors influencing the design of mobile learning environments.

History of Mobile Learning. Kukulska-Hulme, Sharpies, Milrad, Arnedillo-Sánchez, and Vavoula (2009) performed a review of innovation in mobile learning and identified many of the key developments in the field. The origins of mobile learning can largely be traced back to the earliest handheld devices of the 1980s. This was followed by research projects on the use of pen tablet and PDA devices for learning in the 1990s. The first major development in recognizable contemporary mobile learning was the MOBILearn project. MOBILearn ran from January 2002 to March 2005 in 24 countries, with the goal of "exploring context-sensitive approaches to informal, problem-based and

workplace learning by using key advances in mobile technologies" (MOBILearn, 2005, para. 1). According to Kukulska-Hulme et al. (2009) the key contribution of MOBILearn was to redirect attention from the capabilities of the devices themselves to the possibilities for learning in any context.

As MOBILearn was getting underway, the first of the MLEARN series of conferences was held in 2002 in Birmingham, U.K. MLEARN is now the most prestigious of many mobile learning conventions. In 2007 the first issue of the International Journal of Mobile Learning and Organisation (sic) was published with the goal of collecting high-quality theoretical development and applied research in mobile learning. The year 2012 alone will see the shipment of 450 million smartphones (Schonfeld, 2010). Couple this with the fact that Apple has sold more than 55 million iPads since its debut in 2010 (Seghers, 2012), and opportunity to capitalize on mobile technology for learning has reached an epic scale.

Mobile Learning Devices. Nielson (2009) identified three categories of handheld mobile devices: feature phones with tiny screens and numeric keypads; smartphones that include an A-Z keypad and a mid-sized screen; and touch phones featuring a device-sized screen and activated by touch. The omission of tablet devices in Nielson's four year-old categorization speaks to the pace at which mobile devices are emerging. While smartphones may be the dominant device in terms of numbers, there are a variety of mobile devices that have the potential to support mobile learning environments. These devices include the Apple iPod, personal digital assistant (PDA), e-book reader (Amazon Kindle, Barnes and Noble Nook), and the tablet computer (Apple's iPad, ASUS Eee Pad, Dell Latitude, and Motorola's XOOM, etc.). These devices all

share two key technical characteristics, portability and broadband connectivity (Wagner, 2005).

Mobile Learning Research. Research in mobile learning is in its infancy (Cavus & Ibrahim, 2009; Peng, et al., 2009; Pollara & Broussard, 2011). In a meta-analysis of mobile learning research, Mathur (2011) noted that, "a preponderance of researchers used the survey research method" (p. 27). Pollara and Broussard (2011) noted that the vast majority of studies focused solely on attitude. Pollara and Broussard (2011) also noted that the majority of mobile learning research appears to be taking place outside of the U.S.

To further support these assertions, in a review of mobile learning research Elias (2011) reported the cost and multimedia content delivery as leading opportunities associated with mobile learning. The identification of cost was based on a 2009 study by Kreutzer in which he found that among young South Africans, mobile phones are quickly becoming the Internet and multimedia platform of choice (Kreutzer, 2009), and in a 2006 study, Ramos et al. found that 81% of Filipinos surveyed would be willing to set aside a portion of their prepaid cell-phone credits for learning. Elias (2011) concludes, "the entry point for this type of learning is potentially much lower than for forms of online learning" (p. 146). The inclusion of multimedia content delivery was based upon the findings of Ford and Leinonen (2009) who studied the use of a mobile audio-wikipedia in Africa that built on "the strong African oral tradition" (p. 210). Clearly, there remains a need for empirical examinations, particularly in the U.S., of the factors influencing student learning in the mobile environment (Pollara & Broussard, 2011; Rushby, 2012; Solvberg & Rismark, 2012).

As noted, much of the mobile learning literature focuses on student perception (Al-Fahad, 2009; Clarke, Keing, Lam, & McNaught, 2008; Garrett & Jackson, 2006; Kim, Mims, & Holmes, 2006; Maag, 2006; Maniar, 2007; Uzunboylu, Cavus, & Ercag, 2009; Wang, Shen, Novak, & Pan, 2009). For example, Al-Fahad (2009) investigated students' attitudes and perceptions toward the effectiveness of mobile learning in distance education. Using a self-report, Likert-type scale, Al-Fahad confirmed that students found mobile learning effective and widely embraced the technology. Students also noted portability and a general positive attitude towards mobile devices and learning. However, no connection was made to student performance.

Similarly, Uzunboylu, Cavus, and Ercag (2009) surveyed both students and instructors and found that a majority of students liked using mobile devices. Instructors and students reported seeing the potential of mobile technologies for learning, and indicated that the use of discussion tools with mobile learning could be useful. Yet again, no assessment of the impact of mobile devices, or mobile learning on performance was made. Researchers Richardson and Lenarcic (2008) examined the use of short message service (SMS) in mobile learning by encouraging two-way text messaging. Text messages were used to provide students notifications of due dates. Survey results indicated satisfaction with the usefulness of the tool.

In studies of perceptions regarding mobile learning, participants report positive attitudes (Al-Fahad, 2009; Clarke, Keing, Lam, & McNaught, 2008; Garrett & Jackson, 2006; Kim, Mims, & Holmes, 2006; Maag, 2006; Maniar, 2007; Uzunboylu, Cavus, & Ercag, 2009; Wang, Shen, Novak, & Pan, 2009). Student perception is an important piece of the mobile learning research puzzle, but investigations should not stop there.

Among researchers who have taken student performance into account, Cavus and Ibrahim (2008, 2009) investigated the use of mobile devices to teach English words to undergraduate students. The researchers created an instructional program called the Mobile Learning Tool (MOLT) from which SMS messages were sent to students at predefined intervals. The text messages included vocabulary and definitions of the English words being studied. The goal of the system was to provide essential vocabulary to the students while utilizing the flexibility of mobile learning outside of the classroom. Findings from pre and posttest scores indicated that use of the MOLT system had a statistically significant positive impact on student success rates (Cavus & Ibrahim, 2009).

McConatha, Praul, and Lynch (2008) studied the implementation of the mobile test preparation application Learning Mobile Author by HotLava. Learning Mobile Author provides students access to practice and review questions formatted for their mobile device. Findings indicated that students in the Learning Mobile Author group experienced statistically significant gains in test scores (McConatha, Prault, & Lynch, 2008).

Tews, Brennan, Begaz, and Treat (2011) examined medical students' case performance when viewing instructional mobile videos prior to encounters with patients. The students were evaluated by their faculty based upon their case performance with the patient. Results indicated a statistically significant improvement in presentations when the videos were viewed (Tews et al., 2011). The authors concluded that using just-in-time educational videos on a handheld device might be useful as a supplemental instructional strategy.

As researchers attest, (Elias, 2011; Farmer, Yue, & Brooks, 2008; Knoernschild, 2010; Kreutzer, 2009; Nihalani & Mayrath, 2010; Traxler, 2009, 2010) mobile learning has the potential to facilitate: (a) learning on demand, (b) multitasking and increased productivity, and (c) the translation of all environments into sites of learning (Ryu & Parsons, 2009). Mobile learning offers the possibility of situated learning (Dede, 2011; Quinn, 2012), and to support authentic tasks in both formal and informal learning (Mann & Reimann, 2007; Shih, Chuang, & Hwang, 2009; Uzunboylu, Cavus, & Ercag, 2009). However, this cannot be accomplished without a more complete understanding of the optimal design for mobile learning environments and of the affective factors influencing mobile learning.

Instructional Design. Reiser and Dick (1996) and Smith and Ragan (1999) identified instructional design as a systematic and reflective process utilized to produce an effective method of combining learning theory and instruction. Gustafson and Branch (2007, p. 11) described instructional design as a "systematic process that is employed to develop education and training programs in a consistent and reliable fashion." Instructional design methods can be applied from the granularity of a single learning object to an entire curriculum. Instructional Design models are commonly presented as a sequence of iterative steps, often requiring a number of cycles, before the product is fully refined (Harvey, 2005).

The foundational component of most instructional design approaches is the ADDIE model – Analysis, Design, Development, Implementation, and Evaluation (Gagné, Wager, Golas, & Keller, 2005; Reiser & Dempsey, 2012). According to Reigeluth and Keller (2009), instructional approaches applying elements of systematic

instructional design or ADDIE fall within one of four categories: (a) problem-based learning, (b) experiential learning, (c) direct instruction, and (d) instructional simulation. These four categories may exist independently or simultaneously within the scope of an instructional event.

A point of emphasis among instructional designers and curriculum developers during the last 15-20 years has been the translation of systematic instructional design to the online environment for distance learning (Morrison, Ross, & Kemp, 2004; Reigeluth & Carr-Chellman, 2009; Schutt, 2003; Snyder, 2002, 2009). As noted by Reiser and Dempsey (2002), ADDIE makes no assumption that a live facilitator is required for learning, and thus, the ADDIE model is an appropriate starting point for the development of online learning. Researchers have extended this rationale into investigations of the use of the foundational instructional design model in numerous environments including virtual worlds (Wang & Hsu, 2009).

Instructional Design for Mobile Learning. The mobile learning environment presents a number of design similarities to the regular online learning environment. For example, universal design principles remain a key consideration to ensure that systems remain useful to people with diverse abilities (Arrigo & Cipri, 2010). Universal design principles have been developed to provide for accommodation of the maximum range of students (Burgstahler, 2007). Elias (2010) identified eight universal design principles useful in online learning:

1. equitable use,
2. flexible use,
3. simple and intuitive,

4. perceptible information,
5. tolerance for error,
6. low physical and technical effort,
7. community of learners and support, and
8. instructional climate.

Elias (2011) states, "The relevance of almost all of these principles for designing inclusive online learning is further increased when designing inclusive mobile learning" (p. 147). Table 1 on the following page contains a summary of Elias' (2011) relevant recommendations. In addition to the consideration of universal design principles, principles of sound multimedia integration must also be followed (Motiwalla, 2007) when designing for the mobile environment. And, the time-tested principles of systematic instructional design still apply, such as Gagné's Nine Events of Instruction (Gikas, 2011).

A number of constraints in the mobile environment are unique to mobile learning. Traxler (2010, p.12) identified six mobile learning categories:

1. technology driven mobile learning,
2. miniature but portable e-learning,
3. connected classroom learning,
4. informal/personalized/situated mobile learning,
5. mobile training/performance support, and
6. remote/rural/development mobile learning.

Table 1

Universal Design Recommendations for Inclusive Mobile Learning

Universal Design Principles	Online Learning Recommendations	Mobile Learning Recommendations
1. Equitable use	• put content online • provide translation	• deliver content in the simplest possible format • use cloud-computing file storage and sharing sites
2. Flexible use	• present content and accept assignments in multiple formats • offer choice and additional information	• package content in small chunks - consider unconventional assignment options • leave it to learners to illustrate and animate courses
3. Simple and intuitive	• simplify interface • offer offline and text-only options	• keep code simple • use open-source software
4. Perceptible information	• add captions, descriptors and transcriptions	
5. Tolerance for error	• allow students to edit posts • issue warnings using sound and text	• scaffold and support situated learning methods
6. Low physical and technical effort	• incorporate assistive technologies - consider issues of physical effort • check browser capabilities	• use available SMS readers and other mobile-specific assistive technologies
7. Community of learners and support	• include study groups and tools	• encourage multiple methods of communication • group learners according to technological access and/or preferences
8. Instructional climate	• make contact and stay involved	• push regular reminders, quizzes and questions to students • pull in learner-generated content

Note: Table contents adapted from Elias (2011).

The first constraint is simply defining a category of mobile learning. As noted by Martin, Pastore, and Snider (2012), it has become important for instructional designers to first find a focus for development based on the mobile learning categorization in which the eventual learners fall.

A second significant challenge facing mobile learning is due in large part to the diversity of devices. Ally (2009) recommended that designers push their development for mobile environments to the edge of current multimedia capabilities in an effort to make the learning experience stimulating. However, as Stead (2010) noted,

> There is no single solution to push richly interactive mobile content onto every possible phone. Rather, there is a spectrum of possible solutions: On one side, going for the richest possible interactivities...and on the other side going for the widest possible phone coverage. (para. 3)

Researchers attempt to control this variability by restricting learners to a specific device for which the study is designed. However, some argue that Bring-your-own-technology (BYOT) efforts are a central motivating factor in exploring and expanding mobile learning opportunities (Quillen 2011). In a study by Bradley, Haynes, Cook, Boyle, & Smith, (2010) students reported a preference to learning on their own mobile devices over those of the institution. Herrington and Herrington (2010) conclude that "using a learner's own device ensures that many of the features of the devices are well known and practiced" (p.136).

