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Mobile Technology Use as a Moderator for Understanding the Relationship Between Intrinsic Motivation and Grades

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MOBILE TECHNOLOGY USE AS A MODERATOR FOR UNDERSTANDING THE RELATIONSHIP BETWEEN INTRINSIC MOTIVATION AND GRADES

by

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ABSTRACT

MOBILE TECHNOLOGY USE AS A MODERATOR FOR UNDERSTANDING THE RELATIONSHIP BETWEEN INTRINSIC MOTIVATION AND GRADES

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Under the Supervision of Professor Simone C.O. Conceição

Mobile technology is a tool learners rely on. The purpose of this study was to determine if mobile technology use moderates the relationship between intrinsic motivation and grades. Findings show that students with higher intrinsic motivation will have higher grades regardless of whether or not they use technology frequently for their course and regardless of whether or not they perceive mobile technology as valuable for learning in their course. There were positive correlations between students' intrinsic motivation, and multiple facets of their intrinsic motivation, with their current and expected grades. Furthermore, frequency and value of mobile technology use, individually, were significant predictors of students' current and final expected grades. This study importantly shows that increased frequency of mobile technology use adversely impacted expected grades, that learners who placed higher value of mobile technology in terms of learning for their course see a significant correlation to their expected grades, and that learners who perceived the importance of mobile technology as valuable, and used their devices more frequently, had higher predicted expected grades than those who did not. Implications for practice and recommendations for future research are detailed, in order to support these findings.

Higher education should be adapting to the opportunities and challenges presented by the ubiquity and pervasiveness of mobile technology. Faculty and administrators need to be in tune with ongoing research, and likely need to consider providing clear policies and expectations to

learners. This includes how to best adapt mobile technology use for the classroom, and why that is important to the success of learners and faculty members. Learners clearly need structure and expectations for mobile device use for learning established. Various other factors and suggestions for instructors and administrators to consider when adopting learning approaches and practices for mobile technology into their learning environments are discussed.

DEDICATION

To my wife, and my parents.

Kristen, you mean more to me than you may ever know. My love for you is deep, and your support to me throughout this process has been inspiring me to achieve things I could not have imagined. To all my parents, education is one of the great joys and endeavors of life. Without each of you around me, this journey would not have been possible and I would not be here.

Thank you each for your true love, and support.

To my three children.

I hope one day you look on this proudly and leverage it as a platform for your own motivations. There is no limit to your own learning. Be humble in life. Follow your passions, and continue to go after what interests you. Never be ashamed to pursue your interests, and always remember knowledge is a gift and a privilege. Learn to seek out what you do not know from others; always remember to share what you do know with others.

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Firstly, I would like to thank my advisor, Simone Conceição, for believing in me for this entire journey. She has been my advocate now for over 12 years. I owe her tremendously for her patience, insights, and continued time and dedication to my growth as a scholar. Her expertise is second to none, and the University is lucky to have someone of such a high quality on their faculty. Without your support, I most certainly would not have been able to do this the way I have.

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CHAPTER 1: INTRODUCTION

In 2009, Collins and Halverson stated that education was undergoing what they termed the "knowledge revolution," where learning technologies possess their own imperatives of customization, interaction, and user control. They mentioned that technology would "increasingly become mobile, and continue to emphasize access where people can find information on practically any topic and communicate with others wherever they are" (pp. 4–5). Ransdell (2011) later identified a need to push for evidence concerning ways in which undergraduate students in higher education might differ in their interactions with mobile technology in terms of motivation. Other studies have also focused on motivation, motivational dynamics, and learning experiences using mobile technology (Nonis & Hudson, 2010; Wang, 2013; Huang, Hood, & Yoo, 2014; Vansteenkiste & Deci, 2006; Herman, 2012; Kissinger, 2013). While it has been found that mobile devices facilitate the exploration of new subjects (Adams Becker, Cummins, Davis, Freeman, Hall Giesinger, & Ananthanarayanan, 2017), it remains unclear what motivates learners to integrate mobile technology with their academic pursuits, or how much mobile technology use and motivation connects with classroom success.