In a meta-analysis, Kukulska-Hulme (2007) identified inadequate memory, short battery life, slow data speeds on cellular networks, and small screen size as challenges when implementing mobile learning. Furthermore, small keypads do not provide an

ergonomic means for input (Shih, Chuang, & Hwang, 2009). Wagner and Wilson (2005) suggest that mobile learning should not be considered online learning transferred to mobile devices. For example, Adobe Flash, such as web-based video conferencing tools or other interactive multimedia, is not supported by all mobile computing platforms (Bradley, et al., 2009). Researchers must bear in mind these technological constraints when considering a mobile learning investigation, in addition to how the current curriculum might be adapted for mobile delivery (Knoernschild, 2010; Nihalani & Mayrath, 2010).

Additional challenges were identified in a 2012 case study examining mobile-based instructional development by Martin, Pastore, and Snider. The authors enumerated a number of practical challenges when developing instruction for the mobile device. A key challenge was the necessity to determine the delivery method. The students in the study had to decide between the relative ease of developing an instructional website formatted for mobile devices, or the more complex task of authoring a mobile app. Mobile applications offer feature superiority over mobile-friendly websites, but are device specific which limits their ability to be deployed, particularly in a BYOT environment.

A final concern relates to evaluation in the mobile environment. Vavoula and Sharpies (2009) identified six challenges to evaluation in mobile learning:

1. capturing learning in context,
2. measuring processes and outcomes,
3. respecting privacy,
4. assessing usability of technology,

5. considering the organizational and socio-cultural context, and
6. assessing both informal and formal learning.

Furthermore, Vavoula and Sharpies (2009) suggest that because there is little consistency or predictability in the physical setting in which mobile learning will take place, analyzing mobile learning is challenging.

"Beyond usability issues, mobile devices in themselves bring unique challenges to participating in the socio-cultural practices of mobile learning" (Casey, 2009, p.172). One such issue is the uncertainty of the social norms regarding the acceptable use of mobile technology (Kukulska-Hulme et al., 2009). In the short time since the Kukulska-Hulme et al., (2009) article, social norms regarding the use of mobile devices has likely changed.

According to Solvberg and Rismark (2012), in order to facilitate learning when mobile technology is used, designers require knowledge of how learners function within the mobile environment. Cognitivists such as Caple (1996) determined that intermittent delivery of small pieces of instruction and accompanying intermittent practice resulted in greater retention by students than exposure to large chunks of information and constant practice in a computer-based learning environment. Griffin (2011) took this further by recommending that content be divided into two-minute segments, be conversational in presentation, and provide an elegant experience. As noted by Novak and Canas (2006), contemporary learning paradigms promote the benefits of chucking instructional content and combining it with context aware digital technologies to increase learners' rates of information retention. The chunking of instructional content reflects a movement towards the design of small-scale learning interventions and spaced practice that may

facilitate a more efficient transfer of knowledge from short-term to long-term memory (Franetovic, 2011).

> Here too our notions of knowledge and learning are evolving. It could be argued that the need to organize and navigate through bite-sized pieces of mobile learning content will also impact on these notions of knowledge and learning and perhaps individual learners will create their own ontologies on-the-fly as they navigate through a personalized learning journey (Traxler, 2007, p.42).

de Marcos et al. (2006) state, "In this framework [constrains of mobile learning environment] it is crucial to define an architecture for supporting the whole training process, including the repository where the learning objects are stored in order to be delivered to the mobile devices" (p. 1). These authors propose that the learning object model (Wiley, 2000) provides the flexibility to chunk and store well designed instructional content that can be accessed by devices independent of individual features of the device (de Marcos et al., 2006).

Learning Objects. As a means to support and implement such interventions, instructional content must be chunked in such a way as to be deliverable at a finite level (Rosner, 1971; Shore, 2012; Sweller, 1994). One approach to this gradation of content is the learning object. A common definition for learning objects, also commonly referred to as reusable learning objects is, "a predeveloped digital learning activity that can be integrated into lessons, modules, and courses" (Billings, 2010). It is also common to find a learning object defined as possessing some form of web-based or multimedia component (Kay & Knaack, 2009).

The learning object framework has evolved over time. The concept emerged from the idea of foundational modularity as defined by Stephen Downes (1998) in his Model for the Future of Online Learning. Modularity defined initially by Downes (1998) as, "the idea that an entity we consider to be a single unit is in fact composed of separate and independent parts" (para.1). Downes (1998) used the analogy of a computer to describe this modularity, in that various components can be switched, swapped, or replaced.

As technological capabilities improved, the term learning object was introduced to better define the granularity of a module (Barritt, 2002; Chapman, 2007; Francis & Murphy, 2008). Wiley (2000) proposed that a resource must be digital, support learning, and be reusable in different contexts to be considered a learning object. In 2003, Boyle and Cook (2003) added the term reusable to learning object. And later, Downes (2004) refined his definition to include anything that can be reused or referenced during instruction.

According to Tono and Lee (2011), there are four main requirements for a learning object:

1. Adaptability - the level of potential customization of the learning objects such that it can be used to address individual learning objectives;
2. Affordability - the economic impact, or cost effectiveness of the object;
3. Durability - the capability of the learning object to functionally persist through changes in technology;
4. Interoperability- the capability to deploy a learning object in not only various pedagogical contexts, but also on various platforms or using a different set of tools, including mobile devices.

These four requirements address the criteria necessary to ensure that a learning object is technologically worthwhile while addressing pedagogical concerns.

Further pedagogical considerations include the capability of a learning object to be stand-alone, or able to be used in multiple contexts and multiple delivery formats (Windle, McCormick, Dandrea, & Wharrad, 2011). This capability greatly increases the efficiency of the instructional designer, as content for two courses, and multiple devices may be developed once. However, in order to enhance transferability to multiple contexts, development of effective learning objects also involves serious consideration of human-computer interface issues (Cassarino, 2003). Scalability and linkability are both characteristics that deal with the capability of learning objects to be combined in such a way as to comprise increasingly complex learning materials. Linking is a simple way to scale learning objects (Longmire, 2000; Tono & Lee, 2011; Wiley, 2010). Finally, learning objects must support both formative and summative evaluation in multiple contexts (Harvey, 2005).

Alignment in Instruction. Instructional alignment is the process by which the different instructional elements (appropriate goals, objectives, content, teaching strategies, and assessment) are connected to each other (Martin, 2011). Martin further notes that alignment amongst instructional elements is commonly mistaken with curriculum alignment, which she defines as aligning curriculum with standards.
The concept of instructional alignment dates back to at least Skinner (Carrol, 1963; Cohen, 1987; Skinner, 1953). Even throughout the proliferation of sociocultural (Vygotsky, 1978), social-constructivist (Atherton, 2011), and connectivist (Siemens, 2004) approaches to teaching and learning, instructional alignment has maintained a key

characteristic of instruction (Martin, 2011; Martin & Klein, 2008; Martin, Klein, & Sullivan, 2007; Petersen & Cruz, 2004). Cohen (1987) suggested that well-aligned instruction is two to three times more effective in terms of student achievement than non-aligned instruction. The current study seeks to place emphasis on one element of instructional alignment that has been shown to make the largest contribution to student performance: practice (Kranch, 2011; Martin, 2011; Martin & Klein, 2008).

Practice. Robert M. Gagné published the Conditions of Learning in 1965. In the manuscript, he described nine events of instruction that provide an organizational structure for a lesson. "The nine events facilitate and support specific cognitive processes during learning such as attention, encoding, and retrieval" (Driscoll, 2007, p. 46), and have been used as the model for the design of instruction for years (Gagné et al., 2005).

One of the nine events is practice. Practice is the elicitation of performance from learners prior to assessment (Gagné et al., 2005). Opportunities for practice are typically provided after learners have received the information required to master an objective. It provides the opportunity for learners to reinforce new knowledge by strengthening connections for recall and use (Reiser, 2007). According to Martin and Klein (2008), practice assists the confirmation of correct understanding, and repetition of practice increases the likelihood of retention. The same researchers also found that has a significant positive effect on learning in a computer-based environment (Martin & Klein, 2008; Martin, Klein, & Sullivan, 2007). Furthermore, Martin and Klein (2008) found that practice had the largest positive impact on student performance when compared with three other instructional events: objectives, recall, and transfer in a web-delivered lesson.

Assessment aligned practice. This form of practice is one in which the format, modality, and objectives are the same as the final assessment (Merrill, 2002). Merrill (2002) and Reiser and Dick (1996) have noted that practice is effective when it is aligned with the assessment, skills, knowledge, and dispositions defined by the objectives. Crisp (2012) argues for the integration of practice and assessment that is both aligned and designed to enhance future learning.

Reflective practice. The concept of reflective practice was influenced by thinkers such as John Dewey (1933), David Kolb (1981), and Malcolm Knowles (1984). John Dewey (1933) stated, "We do not learn from experience. We learn from reflecting on experience" (p. 78). Dewey defined reflective thought as an "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and further conclusions to which it tends" (1933, p. 9). This form of practice commonly consists of a learning exercise in which students express their understanding of, response to, or analysis of an event, experience, or concept (Knowles, Tyler, Gilbourne, & Eubank, 2006).

Much of the literature discussing reflective practice is found in the medical field teacher preparation programs, and the training of professionals (Disabato, 2011; Schoonover-Shoffner, 2011). According to Reynolds (2011), the last decade has gathered considerable momentum in management education. Theorists in the area of reflective practice suggest that for it to be effective, it should be social, situated, relational, and experiential (Ram & Trehan, 2010; Reynolds, 2011; Trehan & Pedler 2009). These characteristics align well with Traxler's (2010) three defining characteristics of mobile learning: (a) learning delivered and supported by handheld,

mobile computing devices; (b) comprised of formal and informal components; and (c) authentic and situated in context for the learner. If these characteristics of mobile learning are accurate, perhaps a method of eliciting performance that aligns with the modality of the learning, rather than the form of the assessment may be most appropriate and effective.

Self-regulation. Researchers and practitioners have recognized the challenges associated with the changes in student demands and responsibilities present in online learning. These challenges extend to the mobile environment (Cavus & Ibrahim, 2009). In recent years, a number of studies have emerged identifying the influence of self-regulatory learning strategies in online course success (Whipp & Chiarelli, 2004; Winnips, 2000; Zimmerman, 2008). Yukselturk and Bulut (2007) and Puzziferro (2008) have shown the efficacy of using self-regulatory behaviors as predictors of student success in online courses. The void now exists in finding ways to identify and address deficiencies in the self-regulatory strategies of students in all e-learning modalities, including mobile, so that they may be more successful.

Initially defined by Bandura (1997) as controlling our own behavior, the theory of self-regulation was comprised of three components:

1. Self-observation - how one looks at and tracks oneself;
2. Judgment - how one compares oneself with external or internal standards;
3. Self-response - how one responds in relation to perceived achievement of the external or internal standard.

It is important to note that Bandura (1997), as a behaviorist, generally viewed reinforcement as an effective form of self-response, and punishment as a destructive

response. According to Boeree (2006) regarding self-response, the use self-rewards provides for the development of intrinsic self-regulatory characteristics including: (a) setting standards and goals, (b) self-observation, (c) self-judgment, and (d) self-reflection. Thus, from a theoretical standpoint influencing student self-regulatory characteristics involves teaching learners to give themselves instructions that guide their behavior. Boeree (2006) identified five steps to achieve this goal:

1. cognitive modeling;
2. overt external guidance;
3. overt self-guidance
4. faded, overt self-guidance; and
5. covert self-instruction.

In addition, Bandura (1997) advocated ensuring that learners have an accurate picture of their own behavior, and that standards are set at an appropriate level. These principles represent the theoretical framework of this investigation.