Mobile technology has become ubiquitous within the lives of college learners today. According to a 2014 Educause report, approximately 86% of undergraduate-level learners owned a smartphone (Chen, Seilhamer, Bennet, & Bauer, 2015). More recent data has demonstrated a dramatic increase in these numbers. Brooks (2016) likewise stated in an Educause report that from 2015 to 2016, smartphone ownership increased from 92% to 96%, laptop ownership rose from 91% to 93%, and academic usage of smartphones by learners increased by 9% since 2015. Every few months features new technology-based models, designs, frameworks, and philosophies being launched to identify how best to use mobile technology for learning (Chen et

al., 2015; Prensky, 2010; Smith, 2011). This evolving mobile landscape is subsequently creating paradigm shifts that challenge institutions of higher education to accommodate for an increasingly digital and mobile student body.

In the last decade, with the onset of mobile devices (such as iPads, laptops, tablet PCs, PDAs, and smartphones), learning has challenged the notion of space by extending the educational context beyond the traditional classroom. Increased flexibility, new opportunity for interaction, and instantaneous access to information provides for a more dynamic learner experience. In light of this, Metros and Sipher (2013) discussed ways that higher education should be adapting to the opportunities and challenges presented by the ubiquity and pervasiveness of connectivity. They suggest that blending mobile technology with new forms of scholarship, such as online learning, can help to forge new educational pathways for learners. Furthermore, Brooks (2016) found that when compared to the general populous, undergraduates aged 18–24 are exceptional in their adoption of digital world technologies. He also discovered that students view mobile technology as "critical to their learning experiences" (p. 8).

More learners own mobile devices now (96%), and that number has risen quickly in the past five years (Brooks, 2016). In addition, the number of learners who have experienced digital learning environments has also increased. Learners today prefer mobile-friendly, personalized environments, where in-class use of mobile technology increases exponentially with instructor encouragement (Benoit, 2016). Dahlstrom, Brooks, Grajek, and Reeves (2015) identified that learners have become motivated to use mobile technology more actively within the learning environment. Dahlstrom and Bichsel (2014) identified through longitudinal studies that learners "have a complex relationship with technology; they recognize its value, but they still need guidance when it comes to using mobile technology in meaningful and engaging ways for

academics" (p. 5). However, as a tool, mobile technology can be persuasive by making target behavior easier (Fogg, 2003). Knowing how learners' motivations are influenced by the persuasive nature of mobile technology can aid in understanding how learners learn, as well as the ways in which mobile technology may impact their grades. My study sought to determine ways a learner's mobile technology use may influence his or her intrinsic motivation by measuring the relationship that exists between motivation and grades when mobile technology moderates it.

Mobile technology is fully ingrained in learners' lives, and most students are generally inclined to use mobile technology (Kvavik, 2005). It has been found that mobile technology moderately influences students' involvement and motivation in courses, regardless of subject (Dahlstrom & Bichsel, 2014). Previous research has explored trends related to mobile technology usage, device ownership, mobile technology application, and classroom experiences, but has yet to measure mobile technology's influences on learner motivation and grades (Chen et al., 2015). Furthermore, Roberts (2005) explained that undergraduate learners in particular feel "mobile technology is something that adapts to their needs, not something that requires them to change" (p. 32).

Purpose of Study and Research Questions

The purpose of this study was to determine whether mobile technology use moderates the relationship between intrinsic motivation and grades. The research questions below were designed to address how much a learner's intrinsic motivation influences their grades while using or not using mobile technology. Data was collected using a confidential online survey, and it was analyzed via multiple regression analysis.

Research Questions

The following describes the research questions this study addressed:

MAJOR QUESTION: To what extent does learners' use and value of mobile technology moderate the relationship between intrinsic motivation and grades?

SUB-QUESTIONS:

- How much does the learner's perceived value of mobile technology moderate the relationship between intrinsic motivation and grades?
- How does a learner's perception of grades influence the value they place on mobile technology?