Motivation. Rakes and Dunn described motivation (2010) as, "a process through which individuals instigate and sustain goal-directed activity" (p. 79). According to Yukselturk and Bulut (2007) motivation is one of the most important components of learning in any environment. In the literature, motivation has been characterized by locus as intrinsic and extrinsic (Bandura, 1997; Cho & Jonassen, 2009; Mezea, 2008; Virtanen & Nevgi, 2010). Self-regulation specifically relates to intrinsic motivation. Further, Pintrich (2000) proposed three components to intrinsic motivation: goal, orientation, and task value. Intrinsic motivation increases when learners attribute outcomes to factors

they can control (Bandura, 1997; Pintrich & de Groot, 1990). Interest in mastery of a subject also increases intrinsic motivation (Rakes & Dunn, 2010).

Self-regulation and mobile learning. "Whereas self-efficacy measures are task and domain specific, self-regulated learning refers to the motivational orientations and learning strategies that students employ to attain desired goals" (Puzziferro, 2008, p.74). Self-regulation is an active process by which learners monitor and adjust their motivation and behavior (Cho & Jonassen, 2009; Matuga, 2009; Puzziferro, 2008; Rakes & Dunn, 2010). On the basis of their studies, Zimmerman and Schunk (1989) described self-regulated learning as the systematic process by which learners direct their thoughts, feelings, and actions toward the attainment of their goals. Pintrich and de Groot (1990) further clarify self-regulated learning through the identification of three constructs: (a) metacognitive strategies for planning, monitoring, and regulating cognition, (b) managing and controlling of effort on a task, and (c) cognitive strategies for learning, remembering, and understanding material. A student's ability to identify various self-regulatory strategies has shown to improve learner confidence (Hodges, 2009; Whipp & Chiarelli, 2004).

Researchers have shown that academic motivation can be enhanced through the use of certain instructional strategies, course design, and social interaction with other students and faculty (Artino & Ioannou, 2008; Matuga, 2009). It is reasonable to assume that these principles extend into the mobile environment where very little has been done to identify the implications of self-regulatory factors on the design of instruction or student performance (Chang, Chen, Kao, & Shih, 2010; Tu, Sujo-montes, Yen, Chan, & Blocher, 2012).

Summary

Due to the emergent nature of mobile learning and its requisite technology, the quantity of empirical studies in the mobile environment is small. The theoretical foundations for mobile learning are largely in the formational stages, and a single unifying theory has yet to emerge (Solvberg & Rismark, 2012). Subsequently, researchers are left to apply the theories and standards of e-learning when approaching the mobile realm (Cavus & Ibrahim, 2009). Thus, it is imperative to empirically determine the framework for and optimal characteristics of mobile instruction for learning. This review of the literature demonstrates the need to determine the impact of instructional design considerations and other factors influencing student learning in the mobile learning environment on student performance, particularly in the higher education environment.

CHAPTER THREE: METHODOLOGY

The purpose of this study was to investigate the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance and attitude within the context of mobile instruction. The participants for this study were students enrolled in one of four preservice teacher technology courses at a state university in the southeastern U.S. The study focused on the efficacy of differing practice types to influence participant performance. Participant self-regulatory status was determined using the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991). This chapter describes the methodology that was used to carry out this study, including a description of the participants, setting, instrumentation, treatments, procedures, design, and data analysis.

Design

A quantitative, quasi-experimental, pretest-posttest, with nonequivalent groups design was used for the study. The university where the study took place offers a teacher credentialing program and a number of preservice teacher preparation courses. To avoid the variation in treatments within the class, each of the participating course sections, rather than individuals were randomly assigned to a practice type treatment (assessment aligned, reflective, none). This quasi-experimental design was used to avoid differences in content, attitude or time spent on the program between the students enrolled in the same class. Participants completed the treatment individually and were unaware of other treatment groups.

Each practice type treatment consisted of a practice activity administered at the conclusion of a mobile-enabled online instructional module. Participant performance

was measured by researcher-developed pretest and posttest. The posttest was a computer-based proctored exam administered following completion of the treatment.

A factorial design is the most widely accepted way to study the effect of two or more independent variables (Quinn & Keough, 2001). This study used single manipulated variable, practice type (assessment aligned, reflective, none); and a single subject variable, self-regulatory status (high and low). This configuration is commonly referred to as a Person by Environment (PxE) factorial design (Goodwin, 2005).

Research Questions

The research questions for this study are:

RQ1: What is the effect of practice type (assessment aligned, reflective, none) on participant performance and attitude in the mobile learning environment?

RQ2: What is the effect of self-regulatory status (high and low) on participant performance and attitude in the mobile learning environment?

Hypotheses

Null hypothesis H_{01}: There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Null hypothesis H_{02}: There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Null hypothesis H_{03}: There is no significant difference between groups for self-regulatory status (high or low) determined by a subset of the Motivated Strategies for

Learning Questionnaire (MSLQ) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Null hypothesis H_{04}: There is no significant difference between groups for self-regulatory status (high or low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Participants

Participants for this study were 151 undergraduate students enrolled in one of four preservice teacher preparation courses at a public university in the southeastern United States. The study participants were all teacher education majors. The sample included students seeking both elementary and secondary certification. The study participants reflect the demographics of the College of Education. The median age of the undergraduate college population is 21 years old. The college population is 84% White and 69% female. Eighty-eight percent of study participants reported their age as between 18-24 year old. The sample consisted of 78% female participants. Approximately 90% of the participants were reported as Caucasian.

The preservice teacher courses are required core courses for education majors. The participants represented a researcher determined convenience sample selected for likely similarity to the undergraduate population and access to cooperating instructors. Participation in the treatment activity was required by the cooperating course instructors. All students in one of the course sections completed the MSLQ and were given the

opportunity to include or exclude their results from the study by indicating so electronically at the beginning of the survey.

Setting

Four accredited undergraduate preservice teacher courses at a public university in the southeastern United States were utilized as the source of participants in this study. The courses are required core courses for education majors. Students earn three semester hours of college credit for the course. The official competencies are included in Figures 1 and 2.

Course 1

1. Apply central concepts and identify key events in the foundations of American Education.
2. Identify key characteristics of major eras of educational development and reform.
3. Critically reflect and analyze personal experiences, values, and beliefs to examine the relationship between self, schools, and society, and to clarify one's motives and goals for becoming a teacher.
4. Examine dimensions of diversity, including race, class, gender, ethnicity, sexual orientation, language, religion, and exceptionalities, and their impact on educational equity and access, school experiences, and individual and collective identities in a democratic society.
5. Participate in campus, classroom, public school, and/or community experiences to observe, question, and examine the sociopolitical contexts of schools and education.
6. Use technology in course, including various computer software and social media to foster discussion, conduct research, encourage class preparation, and prepare papers and presentations.

Figure 1. Education Course Competencies

Course 2

1. Describe major aspects of the instructional systems design approach.
2. Describe and demonstrate concepts and skills related to analyzing, designing, developing, and evaluating instructional programs.
3. Apply research, learning and instructional theories in designing and justifying the instructional plan for an instructional program.
4. Conduct instructional analysis, subject-content analysis, learner and environmental analysis, and cognitive task analysis.
5. Write goals, instructional objectives, and use conceptual graphs or conventional outlines to analyze and organize subject-matter knowledge.
6. Construct coherent, student-centered instructional and assessment strategies appropriate for given objectives.
7. Select and integrate proper media including computer technology for the delivery of instructor-led instruction.
8. Demonstrate effective technology integration practices while developing, implementing, and evaluating instructional plans.
9. Apply skills in the operation of microcomputers, computer software applications, telecommunications, and distance learning technologies.

Course 3

1. Apply the instructional design process.
2. Apply learning and instructional theories in lesson planning.
3. Apply state best practices to instruction.
4. Develop goals and objectives to sequence instructional content and activities.
5. Design instructional activities to achieve goals and objectives.
6. Plan and develop assessments to measure goals and objectives.

Course 4

1. Generate daily and unit lesson plans that demonstrate a clear understanding of the principles of effective instructional design.
2. Develop an analysis of the learner context and learner.
3. Classify learning outcomes according to the Gagné taxonomy.
4. State performance objectives in clearly articulated and measurable language.
5. State the external conditions for learning.
6. Demonstrate task analysis.
7. Generate a philosophy of assessment that addresses diagnostic, formative, and summative strategies.
8. Construct a learning assessment plan.
9. Generate assessment instruments or procedures for an objective.

Figure 2. Education Course Competencies Continued

A mobile-enabled online program was the source of instruction for this study. The mobile instructional module was based on instruction developed by Martin (2012) titled *Here and Now Mobile Learning.* The instructional module was developed using Articulate Storyline™, and consisted of instruction related to five pieces of art found on the participating university campus. A screen capture of the instruction is shown in Figure 3. The instructional module consisted of an introductory screen, 20 instructional screens, and a completion acknowledgement (no practice condition) or practice screens (aligned and reflective condition). The content of the module was optimized for delivery to smart phones and tablet computers. Each information screen was accessed by scanning a QR code located adjacent to each piece of art. Information about each piece included biographical information about the artist, historical significance of the piece, and interpretations. Participants were able to navigate within the module non-linearly after scanning the QR codes to access the instructional module for each piece. However, participants were required to access all instructional screens for each painting before access to the practice was allowed.

The study occurred during the spring of 2013. All participants completed the study in a one-week period. The pretest and posttest were delivered online via QuestionPro® and were taken in the regular classroom.

Treatments

Three levels of practice type (assessment aligned, reflective, and none) were administered to participants. In this study, the assessment-aligned treatment consisted of a 10-item, multiple choice practice quiz. This practice type used objective, multiple choice questions that are aligned in content and modality to the posttest. The reflective

treatment consisted of a short reflective writing activity. This practice type used open-ended reflective writing prompts designed to stimulate metacognition and to build connections between instructional content and individual experience. An example of each treatment method is included in Table 2 on the following page.

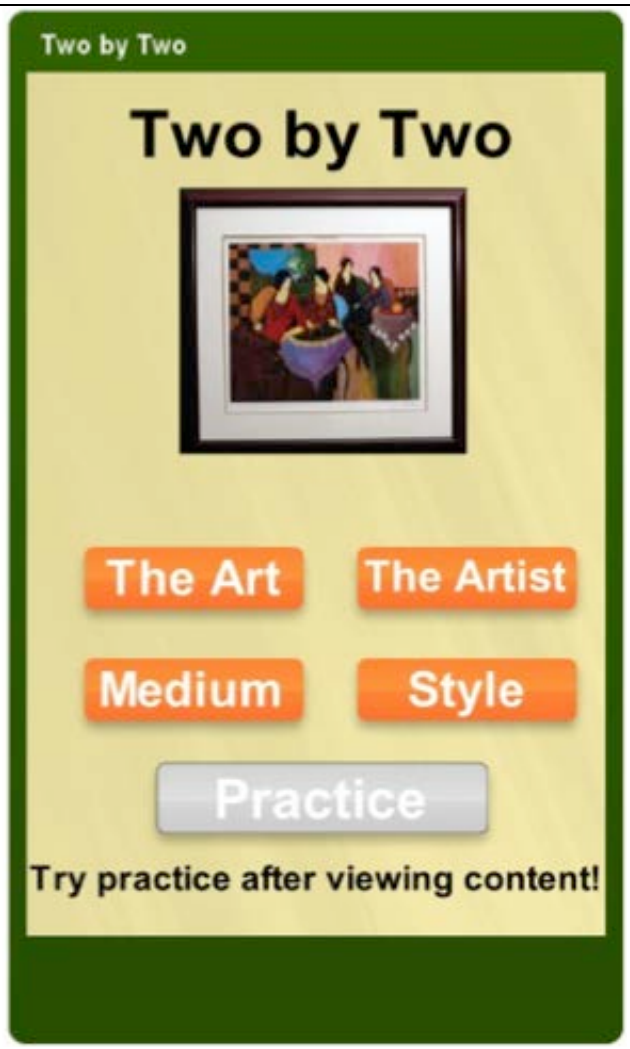

Figure 3. Mobile Instructional Module Screen Capture
Image: Tarkay, I. (Artist). (2000). *Two by two* [seriolithograph]. Retrieved January 29, 2013, from: http://uncw.edu/ed/art/

Table 2

Sample Practice Type Items

Assessment Aligned	Who created King Hall Window? a) Itzchak Tarkay b) Steffan Thomas c) Steffan Thomas d) Virginia Wright-Frierson
Reflective	Discuss your impressions of the painting *Two by Two*. What is a connection to your life that can be made with this piece?

Instrumentation

Self-regulatory Status. Two subscales of the Motivated Strategies for Learning Questionnaire (MSLQ) were used to measure self-regulatory status in this study. The MSLQ is a self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies (Pintrich et al., 1991). The MSLQ is comprised of 81 Likert-type items scored on a seven-point scale (0 – not at all true of me to 6 – very true of me). The items are distributed across two sections: motivation and learning strategies. The motivation section contains six subscales: intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. The learning strategies section contains nine subscales: rehearsal, elaboration, organization, critical thinking, self-regulation, time and study environment, effort regulation, peer learning, and help seeking (Pintrich et al., 1991).

The 15 subscales of the MSLQ can be used together or independently; the scales are designed to be modular and can be used to fit the needs of the researcher or instructor (Pintrich et al., 1991). This study used the self-efficacy for learning and performance and the self-regulation subscales. These two subscales consist of 19 items. A meta-analysis of MSLQ administrations yielded a Cronbach's reliability coefficient of .93 for the complete instrument (Dettori & Persico, 2011). According to the authors, the reliability coefficient of the self-efficacy for learning scale for the first 1000 completers was .93, and was .79 for the self-regulation subscale.

Student Performance. Student performance was measured using researcher-developed pre and posttests. The pretest consisted of 10 four-choice multiple choice questions covering the 5 art pieces. The posttest consisted of 25, four-choice multiple choice questions covering the art. The posttest items were aligned to the instructional module designed by Martin (2012) and modified by the researcher. Posttest items were similar to the assessment aligned example item in Table 2. Both the pre and posttest were administered via computer using QuestionPro® in the regular classroom.

A posttest administered by Martin (2012) to 200 students in the initial study utilizing this instruction yielded a Cronbach's reliability coefficient of .71. The measured reliability coefficient for this administration was .83. Content and face validity of the pre and posttests was established through expert review of the instrument. "A test has content validity built into it by careful selection of which items to include" (Anastasi & Urbina, 1997, p. 126). Furthermore, Foxcroft, Paterson, le Roux and Herbst (2004) note that expert review of the assessment items provides helpful assistance in the establishment of instrument content validity. A high degree of criterion validity, or the extent to which

performance on this instrument is similar to performance on another instrument measuring the same constructs, was also present in the posttest as the overall mean performance for the participants in Martin's (2012) study was 46% and overall mean performance for this administration was 44%.

Attitude. An attitude survey was developed by the researcher based upon the Technology Acceptance Model (Venkatesh & Davis, 1996) to measure participants' perceived usefulness, perceived ease-of-use, and user-acceptance of mobile technologies and mobile-enabled instruction in relation to their perceptions of practice efficacy and feeling of preparedness for the posttest. Venkatesh and Davis (1996) report, "The Cronbach alpha reliability of the TAM scales has generally been found to exceed 0.9 across numerous studies" (p. 21). The survey contained 15, five-choice Likert-type items (4—strongly agree, 0—strongly disagree), three open-ended questions, and five demographic items. The survey was initially designed to include three sections (perceived usefulness, perceived ease-of-use, and attitude toward using) with five items per section.

Content validity was established through selection of items from model TAM assessments and expert review of the instrument. A confirmatory factor analysis was conducted on the instrument following administration. Based on analysis of TAM instruments and the a priori hypothesis that the instrument was three-dimensional, three factors were rotated using a Varimax rotation procedure. The rotated solution yielded three interpretable factors, the loading of which confirmed the instrument design. The factor, attitude toward using, accounted for 31% of the item variance. Perceived ease of

use accounted for 27% of the item variance, and perceived usefulness accounted for 20% of the item variance. The measured Cronbach's Alpha for this administration was .96.

Five additional items were included on the survey to collect demographic information, as well as mobile device ownership and the self-reported proficiency with mobile devices of the participants. The demographic information and participant reported ownership of and proficiency with mobile devices is described in the following chapter.

Procedures

After submitting materials and receiving Institutional Review Board approval at both Liberty University and the participating university, the researcher executed the research. The study began with the random assignment of course sections to treatment groups by the researcher using a computer-generated randomization protocol. After being introduced to the study, participants were presented with information regarding the intention of researchers to collect performance data, provided an explanation of informed consent, and informed that there were no perceived risks to participation in the study. Participants were also informed that they had the option to opt out of participating. Information about the specific treatments was not provided. The data for any students who opted out of the study was not made available to the researcher for analysis. Any participants without access to a smartphone or other web-enabled mobile device were provided an Apple® iPod Touch for the activity by the cooperating university. The participants were not aware of the treatment condition in which they were enrolled.

Following the introductory procedures, participants completed the MSLQ online using classroom computers. The MSLQ was administered during regular course activities. Student responses to the MSLQ were used for self-regulatory status

assignments in analysis. Following submission of the MSLQ, students were released to participate in the mobile learning activity. The five paintings addressed by the mobile instructional module were located in a single hallway of the education building. Students walked through the area, using either a personal mobile device, or the provided Apple® iPod Touch to scan the QR codes associated with each painting and complete the instructional module.

The three practice type treatments (assessment aligned, reflective, and none) were built into the instructional modules assigned to the treatment groups. The treatments were accessed following the completion of the instructional component of the mobile module. Each group received practice activities according to their treatment condition. Upon completion of the final practice activity, participants completed the researcher-designed posttest immediately followed by the attitude instrument. The posttest was a computer-based proctored exam that was taken following completion of the instructional module in the regular classroom.

All data was anonymously reported by QuestionPro® to the researcher. Data from students choosing not to participate was excluded from the report. Participant MSLQ results, treatment assignments, pretest, posttest, and attitude survey results were assigned a randomized unique personal identifier to ensure the researcher had no means of identifying individual participants.

Data Analysis

A two-way analysis of covariance (ANCOVA) was used to analyze the null hypotheses. ANCOVA evaluates whether population means of a dependent variable are equal across levels of a categorical independent variable, while statistically controlling

for the effects of other continuous variables (Gall, Gall, & Borg, 1999). By performing ANCOVA, dependent variable means are adjusted to what they would be if all groups were equivalent on the covariate. Two-way ANCOVA was used because the researcher prioritized neutralization of the effect of preexisting knowledge on the dependent variable participant performance. As noted by Maxwell et al. (2003), an ANCOVA that uses the pretest as a covariate will virtually always be more powerful than an ANOVA that utilizes the same dependent variable but ignores the pretest. Further, the researcher postulated a high degree of correlation between covariate and the dependent variable. ANCOVA is also used, albeit controversially, to adjust for preexisting differences in nonequivalent groups (Maxwell et al., 2003). However, as noted in the following chapter, the groups in this study did not significantly differ on the covariate. Finally, ANCOVA reduces error when there are two assignable sources of variation, and can test for independence of factors (Foley, 2003).

Various conventions exist to determine the number of participants per cell to conduct an ANCOVA. For this study, the minimum number of participants in any cell was 21 as the smallest group size was 42 participants. Limitations to the sample size are discussed in chapter 5. A $p < .05$ level of significance was used for all main effects analyses in the study to determine if the null hypotheses can be rejected. The effect size was calculated using the Eta squared statistic and interpreted based on Cohen's *d* (1988). Preliminary analyses to examine the assumptions of no extreme outliers, normality, linearity, singularity, and multicollinearity revealed that no assumptions were violated. Where a significant main effect was found for practice type, multiple comparisons of

main effects were performed to determine between which groups the differences occurred.

Attitude survey results were analyzed using a multivariate analysis of variances (MANOVA) on the items comprising each of the attitude factors (perceived usefulness, perceived ease-of-use, and user-acceptance). Follow-up analyses were applied where appropriate.

CHAPTER FOUR: RESULTS

The purpose of this quantitative, quasi-experimental, pretest-posttest design with nonequivalent groups study was to investigate the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance and attitude within the context of mobile instruction. The participants for this study were students enrolled in one of four preservice teacher courses at a state university in the southeastern U.S. The study focused on the efficacy of differing practice types to influence participant performance and attitude in an instructional module developed for the mobile environment. Participant self-regulatory status was determined using a subset of the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991). Participant attitude was measured using a questionnaire based on the Technology Acceptance Model (TAM) (Venkatesh & Davis, 1996). The research study examined the following questions and hypotheses.

Research Questions

The research questions for this study are:

RQ1: What is the effect of practice type (assessment aligned, reflective, none) on participant performance and attitude in the mobile learning environment?

RQ2: What is the effect of self-regulatory status (high and low) on participant performance and attitude in the mobile learning environment?

Hypotheses

Null hypothesis H_{01}: There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Null hypothesis H_{02}: There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Null hypothesis H_{03}: There is no significant difference between groups for self-regulatory status (high or low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Null hypothesis H_{04}: There is no significant difference between groups for self-regulatory status (high or low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Demographics

One hundred fifty-one students participated in this study. Of the 151 participants, 19 participants failed to fully complete all study activities or instruments and were removed from the study. This omission resulted in 132 participants included in the data analysis representing an 87% completion rate. The sample consisted of 78% female and 22% male participants with 88% of participants reporting an age of 18-24 years old. Less

than 3% of participants reported an age of 35 years old or greater. Approximately 90% of the participants were reported as Caucasian; 5% reported Hispanic or Latino; the remaining 5% of participants reported race/ethnicity was either Asian or African American. Participants reported a mean level of proficiency in using mobile devices of 3.6 on a five-point Likert scale, (1 – not proficient at all to 5 – very highly proficient). Fifty-five percent of participants rated themselves as highly or very highly proficient. Less than 1% of participants rated themselves as not at all proficient.

Participants were evenly divided (n = 66) into high and low self-regulatory status groups by means of median splits. Due to the constraints of assigning intact classes to practice type treatments and attrition, it was not possible to maintain an equal number of participants in each condition. The no practice treatment group contained 42 participants. The assessment aligned treatment group contained 47 participants, and the reflective treatment group contained 43 participants. Despite the inability to obtain the intended 180 participants, a post hoc analysis of achieved power with the program *G*Power* (Erdfelder, Faul, & Buchner, 1996) revealed that the sample at $\alpha = .05$ was sufficient to achieve a power (1-β) of .99 to detect a large effect ($f = .4$; cf. Cohen, 1988), and (1-β) = .72 to detect a medium-sized effect ($f = .25$; cf. Cohen, 1988). This indicates that the sample size was quite close to the desired (1-β) of .80, $\alpha = .05$.

Instruments

The instruments used in this study to measure the dependent variables were a researcher-developed, multiple choice, pretest/posttest exam and a researcher-developed, Likert-type attitude assessment. The posttest items were aligned to the instructional module designed by Martin (2012) and modified by the researcher. The measured

Cronbach's reliability coefficient for posttest in this study was .83. George and Mallery (2003) suggested the following scale for interpreting Cronbach's reliability coefficient for researcher-developed assessments: " > .9 – Excellent, > .8 – Good, > .7 – Acceptable, > .6 – Questionable, > .5 – Poor, and < .5 – Unacceptable" (p. 231). Thus, coefficient of reliability for the administration of the assessment in this study may be considered good. Content and face validity of the pre and posttests were established through expert review of the instrument. "A test has content validity built into it by careful selection of which items to include" (Anastasi & Urbina, 1997, p. 126). Furthermore, Foxcroft, Paterson, le Roux and Herbst (2004) note that expert review of the assessment items provides helpful assistance in the establishment of instrument content validity. A high degree of criterion validity, or the extent to which performance on this instrument is similar to performance on another instrument measuring the same constructs, was also present in the posttest as the overall mean performance for the participants in Martin's (2012) study was 46% and overall mean performance for this administration was 44%.

The attitude instrument used in the study was based on the Technology Acceptance Model (Venkatesh & Davis, 1996).Venkatesh and Davis (1996) report, "the Cronbach alpha reliability of the TAM scales has generally been found to exceed 0.9 across numerous studies" (p. 21). A confirmatory factor analysis was conducted on the instrument following administration. Based on analysis of TAM instruments and the a priori hypothesis that the instrument was three-dimensional, three factors were rotated using a Varimax rotation procedure. The rotated solution yielded three interpretable factors, the loading of which confirmed the instrument design. The factor attitude toward using accounted for 31% of the item variance. Perceived ease of use accounted for 27%

of the item variance, and perceived usefulness accounted for 20% of the item variance. The measured Cronbach's Alpha for this administration was .96.