Study Significance

A critical awareness concerning mobile technology use, motivation, and learning outcomes within higher education can positively influence the ways that teachers and administration incorporate strategic, pedagogically sound uses of mobile technology into teaching practice, in addition to establishing higher levels of learner engagement. Students currently possess unprecedented levels of skill with mobile technology; they think about and use mobile technology very differently (Kvavik, 2005) than previous learner generations, and mobile technology has changed how they communicate, gather information, allocate time and attention, and potentially how they learn (Chen et al., 2015).

Jeno, Grytnes, and Vandvik (2017) found evidence that mobile applications enhance intrinsic motivation, perceived competence, and achievement when comparing groups of learners who only used textbooks against those who only used a mobile app. Their results also emphasized that better learning outcomes can be achieved when learners act out of self-interest, have the ability to choose what they want to learn about, and are provided autonomy to learn.

The questions my study asked attempted to uncover whether mobile technology represents a significant moderator for the intrinsic motivation and grades a learner receives. For example, my study quantified levels of intrinsic motivation (independent variable), asked questions to define the dependent variable of "grades," and defined the primary moderators "frequency of use" and "perceived value of technology." The results yielded data regarding the interactions between intrinsic motivation and grades, as well as used moderator variables known to be closely tied to mobile technology use (Mehri, 2014; Gan & Balakrishnan, 2016; Jeno, Grytnes, & Vandvik, 2017), in order to further define the relationship between intrinsic motivation and grades. Adversely, my study also sought to demonstrate that mobile technology use may not effectively moderate low motivation levels and grades. The aim of my study was also to illustrate how mobile technology and learners' intrinsic motivation levels across a broad range of subjects and ages relate to each other, and to provide the institution with a direct understanding of mobile technology's influence on learner motivations.

Similarly, studies have demonstrated that mobile technology use continues to increase among students, and that they are aware that mobile technology's use can increase their levels of achievement (Chen et al., 2015; Benoit, 2016; Jeno, Grytnes, & Vandvik, 2017). In 2016, for instance, StatCounter reported that 51.3% of web browsing worldwide took place via mobile devices, overtaking desktop browsing for the first time (Adams Becker et al., 2017). The pervasiveness and convenience of mobile technology enables learners to access materials anywhere, often across multiple devices, and learning how to use or connect mobile technology can influence student achievement (Adams Becker et al., 2017).

Adams Becker et al. (2017) referred to a study conducted in the UK where mobile learning was integrated into select courses across a university. Learners in experimental groups

were provided with iPads during class to access and interact with information in a more hands-on format. The findings "indicated that students found the technology fun and preferred the hands-on experiences to the lecture format; the iPad cohort also earned better grades" as a result (p. 41). In a broad-ranging study of undergraduates and information technology, Brooks and Pomerantz (2017) found that the percentage of learners who preferred courses incorporating mobile technology has increased 5% in the past year, while the number of learners wishing instructors used more student smartphones, laptops, or tablets as learning tools is also increasing.

Additionally, the authors stated not only that having learners use their own mobile devices conveys practical and financial benefits, but also that the percentage of learners who would like to see greater use of technology to obtain information, produce content, and perform their required work is on the rise; learners are more enthusiastic to engage in activities using their own devices and see value in using these devices for more activities. Uncovering the value that learners associate with technological tools can further help contextualize how and why learners might express varying levels of intrinsic motivation while using mobile technology as they are learning. Knowing this can help to change how researchers view mobile technology in the learning environment and enable more critical engagement of learners and their tools.

Theoretical Framework

This study's theoretical framework was based on self-determination theory (SDT). This theory has often been used to frame intrinsic and extrinsic sources of motivation, define motivation's role in decision-making processes or behavioral tendencies, and explore conditions that shape an individual's experience. Self-determination theory posits that different types of motivation underlie our behaviors (Deci & Ryan, 1985). These different types of motivation differ concerning their levels of self-determination. According to this framework, an individual's

self-determination involves a true sense of the freedom of choice. Intrinsically motivated behaviors describe those that are engaged in for their own sake and for the pleasure and satisfaction derived from performing them (Deci, 1971). This study focuses specifically on intrinsic motivation. Intrinsic motivation is primarily associated with positive growth in relation to course-learning outcomes. When learners grow in areas essential to their success in a course, positive outcomes occur, and they are usually followed by identified regulation of behavior and through patterns that emerge the more frequently an individual may engage in a process.