Results

Analysis of covariance (ANCOVA) was conducted with a sample (N = 132) of undergraduates majoring in education at a university in the southeastern U.S. to determine whether an effect for varying practice types or self-regulatory status was significant on student performance. The ANCOVA was selected to control for differences in pretest performance of the participants. Two key considerations when interpreting the outcome of ANCOVA: (1) it is assumed that the covariate and treatment effect are independent, and (2) it is assumed that the regression slopes are homogenous (Miller, & Chapman, 2001). In order to satisfy these assumptions, the ANCOVA was run with the covariate as the dependent measure. This analysis showed that the covariate and treatment effect were indeed independent, $F(2,126) = .17$, $p > .05$, partial $\eta^2 < .01$. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variable, $F(1,126) = .68$, $p > .05$, partial $\eta 2 = .01$. Further, analyses of variances (ANOVA) on the pretest revealed no significant differences across the groups. The means and standard deviations for participant performance on the pretest by practice type are presented in Table 3. The ANOVA for practice type was not significant, $F(2,126) = 1.65$, $p > .05$, partial $\eta 2 = .03$. And the ANOVA for self-regulatory status was not significant, $F(1,126) = 1.21$, $p > .05$, partial $\eta 2 = .01$.

Table 3

Pretest Performance by Practice Type

Group	n	M	SD
No Practice	42	2.88 (29%)	1.50
Aligned	47	2.62 (26%)	1.40
Reflective	43	3.01 (30%)	1.56

A multivariate analysis of variance was conducted with the same sample described above (N = 132) to determine whether an effect for varying practice types or self-regulatory status was significant on student attitude. The MANOVA was selected to evaluate the linear combination of attitude subscales. The assumption of homogeneity of covariance matrices was tested due to the use of un-equivalent cell sizes. A Box's M test indicated the assumption was satisfied.

Participant Performance – Null Hypothesis One. An ANCOVA was conducted to evaluate the effects of three practice type conditions (assessment aligned, reflective, none) on participant performance. The adjusted means and standard deviations for participant performance on the posttest by practice type are presented in Table 4. The ANCOVA was significant for practice type, $F(2,125) = 13.99$, $p < .01$, partial $\eta 2 = .18$. Therefore, approximately 18% of the variance between groups can be explained by participation in the practice treatment condition.

Follow-up analyses to the ANCOVA for practice type consisted of pairwise comparisons of main effects to evaluate differences among the adjusted means. The Holm's Sequential Bonferroni procedure was used to control for Type 1 error across the

three pairwise comparisons. Participants in both the aligned (*M* = 12.61) and reflective practice condition (*M* = 11.22) significantly outscored participants in the no practice condition (*M* = 8.70). No significant difference was found between the assessment aligned and reflective practice conditions. Examination of the adjusted mean scores indicated that participants receiving aligned practice performed the best on the posttest. The results of the pairwise comparisons are reported in Table 4.

Table 4

Posttest Performance by Practice Type

Group	n	Adjusted M	SD
No Practice	42	8.70 (35%)[a,b]	3.07
Aligned	47	12.61 (50%)[a]	3.20
Reflective	43	11.22 (45%)[b]	4.10

Note: Superscript indicates mean difference is significant $p < .01$.

The analyses suggest that the null hypothesis may be rejected. There is a statistically significant difference between groups for practice type (assessment aligned, reflective, none) on student performance as measured by a post assessment of content in a mobile learning based instructional module. Participants in both the aligned (M = 12.61) and reflective practice condition (M = 11.22) significantly outscored participants in the no practice condition (M = 8.70). No significant difference was found between the assessment aligned and reflective practice conditions.

Participant Performance – Null Hypothesis Three. An ANCOVA was conducted to evaluate the effects of two levels of self-regulatory status (high and low) conditions on participant performance. The adjusted means and standard deviations for participant performance by self-regulatory status on the posttest are presented in Table 5. The ANCOVA was non-significant for self-regulatory status, $F(1,125) = .03$, $p > .05$, partial $\eta 2 < .01$. Therefore, less than 1% of the variance between groups can be explained by self-regulatory status.

Table 5

Posttest Performance by Self-regulatory Status

Group	n	Adjusted M	SD
Low	66	10.92 (44%)	3.87
High	66	10.91 (44%)	3.77

Examination of the adjusted mean scores indicated that there was no difference between participants reporting low self-regulatory status and participants reporting high self-regulatory status in posttest performance. The analyses indicate a failure to reject the null hypotheses. No statistically significant difference between groups was found for self-regulatory status (high and low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student performance as measured by a post assessment of content in a mobile learning based instructional module.

Participant Attitude – Null Hypothesis Two. A MANOVA was conducted to determine the effects of three practice type conditions (assessment aligned, reflective,

none) on participant attitude. Significant differences were found among the three practice types on the attitude subscales (attitude toward using, perceived ease of use, perceived usefulness), Wilks's $\Lambda = .87$, $F(6,248) = 2.93$, $p < .01$. However, the multivariate partial η^2 based on Wilks's Λ was small, .07. Table 6 contains the means and standard deviations on the attitude subscales for the three groups.

Analyses of variances (ANOVA) on each subscale were conducted as follow-up tests to the MANOVA. To avoid Type I error, each ANOVA was tested at the .025 level. The ANOVA on perceived ease of use was significant, $F(2,126) = 5.22$, $p < .01$, partial $\eta^2 = .08$. The ANOVA on attitude toward using was not significant, $F(2,126) = .69$, $p > .025$, partial $\eta^2 = .01$. The ANOVA on perceived usefulness was also not significant, $F(2,126) = .18$, $p > .01$, partial $\eta^2 < .01$.

Table 6

Attitude by Practice Type

	Perceived Ease of Use		Attitude Toward Using		Perceived Usefulness	
Group	M	SD	M	SD	M	SD
No Practice	3.30[a]	1.08	3.42	1.14	3.27	.970
Aligned	3.98[a]	1.05	3.68	1.27	3.38	1.18
Reflective	3.82	.901	3.43	1.13	3.40	1.11

Note: Superscript indicates mean difference is significant $p < .01$.

Post hoc analyses to the univariate ANOVA for perceived ease of use consisted of Tukey HSD multiple comparisons to find which practice type affected attitude most strongly. The participants in the aligned practice condition produced the most positive

attitude in comparison with either of the other two groups, and reported a significantly more positive attitude than participants in the no practice condition, $p < .05$. No other significant differences were measured.

The analyses suggest that the null hypothesis may be rejected. There is a significant difference between groups for practice type (assessment aligned, reflective, none) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Participant Attitude – Null Hypothesis Four. A MANOVA was conducted to determine the effects of two levels of self-regulatory status (high and low) on participant attitude. The MANOVA was nonsignificant for self-regulatory status, Wilks's $\Lambda = .04$, $F(3,124) = 1.58$, $p > .05$, partial $\eta^2 = .04$. Table 7 contains the means and standard deviations on the attitude subscales for the two groups.

Table 7

Attitude by Self-regulatory Status

	Perceived Ease of Use		Attitude Toward Using		Perceived Usefulness	
Group	M	SD	M	SD	M	SD
High	3.77	1.14	3.45	1.22	3.25	1.13
Low	3.65	.955	3.58	1.47	3.45	1.05

Examination of the adjusted mean scores indicated that there was no difference between participants reporting low self-regulatory status and participants reporting high self-regulatory status in attitude. The analyses indicate a failure to reject the null hypotheses. No statistically significant difference between groups was found for self-

regulatory status (high or low) determined by a subset the Motivated Strategies for Learning Questionnaire (MSLQ) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment.

Summary

This chapter provided a report of the statistical study findings including a detailed report of measures, analyses, and assumption testing utilized in this study. The data were analyzed using PSPP and G*Power to perform the power analysis and parametric tests of the data. The results indicated that both null hypotheses regarding the three levels of practice type (H_{01} and H_{03}) were rejected indicating a significant effect for practice type (assessment aligned, reflective, none) on participant performance and attitude. The results indicated that both null hypotheses regarding the two levels of self-regulatory status (H_{02} and H_{04}) were unable to be rejected indicating a nonsignificant effect for self-regulatory status (high, low) on participant performance and attitude. Further explanation for these findings is discussed in the following chapter.

CHAPTER FIVE: DISCUSSION

This chapter provides a summary of the study findings and interpretation of the results as well as a discussion of the implications, limitations, and recommendations for further research.

Problem Statement

The next generation of computer-based learning environments has arrived. This generation of technology is characterized by such mobile and portable devices as smartphones and tablet computers with wireless broadband access. With these devices comes the promise of extending the online learning revolution, by placing ubiquitous learning in the hands of students. Yet, "If education is to have any place in this niche, we must acknowledge that the research must constantly evolve with the technology" (Pollara & Broussard, 2011, p. 7).

Empirical data are needed to determine the framework for and optimal characteristics of mobile instruction for learning, particularly in the higher education environment. The problem is the impact of instructional design considerations and other factors in mobile learning on student performance has yet to be quantified (Pollara & Broussard, 2011; Rushby, 2012; Solvberg & Rismark, 2012). As stated previously, the vast majority of literature addressing mobile learning has focused on student perception. "These studies do not move us significantly beyond what is already known and widely published in the field" (Rushby, 2012, p. 355). Further, even among studies that considered factors such as motivation (Karim, 2008; Millard, 2007), they were not empirically linked to performance.

Summary

The purpose of this quantitative, quasi-experimental, pretest-posttest with nonequivalent groups design study was to investigate the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance and attitude within the context of mobile instruction. Participant performance data were analyzed using ANCOVA. Participant attitude data were analyzed using MANOVA. Results indicated that the inclusion of practice activities in mobile instruction has a positive effect on student performance. Study participants who received either assessment aligned or reflective practice significantly outperformed participants who did not receive practice. While not significant, participants who received assessment aligned practice performed better on the posttest than participants receiving a reflective practice activity. Further, the results indicated that self-regulatory status does not have a significant effect on performance in mobile instruction.

The study results also indicated that the inclusion of practice activities in mobile instruction have a positive effect on student attitude. Study participants who received assessment aligned practice reported significantly more positive attitudes than participants who did not receive practice. Participants who received assessment aligned practice also reported more positive attitudes than participants receiving a reflective practice activity; the difference was not significant. The results indicated that self-regulatory status does not have a significant effect on student attitude toward mobile instruction.

Null hypothesis H_{01}. There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student performance as measured by a post assessment of content in a mobile learning based instructional module. Results indicated that participants in both of the two practice treatment groups significantly outperformed participants in the no practice group ($p < .01$, partial $\eta 2 = .18$). Thus, the null hypothesis was rejected.

Null hypothesis H_{02}. There is no significant difference between groups for practice type (assessment aligned, reflective, none) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning environment. Results indicated that participants in the aligned practice treatment group reported significantly more positive attitudes than participants in the no practice group ($p < .01$, partial $\eta^2 = .08$). Thus, the null hypothesis was rejected.

Null hypothesis H_{03}. There is no significant difference between groups for self-regulatory status (high and low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student performance as measured by a post assessment of content in a mobile learning based instructional module. Results indicated that participants reporting high self-regulatory status did not significantly differ in performance from participants reporting low self-regulatory status ($p > .05$, partial $\eta 2 < .01$). Thus, the null hypothesis was unable to be rejected.

Null hypothesis H_{04}. There is no significant difference between groups for self-regulatory status (high and low) determined by a subset of the Motivated Strategies for Learning Questionnaire (MSLQ) on student attitude as measured by an attitude questionnaire based on the Technology Acceptance Model (TAM) in the mobile learning

environment. Results indicated that participants reporting high self-regulatory status did not significantly differ in reported attitude from participants reporting low self-regulatory status ($p > .05$, partial $\eta^2 = .04$). Thus, the null hypothesis was unable to be rejected.

Discussion

The statistically significant findings of the study reinforce the importance of the role of practice in sound instructional design. As noted in the framework for this study, Robert M. Gagné published the Conditions of Learning in 1965. One such condition was practice. The findings of this study further confirm the investigations of practice of numerous researchers including: Caverly, Ward and Caverly (2009); Kukulska-Hulme and Shield (2008); Martin and Klein (2008); and Martin, Klein, and Sullivan (2007). The findings are consistent with those of Martin and Klein (2008) who asserted that practice assists the confirmation of correct understanding and repetition of practice increases the likelihood of retention. The same researchers also found that practice has a significant positive effect on learning in a computer-based environment (Martin & Klein, 2008; Martin, Klein, & Sullivan, 2007).

Student Performance. Contemporary researchers and theorists: Elias (2011); Farmer (2008); Knoernschild (2010); Kreutzer (2009); Nihalani and Mayrath (2010); Ryu and Parsons (2009); and Traxler (2010) attest that mobile learning has the potential to facilitate: (a) learning on demand, (b) multitasking and increased productivity, and (c) the translation of all environments into sites of learning. Mobile learning offers the possibility of situated learning (Dede, 2011; Quinn, 2012), and supports authentic tasks in both formal and informal learning (Mann & Reimann, 2007; Shih, Chuang, & Hwang, 2009; Uzunboylu, Cavus, & Ercag, 2009). These assertions rely on the theoretical

constructs that constitute much of the framework of the current study including: (a) Zone of Proximal Development, (b) Situated Learning and, (c) Social Learning Theory. The combination of these constructs serves to paint a picture of mobile learning that is based on ubiquity and socialization. This is reinforced by Herrington and Oliver (1999) who identified a framework of nine key elements of situated learning as applied to the instructional design of a multimedia instruction.

1. Provide authentic contexts that reflect the way the knowledge will be used in real life.
2. Provide authentic activities.
3. Provide access to expert performances and the modeling of processes.
4. Provide multiple roles and perspectives.
5. Support collaborative construction of knowledge.
6. Promote reflection to enable abstractions to be formed.
7. Promote articulation to enable tacit knowledge to be made explicit.
8. Provide coaching and scaffolding by the teacher at critical times.
9. Provide for authentic assessment of learning within the tasks. (p.5)

Further, Social Learning Theory is a theoretical framework that, according to Bandura (2006), accounts for the internal and external factors that determine a person's ability to learn new things. The focus of the theory is on the interactions between the learner's environment and their behavior. At the core of social learning theory is self-efficacy. Bandura (1997) described self-efficacy as one’s convictions about their own abilities to perform at a specific level. Self-efficacy is a key component of self-regulation (Pintrich & de Groot, 1990).

These theories may lead to the deduction that reflection-oriented activities are better suited to the highly contextual and social nature of mobile-based instruction (Quinn, 2012), or that level of self-regulation would play a greater role in predicting success in such an unstructured environment. Yet, there was no significant difference for performance between participants who completed reflective practice and participants who completed assessment aligned practice in this study.

Assessment aligned practice is a form of practice in which the format, modality, and objectives are the same as the final assessment (Merrill, 2002). Merrill (2002) and Reiser and Dick (1996) also noted that practice is effective when it is aligned with the assessment, skills, knowledge, and dispositions defined by the objectives. As operationalized in this study, assessment aligned practice consisted of multiple choice, knowledge-based items. Whereas, Dewey defined reflective thought as an "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and further conclusions to which it tends" (1933, p. 9). This form of practice commonly consists of a learning exercise in which students express their understanding of, response to, or analysis of an event, experience, or concept (Knowles, Tyler, Gilbourne, & Eubank, 2006). Theorists in the area of reflective practice suggest that for it to be effective, it should be social, situated, relational, and experiential (Ram & Trehan, 2010; Reynolds, 2011; Trehan & Pedler, 2009).

The results of the study suggest that not only is the inclusion of practice an important consideration in the design of mobile-based instruction, but so too is the alignment to the outcome dispositions. Surprisingly, a method of eliciting performance

that aligns with the modality of the learning, rather than the form of the assessment ultimately may not be most appropriate and effective.

The inability to detect an effect for self-regulatory status on student performance in the current study was equally surprising. In addition to the characteristics described above which suggest the ill-structured nature of the mobile learning environment would lend itself to predictably greater success by students with higher levels of self-regulatory characteristics, educational researchers have engaged in numerous studies correlating self-regulation and performance (Abts, 2012; Alldred, 2013; Evans & Rosenbaum, 2008; Hannafin & Land, 1997; House, 2000; Pintrich & de Groot, 1997). In a 2013 study of 9th-grade physics students by Fouche, the researcher found that the use of metacognitive and self-regulatory strategies improved achievement for students who possessed requisite mathematics skills. However, none of these studies were based in the mobile learning environment.

Student Attitude. The findings for attitude parallel the findings for achievement. Overall reported attitude was positive across treatment groups (M = 3.53 of 5). The majority of students expressed positivity towards the creativity, freedom, and interactivity of the mobile instructional activity. When asked, "What did you like about the technology?" participants regularly reported comments such as:

- "I liked that it was interactive and it made learning fun;"
- "Easy to use, fun, easy to collaborate with fellow students;"
- "It kept my attention and engaged my brain more in learning the information."

Further, the findings for attitude are consistent with much of the mobile learning literature examining student perception. In studies of perceptions regarding mobile learning, participants generally report positive attitudes (Al-Fahad, 2009; Clarke, Keing, Lam, & McNaught, 2008; Garrett & Jackson, 2006; Kim, Mims, & Holmes, 2006; Maag, 2006; Maniar, 2007; Wang, Shen, Novak, & Pan, 2009). For example, Uzunboylu, Cavus, and Ercag (2009) surveyed both students and instructors and found that a majority of students liked using mobile devices. Instructors and students reported seeing the potential of mobile technologies for learning, and indicated that the use of discussion tools with mobile learning could be useful.

In this study, participants who received some form of practice reported more positive attitudes towards mobile instruction than participants who did not receive any form of practice. Participants who received assessment aligned practice reported significantly more positive attitudes than participants who did not receive practice, as shown in Table 6. Examination of student responses to open-ended survey items suggest that this result may be due to the student's perceived level of success on the posttest. Participants were not made aware of their posttest score, however, the attitude instrument was administered immediately following the posttest.

A pattern emerged in the attitude data that may inform conclusions about both attitude and performance. When asked about how to improve the learning activity, students in the no practice condition reported comments such as:

- "Include a way to go back to the information;"
- "Have fewer paintings to remember;"

- "If there was a way to help remember the information better since all of the terms, names, and information was hard to remember."

Participants in the reflective practice condition reported comments such as:

- "More time to study it before the test;"
- "More time for students to participate;"
- "More time allowed."

This pattern of responses indicates that participants in the no practice condition may have felt unprepared for the posttest, and appear to have suggested that the inclusion of some form of practice or review would have assisted their performance and improved their attitude towards the instruction. Whereas, the emphasis on desiring additional time among participants in the reflective practice condition may reinforce the metacognitive nature of reflective practice, and that additional time for reflection would have assisted their performance and improved their attitude towards the instruction.

The last comment noted above was unexpected because no time constraints were placed on the activity. Participants in the reflective practice condition did spend more time in the instructional activity than participants in the no practice and aligned practice conditions. However, the mean time spent was only 18 seconds greater for reflective condition participants (M = 19:49, SD = 6:30, max = 29:42) than aligned practice participants (M = 19:31, SD = 3:50, max = 24:37). Participants in the no practice condition spent a mean time of 14:20 (SD = 3:45, max = 20:11). It should also be noted that the standard deviation for the reflective condition is considerably larger.

The lack of a significant effect for self-regulatory status on attitude also paralleled the findings for performance. This finding is inconsistent with much of the literature.

For example, studies in the online environment by Hodges (2009) and Whipp and Chiarelli (2004) found that a student's ability to identify various self-regulatory strategies has shown to improve learner confidence. Pintrich and de Groot (1990) described self-regulated learning through the identification of three constructs: (a) metacognitive strategies for planning, monitoring, and regulating cognition, (b) managing and controlling of effort on a task, and (c) cognitive strategies for learning, remembering, and understanding material.

Assumptions

Several research assumptions were made relative to this study. The first such assumption was that student performance in mobile instruction is a measureable phenomenon. A growing body of literature supports the ability to measure performance in the mobile learning environment (Cavus & Ibrahim, 2009; McConatha, Praul, & Lynch, 2008; Tews et al., 2011).

It was assumed that the students enrolled in the undergraduate preservice teacher technology courses selected to participate are representative of the intended population, and that student selection of course section was not due to a systematic confounding variable. The demographic information provided by the participants indicated a reasonable approximation of the college population.

A second assumption was that participant responses to the initial self-regulatory characteristics questionnaire were honest assessments and free from substantial self-presentation bias. Multiple iterations and subsets of the MSLQ have been evaluated to demonstrate the validity and reliability to measure participant self-efficacy (Abts, 2012). The TAM has also been utilized as the basis for numerous valid and reliable

questionnaires measuring attitude in technology-enhanced environments (Venkatesh & Davis, 1996). Scores from the derivatives of these instruments were assumed to be valid measures of self-regulatory status and participant attitude. A factor analysis was performed to verify the dimensionality of the attitude instrument. The measured Cronbach's Alpha for this administration was .96.

A third assumption was that the performance instruments provided valid assessments of the intended characteristics and that the posttest was sufficiently different from the pretest such that a testing effect was avoided. The performance assessment was based upon a previously developed and tested instrument for assessment of content identical to that used in the study and was subject to rigorous expert review. The measured Cronbach's reliability coefficient for this administration was .83.

Finally, it was assumed that students in all treatments received equivalent support and that the conditions for analysis of covariance were met by the sample.

Limitations

Key limitations to the study are: the use of a quasi-experimental design; the limited treatment period; the use of course-level median splits for dichotomization of the self-regulatory status variable, the relative performance of the participants on the posttest, and the sample size.

A quasi-experimental design with a convenience sample was used in this study to avoid differences in content, attitude, or time spent on the program between the students enrolled in the same class. Each of the participating course sections, rather than individuals were randomly assigned to a practice type treatment (assessment aligned, reflective, none). The lack of random assignment at the individual level in this design

leads to additional potential vulnerabilities to internal validity. However, participants completed the treatment individually and were unaware of other treatment groups. Further, selection bias was addressed through the selection of demographically similar course populations at a single institution. External validity was threatened by the limited convenience sample.

The exposure to an approximately one-hour treatment period constrains the time available for measuring student performance. This constraint introduced the possibility of a selection-testing threat, as the pretest may have influenced performance on the posttest. The duration of the treatment period limited the power of the treatment and thus, also limited the implications of the detected effects. However, the duration of the study period assisted to limit threats from history effects as the groups were unlikely to substantially differ in exposure between the pre and posttest. Maturation and mortality were also largely controlled as differential rates between groups were unlikely.

An additional limitation of the study was the dichotomization of the self-regulatory status factor. The authors of the MSLQ specify in the administration in procedures for the instrument that:

> the Motivated Strategies for Learning Questionnaire is designed to be used at the course level…we assume students' responses to the questions might vary as a function of different courses, so we suggest the development of course level norms at the local institution. (Pintrich, Smith, Garcia, & McKeachie, 1991, p. 5)

Following the recommended procedure, dichotomization of the self-regulatory status was performed by means of median splits at the course level. The use of median splits for the purpose of categorizing a continuous factor results in a loss of statistical power reducing

the likelihood of finding effects that are really there (Aiken & West, 1991). This may have contributed to the inability to detect an effect for the self-regulatory factor on performance or attitude.

As shown in Table 5, the overall performance of the participants on the posttest was poor. While it is somewhat disconcerting that the participants did not perform at a higher level, the relationship between the various practice types and performance remains interpretable.

Finally, although power analysis indicated acceptable power was achieved in the study, the usable sample size of 132 participants did limit the ability to detect differences between groups. The sample size was limited due to the challenges of finding instructors willing to permit their students to participate and due to substantial attrition during the study.

Implications

There are a number of promising implications for the design of mobile-based instruction that stem from the study results. The significance found for the inclusion of practice in the design of mobile learning environments implies that the time-honored elements of systematic instructional design remain relevant even in contemporary, ubiquitous learning environments. The study findings suggest that students may benefit from the inclusion of practice activities and that these activities can be delivered to the student via the mobile medium.