Study Methodology

Research Method

Quantitative research seemed most appropriate for this study because it involves collecting survey data from a large sample size, and it attempts to "establish the overall tendency of responses from individuals and to note how this tendency varies among people" (Creswell, 2012, p. 13). Similar studies by Ryan (1982); Ryan, Mims, and Koestner (1983); Plant and Ryan (1985); Ryan, Connell, and Plant (1990); Ryan, Koestner, and Deci (1991); and Deci, Eghrari, Patrick, and Leone (1994) also utilized quantitative approaches to assess characteristics of intrinsic motivation in ways that mirror this study. Each of these studies modified and employed the same multidimensional measurement survey as this study—the Intrinsic Motivation Inventory (IMI)—to measure participants' experience related to a targeted activity.

Sampling

The target population of this study consisted of undergraduate learners in an urban higher education setting in the United States.

Data Collection

An online survey possessing a total of 53 items was distributed 10 weeks into the 2018 fall semester using Qualtrics Survey Software. Two forms of measurement were used to collect data. The first was the IMI. This multidimensional measurement survey was modified to determine the strength of participants' intrinsic motivational levels as related to the experience in their course. The IMI comprises a self-report instrument specifically developed to assess intrinsic motivation. This scale was designed to assess several underlying situational dimensions of intrinsic motivation. A number of studies have revealed a high level of internal consistency for the subscales (Duda, Chi, Newton, Walling, & Catley, 1995; McAuley, Duncan, & Tammen, 1989; Seifriz, Duda, & Chi, 1992), and additionally, the scale's validity has been supported by results in line with existing theories (Duda et al., 1995; McAuley & Tammen, 1989). This survey's subscales specifically assess participants' perceived interest or enjoyment, perceived competence, perceived effort, perceived value or usefulness, perceived level of pressure and tension, and perceived choice while performing a given activity or using a tool.

The second form of measurement involved a set of 18 items concerning demographics, grades, and technology use. The first nine questions collected demographic data and were asked in the beginning of the survey. The information collected through the first nine questions was used to identify variables outside of motivation that might play a role in influencing a learner. The remaining nine questions were used to define the dependent variable of "grades," as well as the primary moderators of the mobile technology construct variable, namely, "frequency of use" and "perceived value of technology."

Data Analysis

Multiple regression analyses were employed to effectively describe the relationships

between the variables (Gravetter & Wallnau, 2009). As MacKinnon, Krull, and Lockwood (2000) stated, relations might be modified, informed, influenced, or changed by the addition of a third variable, such as a moderator.

Assumptions

As both a learner and someone who works professionally to design and develop academic programs, I made several assumptions concerning the ways that learners are motivated and the types of attitudes they possess regarding mobile technology use. Education is highly influenced by new technologies, and learners are equally influenced when it comes to adopting mobile technology for communication, learning, socializing, and engaging with information (Corrin, Bennett, & Lockyer, 2010; Delialioglu & Alioon, 2014; Guhr & Gair, 2012; Ito et al., 2010; Jones & Healing, 2010; Lohnes & Kinzer, 2007; Prensky, 2008; Rosen, 2010; Smith, 2011; Thomas, 2011). I believe that learners are engaging with mobile technology more throughout their lives, and that they are also motivated to integrate mobile technology in assisting with their learning. In my study, all participants were assumed to possess access to an Internet-connected mobile technology device of some sort, whether it is actively used or not.

Limitations of the Study

This study was heavily dependent on self-reports, and participants may not have answered honestly or may not have possessed good insights into their own preferences or reasons for using mobile technology, and thus may not have answered in line with what might be expected. In addition, although university-assigned email addresses were used to distribute invitations and a summary of the study, the survey instrument's delivery was entirely over the Internet. It was thus entirely possible that students who were comfortable with or interested in mobile technology would have been more likely to respond than those who were not. In that

light, with self-reporting, nonresponse bias still remained, because responding to the survey was completely voluntary, and those who chose not to respond may be systematically different from those who did respond.