The significance found for the inclusion of practice also implies not only that the inclusion of practice is an important consideration in the design of mobile-based instruction, but so too is alignment of practice to the outcome dispositions. As noted

above, a method of eliciting performance that aligns with the modality of the learning, rather than the form of the assessment ultimately may not be most appropriate and effective. The significance of including practice was found for both performance and attitude, implying that the inclusion of practice leads to a sense of readiness and ultimately influences the affective domain.

Further supporting this implication are the open-ended responses of students in the reflective practice condition to the question, "How could the mobile learning activity be improved?" Many participants commented on the lack of reinforcement of facts, with one student stating the activity needed, "more multiple choice questions," and another stating, "use practice questions that are more similar to the test." Based on these findings, the researcher contends that were the intended outcome dispositions in the study reflection oriented, the effect of the practice types may have been different. These findings support the benefit to students of the principles of systematic instructional design in the development of mobile learning, and perhaps other ubiquitous learning environments.

Finally, the inability to detect an effect for self-regulatory status on student performance or attitude implies that the mobile environment may mediate self-regulatory behavior. Although the findings of the current study support such a conclusion, an implication of this nature may be premature due to the design limitations of the study.

The findings and implications of this study may indicate a need for pause in the rush to discard 20th Century models of instructional design in response to 21st Century platforms. The participant response to the inclusion of practice and alignment, or lack

thereof, to outcome dispositions is noteworthy. In the least, the implications of this study suggest the need for further investigation of the design of mobile learning environments.

Recommendations for Future Research

Recommendations for future research stemming from the current study are derived from both the study findings and the technological capabilities of the mobile platform. The implication from the practice type findings that alignment of assessment modality with desired outcome dispositions is a preferable method of eliciting performance to alignment with the learning modality, even in novel environments, is worthy of further consideration. As the study has shown a significant effect for practice type in the mobile learning environment, future studies of this nature could be similar in construction to the current study, but utilize a variety of assessment types. The transition of the assessment itself to the mobile environment would also be a factor of interest that could further inform the design of instruction for mobile learning environments.

A second recommendation would be to redesign a study in the mobile environment to further investigate the implication that the mobile environment mediates self-regulatory behavior. It is recommended that a study utilizing the MSLQ or other instrument to measure self-regulatory status be designed in such a way as to allow for individual assignment to treatments and perhaps the use of regression analysis in order to preserve the continuous nature of the self-regulation factor. A related consideration for future research would be to design and validate a contemporary instrument for measuring self-regulation.

Third, the ubiquitous nature of mobile devices invites the opportunity to examine the factors of practice and self-regulatory status, among many others, in less restrictive

environments. The current study was limited in scope in the sense that the learning application was static in nature. While the opportunity for collaboration was present, it was not necessary. It is recommended that future research push further into pedagogically rich learning applications such as instruction utilizing the location awareness capabilities of mobile devices, content sharing, or the use of collaborative learning activities in the mobile environment.

Conclusions

As mobile instruction proliferates, it becomes increasingly more important to determine the impact the ubiquity afforded by the platform will have on current models of instructional design. As researchers attest (Elias, 2011; Farmer, 2008; Knoernschild, 2010; Kreutzer, 2009; Nihalani & Mayrath, 2010; Traxler, 2010), mobile learning has the potential to facilitate: (a) learning on demand, (b) multitasking and increased productivity, and (c) the translation of all environments into sites of learning (Ryu & Parsons, 2009). Mobile learning offers the possibility of situated learning (Dede, 2011; Quinn, 2012), and to support authentic tasks in both formal and informal learning (Mann & Reimann, 2007; Shih, Chuang, & Hwang, 2009; Uzunboylu, Cavus, & Ercag, 2009). However, this cannot be accomplished without a more complete understanding of the optimal design of instruction for mobile learning environments and of the affective factors influencing mobile learning.

In an effort to begin the process of building the framework for the effective design and implementation of mobile learning, this study investigated the effects of three levels of practice type (assessment aligned, reflective, none), and two levels of self-regulatory status (high and low) on student performance and attitude within the context of mobile

instruction. The findings of the study indicated that the inclusion of practice activities in mobile instruction have a positive effect on student performance and attitude. Study participants who received either assessment aligned or reflective practice significantly outperformed participants who did not receive practice. And study participants who received assessment-aligned practice reported significantly more positive attitudes than participants who did not receive practice. However, self-regulatory status was not found to significantly affect performance or attitude.

The findings for practice implicate the possibility that even in such dynamic and robust environments as mobile, practice activities may be more effective when aligned with the modality of the assessment than with the learning modality. Peng, et al. (2009) noted, the inability of researchers to arrive at even a common definition for mobile learning indicates that there remains much work to be done. The study findings reinforce this notion. By continuing to emphasize the importance of practice as Robert Gagné did in 1965, an effective instructional design model can begin to form for the contemporary, dynamic, and ubiquitous environment of mobile computing devices.

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APPENDIX A – Pretest Items

Your participation in this study is voluntary. You may stop at any time or refuse to answer any question and will not be treated any differently by the researcher(s). Data will be kept secure once it is in the PI's possession; however the PI cannot guarantee security during transmission of data due to key logging and other spyware technology that may exist on any computer.

1. Which artist created "The Gathering"?
    a) Itzchak Tarkay
    b) Jean Jansem
    c) Susan Tereba
    d) Unknown

2. "The Gathering" was created using
    a) Acrylic Paints
    b) Lithographic Prints
    c) Serigraph
    d) Watercolors

3. Classical Style of art places high value on
    a) Distinctive brush strokes
    b) Realistic figures
    c) Reference to real world
    d) Skill & beauty

4. Which artist created "Head of a Woman"?
    a) Jean Jansem
    b) Itzchak Tarkay
    c) Steffan Thomas
    d) Susan Tereba

5. Which best describes Figurative style of art?
    a) Classic art meets modern world
    b) Emphasis on geometric forms
    c) Retains strong reference to real world
    d) Uses form, color and line to create composition

6. “On the Back of Looking In” was created using:
    a) Acrylic Paints
    b) Lithographic Prints
    c) Serigraph
    d) Watercolors

7. Which of the following best describes post impressionism style of art?
    a) Depicts subjects as realistically as possible
    b) Emphasis on geometric forms
    c) Retains strong reference to real world
    d) Uses form, color and line to create composition

8. Neo-Classical Surrealist Art can best be described as
    a) Vivid colors with definitive art strokes
    b) Retains a strong reference to the real world
    c) Classic art meets the modern world
    d) Copies natural forms in exact detail

9. Travel has played an important role in this artists work, allowing the artist to paint on-site. Name the artist.
    a) Susan Teraba
    b) Jean Jansem
    c) Virginia Wright-Frierson
    d) Steffan Thomas

10. In the painting "Two by Two", the artist
    a) Expresses contemporary pain and anxiety in an original technique
    b) Sums up the characteristics of his model subject without relying copying natural forms in exact detail
    c) Depicts subjects as realistically as possible
    d) Blurs the lines between drawings and paintings

APPENDIX B – Posttest Items

Your participation in this study is voluntary. You may stop at any time or refuse to answer any question and will not be treated any differently by the researcher(s). Data will be kept secure once it is in the PI's possession; however the PI cannot guarantee security during transmission of data due to key logging and other spyware technology that may exist on any computer.

1. What is one primary feature of the Classical art style?
    a. form
    b. color
    c. beauty*
    d. line

2. Thomas' *Head of Woman* is an example of what style(s)?
    a. Both classical and abstract *
    b. Classical only
    c. Abstract only
    d. Modern

3. Thomas is known for which art medium?
    a. Oil painting
    b. Lithography*
    c. Watercolor
    d. Wood

4. Which style is the work, *On the Back of Looking In*?
    a. Neo-Classic Surrealistic *
    b. Avant-garde
    c. Impressionism
    d. Classical

5. In her piece, *On the Back of Looking In,* Susan Tereba describes her work as a:
    a. Drawing
    b. Painting
    c. Both drawing and painting*
    d. Sculpting

6. What is Itzchak Tarkay's medium in his work, *Two by Two*?
    a. Screen printing*
    b. Sculpture
    c. Carpentry
    d. Watercolor

7. Which best describes Itschak Tarkey's style in *Two by Two*?
    a. Real-life portraits
    b. Transparency and texture*
    c. Pastels
    d. Abstract forms

8. *The Gathering* by Jansem was created to express what emotion?
    a. Joy
    b. Fear
    c. Terror
    d. Pain*

9. *The Gathering* is an example of which medium?
    a. Glass
    b. Metal
    c. Cloth
    d. Lithographic print*

10. Abstract art may best be described as:
    a. Use of form, color and line to create composition *
    b. Places a high value on skill and beauty
    c. Blurs the lines between drawings and paintings
    d. Copies natural forms in exact detail

11. This artist apprenticed as a stone carver:
    a. Tereba
    b. Jansem
    c. Thomas *
    d. Tarkay

12. Texture was created in Two by Two by using
    a. Large, definite brush strokes
    b. Colors layered on top of one another *
    c. Geometric forms that create depth
    d. Watercolor

13. Which artist is an Austrian born Israeli painter
    a. Tereba
    b. Jansem
    c. Thomas
    d. Tarkay*

14. Post Impressionism emphasizes
    a. Geometric forms*
    b. Subjects depicted realistically
    c. Lithography
    d. bland, subtle colors

15. Which artist was an Armenian born French painter
    a. Tarkay
    b. Thomas
    c. Jansem *
    d. Tereba

16. Jansem expresses contemporary pain and anxiety in his painting by
    a. smooth lines
    b. heavily textured paint lines
    c. small brush strokes
    d. thin layers and sensitive curves*

17. Jansem's art style is
    a. Impressionistic
    b. Figurative *
    c. Abstract
    d. Neo-classical

18. Given its historical significance A Scene of Battle of Ohnin accomplished which of the following
    a. Destroyed earlier though of Japanese art
    b. Opened up a new political and cultural regime in Japan *
    c. Stifled new innovation in Japanese art
    d. Nothing

19. The original A Scene of Battle of Ohnin is kept
    a. at the Osaka Kyoihu University
    b. Japanese National Archives
    c. Shin-nyodo Temple in Kyoto *
    d. Tokyo Museum of Art

20. Transparency is a technique used in Seragraphic medium in which art style
    a. Neo-classical
    b. Post Impressionism
    c. Classical
    d. Abstract

21. What style is *A Scene of Battle of Ohnin*?
    a. Classical
    b. Abstract
    c. Yamato-e (Japanese Traditional)*
    d. Modern

22. The Yamato-e (Japanese Traditional) style is usually found in:
    a. Books
    b. Scrolls*
    c. Stone etchings
    d. Hieroglyphics

23. Classical art places high value on
    a. Distinctive brush strokes
    b. Realistic Forms
    c. References to real world
    d. Skill and beauty *

24. The original masterpiece of A scene of the Battle of Ohnin was painted in:
    a. 1467
    b. 1524 *
    c. 1724
    d. 1802

25. Which artist was well known for their depiction of women?
    a. Thomas *
    b. Tarkay
    c. Perske
    d. Golden

APPENDIX C - Mobile Instructional Module Outline

2nd Floor Art

WATSON SCHOOL OF EDUCATION
University of North Carolina at Wilmington

Head of a Woman

- Artist: Steffan Thomas
  - Thomas was born in 1906 in Furth, Germany. At around the age of fourteen he began an apprenticeship as a stone carver that formed his career and predisposed him to become a figurative sculptor. He immigrated to the United States in the 1930's settling in Atlanta, GA.
- About the Art
  - *Head of a Woman is* an excellent example of the artist's depiction of women for which he is well known. Thomas' depiction of women has been described as allied to the classical tradition dating to ancient Greece without being specifically classical in appearance.
- Art Style
  - Mix of Classical & Abstract
    - Classical – Places high value on skill & beauty
    - Abstract – Uses form, color and line to create composition
- Art Medium
  - Colored Lithographic Print
    - Created by drawing an image into a stone using a grease crayon. Then stone is washed and image can be printed. When adding color, a different drawing stone is used for each color.

Image: Thomas, S. (Artist). (1935). *Head of a woman* [lithograph]. Retrieved January 29, 2013, from: http://uncw.edu/ed/art/

Practice

- Aligned

1. Which artist created "Head of a Woman"?
   a) Jean Jansem
   b) Itzchak Tarkay
   c) Steffan Thomas
   d) Susan Tereba

2. True or False: A colored lithographic print is created by drawing an image on a stone with a grease crayon, washing the stone and printing the image. (T)

Practice

- Reflective

1. Describe how Steffan Thomas' art style of a classical and abstract mix exemplifies the classical tradition of the depiction of women.
2. Reflect on your three most interesting or meaningful impressions of the piece or artist.

On the Back of Looking In

- Artist: Susan Tereba
  - Susan has been making her living as an artist since obtaining her BA degree in 1973.
  - American Artist, jewelry designer, poet and writer
  - Lives in Bali
- About the Art
  - The work blurs the lines between drawings and paintings with the artist describing it as "both". The work was drawn in pencil first with much erasing and changing. It is then penned and transferred to watercolor paper. After the paper is stretched, coloring began which takes anywhere from several hours to several days.
- Art Medium: Painted
  - Watercolor
- Art Style: Neo-Classic Surrealistic Art
  - Classic art meets the modern world

Image: Tereba, S. (Artist). (1980). *On the back of looking in* [watercolor]. Retrieved January 29, 2013, from: http://uncw.edu/ed/art/

Practice

- Aligned

1. An example of Neo-classic Surrealistic Art is:
   a) *Head of a Woman*
   b) *On The Back of Looking In*
   c) *Curlicue #2*
   d) *Steerhead*

2. True or False: Susan Tereba is a poet and a writer as well as an American artist. (T)

Practice

- Reflective

1. How does artist Susan Tereba's technique blur the lines between drawings and paintings?
2. Reflect on your three most interesting or meaningful impressions of the piece or artist.

Two by Two

- Artist: Itzchak Tarkay
  - Born 1935
  - At the age of 9, Tarkay and his family were sent to the Mathausen Concentration Camp where the Allied liberation freed them a year later. In 1949 his family immigrated to Israel, living in a kibbutz for several years.
  - Austrian born, Israeli painter
- About the Art
  - He sums up the characteristics of his model subject without relying on copying natural forms in exact detail. In this medium colors are laid over one another and used to create texture and transparency.
- Art Medium: Serigraph
  - Screen Printing
  - Woven mesh supports an ink blocking stencil
  - Colors laid over one another to create texture
- Art Style: Post Impressionism
  - Vivid colors, distinctive brush strokes, and real-life subject matter, with an emphasize on geometric forms

Image: Tarkay, I. (Artist). (2000). *Two by two* [seriolithograph]. Retrieved January 29, 2013, from: http://uncw.edu/ed/art/

Practice

- Aligned

1. *Two by Two* was painted by :
   a) Jean Jansem
   b) Virginia Wright-Frieson
   c) Martha Perske
   d) Itzchak Tarkay

2. True or False: The art medium of a serigraph makes use of colors laid over one another to create texture. (T)

Practice

- Reflective

1. A Serigraph medium involves a three step technique. Identify the steps in the technique and how they depict the artist's post impressionist art with his description about his art.
2. Describe your impressions of the painting *Two by Two*. What is a connection to your life that can be made with this piece?

The Gathering

- Artist: Jean Jansem
  - Jansem (1920-1990) was born in Seulejze, Turkey. He came to Paris in 1931 .
  - Armenian Born, French Painter
- About the Art:
  - He expresses contemporary pain and anxiety in an original technique, by using thin layers and scribbling sensitive curves. He captures the subject with his perceptive, delicate accumulation of sharp lines.
- Art Medium: Lithographic Prints
  - Created by drawing an image into a stone using a grease crayon. Then stone is washed and image can be printed.
- Art Style: Figurative
  - Retains strong reference to real world

Image: Jansem, J. (Artist). (1968). *The gathering* [lithographic print]. Retrieved January 29, 2013, from: http://uncw.edu/ed/art/

Practice

- Aligned

1. The Figurative art style is indicative of :
   a) handicapped persons
   b) layers of paint color to create texture
   c) retaining a strong reference to the real world
   d) uses color and shape to show emotion

2. True or False: The Figurative Art Style retains a strong reference to the real world. (T)

Practice

- Reflective

1. What expression is Jean Jansem attempting to communicate through his subject and technique?
2. Reflect on your three most interesting or meaningful impressions of the piece or artist.

A Scene of Battle of Ohnin

- Artist: Unknown
- Art Medium: Reproduction
  - Print
- Art Style: Yamato-e (Japanese Traditional)
  - Colorful and usually found in scrolls
- About the Art
  - Piece describes a scene of the Battle Of Ohnin, which occurred in Kyoto in 1467 and lasted for ten years. This battle marked an epoch in Japanese history and opened up a new political and cultural regime.
  - The original masterpiece painted in 1524 is in safekeeping with Shin-nyodo Temple in Kyoto as an Important National Cultural Property.
  - Presented to Dean Barlow at the agreement signing ceremony on July 7, 2006 held at the Center for School Leadership Development in Chapel Hill by Takashi Inagaki, President of Osaka Kyoiku University.

Image: *A scene of battle of ohnin* [print]. (1594). Retrieved January 29, 2013, from: http://uncw.edu/ed/art/

Practice

- Aligned

1. *Scene of Battle of Ohnin* artist is
   a) Perske
   b) Unknown
   c) Tarkay
   d) Jansem

2. True or False: *A Scene of Battle of Ohnin* is a reproduction lithograph (F - Print)

Practice

- Reflective

1. What emotions are stirred by the *Battle of Ohnin* and what historical significance does it have?
2. Describe your impressions of the painting *A Scene of Battle of Ohnin*. What is a connection to your life that can be made with this piece?

APPENDIX D - Liberty University IRB Approval

LIBERTY
UNIVERSITY

The Graduate School at Liberty University

April 12, 2013

Jeremy Tutty
IRB Exemption 1569.041213: Effects of Self-Regulatory Status and Practice Type on Student Performance in the Mobile Learning Environment

Dear Jeremy,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required.

Your study falls under exemption category 46.101 (b)(2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:

> (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
> (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Please note that this exemption only applies to your current research application, and that any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption, or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

[redacted]

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling

(434) 592-4054

LIBERTY
UNIVERSITY

Liberty University | Training Champions for Christ since 1971

APPENDIX E - University of North Carolina, Wilmington IRB Aproval

IRB Human Subjects Protocol Form
Revised October 2011

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RESEARCH SERVICES

University of North Carolina Wilmington
Institutional Review Board
Human Subjects Protocol Form

For IRB Use Only
Protocol #: H13-140
Approval Date: 2/28/13
Expiration Date: N/A

PART A: GENERAL PROJECT INFORMATION

1. **Title of Project** (use same title as grant proposal, if applicable):
   EFFECTS OF SELF-REGULATORY STATUS AND PRACTICE TYPE ON STUDENT PERFORMANCE IN THE MOBILE LEARNING ENVIRONMENT

2. **Proposed Start Date*:** April 2013 **Proposed End Date:** Dec 2013
   **In order for research to begin on the proposed start date, ORSSP must receive the signed hard copy of this form and all supporting documentation at least ten (10) days prior to the start date.*

3. **Principal Investigator:** (If student is primary researcher, PI must be faculty or staff member.)

Name: Florence Martin	**Date of IRB Training:** 09/02/2007
Title: Associate Professor	**Phone:**910-962-7174
Department: Instructional Technology	**Fax:**910-962-3609
Campus Post Box #:5980	**E-mail:**martinf@uncw.edu
Building OR Mailing Address (if off-campus):	

4. **Student Researcher:** (Leave blank unless student is primary researcher.)

Name:	**Phone:**
E-mail:	***Date of IRB Training:**

5. **Alternate Contact:** Enter the name of someone **other than the PI** who can report to the IRB in the event the PI is unavailable. *(If this is student research, write the student researcher name here. If PI is sole researcher, this can be department chair or other responsible individual):* ____

A copy of this page signed by the IRB Chair below serves as formal notice of IRB action.

Approval of this protocol (and if applicable, consent/assent forms or handout/flyers) EXPIRES on the date specified in the upper right corner of this page. ***Please note: If this study will continue beyond the expiration date, it is the responsibility of the PI to file an Annual Renewal Form prior to expiration.*** **Any changes to this study, no matter how small, are subject to approval by the IRB on a Protocol Amendment Form. UNCW policy requires the submission of a Closure Report upon completion of a study.** *****IRB forms are available at*** http://www.uncw.edu/orsp/conduct-human-forms.html.**

IRB Use ONLY:
Type of IRB Review: ☐ Full Review ☐ Expedited # ☒ Exempt
Results: ☒ Approved ☐ Approved Pending Revisions ☐ Deferred ☐ Disapproved

[redacted]
Signature of the IRB Chair or Designate **Date** 2/28/13

☐ **If necessary, revisions/clarification received:** ____
Results: ☐ Approved ☐ Approved Pending Revisions ☐ Disapproved

Signature of the IRB Chair or Designate **Date**

1

6. **Additional Personnel:** List all personnel involved in the design and/or conduct of the research. Attach another sheet if necessary. *Each individual listed below must provide documentation of acceptable human subject protection training. Note instructions in gray box below.*

Name: Jeremy Tutty	☐ **Faculty** ☐ **Staff** ☒ **Student**
E-mail: jtutty@liberty.edu	***Date of IRB Training:** 8/26/2008
Affiliation: ☐ **UNCW** ☒ **Other – Specify:** Liberty University	
Role: ☐ **Co-PI** ☒ **Researcher** ☐ **Research Asst.** ☐ **Other – Specify:**	

Name:	☐ **Faculty** ☐ **Staff** ☐ **Student**
E-mail:	***Date of IRB Training:**
Affiliation: ☐ **UNCW** ☐ **Other – Specify:**	
Role: ☐ **Co-PI** ☐ **Researcher** ☐ **Research Asst.** ☐ **Other – Specify:**	

Name:	☐ **Faculty** ☐ **Staff** ☐ **Student**
E-mail:	***Date of IRB Training:**
Affiliation: ☐ **UNCW** ☐ **Other – Specify:**	
Role: ☐ **Co-PI** ☐ **Researcher** ☐ **Research Asst.** ☐ **Other – Specify:**	

Name:	☐ **Faculty** ☐ **Staff** ☐ **Student**
E-mail:	***Date of IRB Training:**
Affiliation: ☐ **UNCW** ☐ **Other – Specify:**	
Role: ☐ **Co-PI** ☐ **Researcher** ☐ **Research Asst.** ☐ **Other – Specify:**	

Please Note

Personnel Change: A protocol amendment form is required for any change in personnel.

***Date of IRB Training –** if you are unsure of a training date, but believe it is on file in ORSSP, please contact the regulatory compliance officer (ext. 7774 or kellya@uncw.edu).

Training Requirement: As required by UNCW IRB policy, key personnel, student researchers and research assistants who are involved in the design and/or conduct must demonstrate completion of human subject protection training. Documentation of completion must be on file in ORSSP before the protocol will receive IRB review. This includes faculty, staff, students or professionals from other institutions. **A link to the approved online training course and instructions are provided on the IRB website** [http://www.uncw.edu/orssp/conduct-human-training.html]. ***ORSSP retains record all completed training. If documentation of training is already on file, it is not necessary to resubmit it. It is the PI's responsibility to ensure all research team members have been appropriately trained and have documentation of training on file.***

APPENDIX F - Permission to Use the Motivated Strategies for Learning Questionnaire

Permission to use the MSLQ

Marie Bien <mabien@umich.edu> Thu, Nov 29, 2012 at 7:15 PM
To: "Jeremy Tutty(Faculty)" <jeremy.tutty@riosalado.edu>

Dear Jeremy, yes, you have permission to use the MSLQ with the promise that you will cite the authors.... I have attached a scanned copy for your use.
Best wishes, Marie

[Quoted text hidden]

Scanned MSLQ 1.pdf
1364K

Pintrich, P. R., Smith, D. A. F., Garcia, T. & McKeachie W. J. (1991). *A manual for the use of the motivated strategies for learning questionnaire (MSLQ)*. Ann Arbor, MI: University of Michigan, National Center for Research to Improve Postsecondary Teaching and Learning.