In addition, even if anonymity was assured, it remains possible that respondents were less straightforward regarding their perceived motivations and attitudes toward mobile technology. For example, students may have been at different levels of their academic experience, which means that their responses may vary based on the type of exposures they had experience through previously completed specialized coursework in their chosen majors. Additionally, the survey data was obtained near the end of the semester, which may not account for varying motivation levels at the beginning or middle of a semester. However, one of the strengths of self-reporting measures within this study was that questions were designed to reveal feelings relative to experiences in real classroom environments and across a large number of variables. Assuming that the minimum number of responses eclipses the power considered efficient enough for multiple regression, the sample should be able to generate clear and generalizable conclusions regarding the larger student population and allow future research to build upon the results.

Another limitation was that although classrooms were identified, reviewed, and documented prior to releasing the survey tool, this study employed convenience sampling to recruit participants across the schools and programs within the university. Research questions usually concern entire populations, of which a sample is intended to be representative (Gravetter & Wallnau, 2009). The sample's representativeness of the population from which it is selected can directly influence the inferences and generalizations that can be made concerning the entire population (Gravetter & Wallnau, 2009).

Definition of Terms

For consistency and clarification purposes, the definitions of terms are provided below:

Mobile technology: For the purposes of this study, I adopted the definition put forward by Hashim, Osman, and El-Gelany (2016). They defined mobile technology as devices that learners use in classroom settings to access information, aid in understanding concepts, or support the completion of required work for classroom sessions, including the iPod, e-book reader, laptop PC or Mac, desktop PC or Mac, tablet, and smartphone.

Intrinsic motivation: This study focused directly on learners' intrinsic motivation. Intrinsically motivated behaviors are driven by spontaneity, exploration, and mastery of concepts, and are essential to development. This is why they are regulated by energy, enjoyment, satisfaction, and vigor (Ryan & Deci, 2000) and result in an individual's impulse to impose his or her organizational cognitive structure. When learners are intrinsically motivated, they continually seek to find or create what Deci and Ryan (1980) described as "optimally challenging situations" (p. 42).

Full-time undergraduate student: In the survey portion of this study, a full-time undergraduate student was defined as a learner enrolled in 12 or more credits during a semester.

Part-time undergraduate student: In the survey portion of this study, a part-time undergraduate student was defined as a learner enrolled in less than 12, but at least two, credits during a semester.

Learning outcomes: Learning outcomes come up frequently in studies cited throughout this thesis. Those studies have focused primarily on intrinsic motivation and defined learning outcomes as essential areas that learners need to focus on in order to be able to demonstrate what they know and are able to perform because of their learning in the course. Learning outcomes

were assessed in terms of the overall understanding they achieve in a course. For the purpose of this research, this was defined by the grades the learner received.

Learning: The following definition of "learning," put forth by Ambrose, Bridges, DiPietro, Lovett, and Norman (2010), was adopted for this study. These authors defined learning as "a process that leads to change, which occurs as a result of experience and increases the potential of improved performance and future learning" (p. 3).

Urban: For the purpose of this study, I have adopted the definition for "urban" put forward by the National Geographic Society. The society defined an urban area as an area surrounding a city. However, since my study focuses on an urban-serving university, I also leverage the definition developed by the Coalition of Urban Serving Universities, which identifies an urban-serving university as more than just a university located in an urban area. To be urban-serving means being an institution "whose physical presence is integral to the social, cultural, and economic wellbeing of the community" in which the university is located.

Characteristics of traditional age student: The 2017 National Center for Educational Statistics (NCES) Higher Education General Information Survey (HEGIS) defined the "traditional aged undergraduate student" (p. 9) as being aged "18–24 years old." The study also characterized learners as "registered at an institution of postsecondary education who are working in a baccalaureate degree program or other formal program below the baccalaureate, such as an associate's degree, vocational, or technical program" (p. 854). Learners in my study were aged 18–24 and were also individuals who likely work while in school, may attend the university only on a part-time basis, may have delayed enrollment or have dependents, or are recognized as financially independent. These also represent learners who may take longer to complete their degrees than those in previous years, but are most likely to live within the greater

metropolitan area in order to access the campus and its resources.

Chapter Summary

Chapter one introduced the research problem investigated in this study. It also defined several terms utilized throughout the study and incorporated data and current research regarding mobile technology use, access to mobile technology, and definitions of motivation types. In addition, this chapter presented the problem statement, purpose of my study, research question and methodology, study significance, definitions of terms, assumptions, and limitations of my study.

The following chapter presents a review of the relevant literature pertaining to motivation and mobile technology, and the connections between them. I also discuss gaps in the literature and provide a further description of this study's theoretical framework.

CHAPTER 2: LITERATURE REVIEW

This chapter addresses relevant literature pertaining to motivational factors that affect students' use of mobile technology while learning. Specifically, literature on intrinsic motivation was explored by identifying and explaining the various types of triggers for intrinsic motivations during learning. Literature on mobile technology then connected the types of triggers and predictors for intrinsic motivation to reasons why learners employ technology when learning. This served as the foundation for utilizing SDT as this study's framework. The literature related to SDT established the framework's importance for exploring how and why learners are motivated to utilize mobile technology while learning in higher education settings.

Scope of the Review and Inclusion Criteria

The purpose of this literature review was to understand research on intrinsic motivation and mobile technology. Initial searches on topics related to motivation, mobile technology, and SDT produced a large number of studies, so more specific keywords and a narrowed focus were required. Once the search was narrowed, mobile technology and motivation became consistent themes. Research on the themes of motivation and technology was extensive and covered a wide range of topics, from the various types of motivation to specific use of technology. The studies themselves primarily focused on each theme being studied independent of the other. For example, empirical studies were conducted on motivation type, but not necessarily on connections between motivation types and technology. Using online databases such as Academic Search Complete, PsychINFO, ERIC, Education Research Complete, and Google Scholar, the following keywords were employed in an initial search in order to examine empirical, conceptual, and theoretical studies pertaining to higher education, mobile technology use, and intrinsic motivation: "higher education," "undergraduate student," "4-year public urban

institution," "how students use mobile technology," "learner motivation," "technology and motivation," "intrinsic motivation," "learning and motivation," "technology and learning," and "self-determination theory."

With the exception of approximately 30 foundational resources, the search was restricted to years 2005 through 2019 to ensure the most relevant literature was used to support this study. Literature types included peer-reviewed publications, dissertations, and conference paper proceedings. The sources were multidisciplinary in scope, often coming from various theoretical paradigms within higher education, such as motivation, self-determination, psychology, or technology acceptance. The reference sections of the resources were also used to locate more resources and to deepen the understanding of and exposure to research in these areas. Some of the articles identified through this process fell outside of the time frame used to narrow the search, but were still included, as they were considered important to the items being researched.

Many of the articles provide support by deepening information or context regarding the targeted themes. Several can be categorized together; for example, the concept of self-regulation is closely tied to the framework of self-determination, and useful information and data was provided by Karoly (2003); Sansone and Smith (2000); and Zeidner, Boekaerts, and Pintrich (2000). Additionally, topics such as motivating learners (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991); individual interest and intrinsic motivation (Reninnger, 2000; Schiefele, 1991; Schiefele, 2001); interpersonal relations and causation (deCharms, 1968; Heider, 1958); knowledge, interest, and learning (Alexander, Murphy, Woods, Duhon, & Parker, 1997); and, in particular, much of the foundational research on intrinsic motivation (Deci & Ryan, 1980; Ryan, 1995; Ryan & Deci, 2000, 2000a, 2000b, 2002; Hidi, 2000) helped to establish the relationships between themes as they emerged.

After applying additional selection criterion, the listing of articles narrowed from over 800 down to 140. In order to be included, the resource needed to address motivation, mobile technology use, or SDT within the context of higher education. As an example, articles that referenced workplace or professional settings as incubators for data collection, those that focused too narrowly on the experience of the teacher versus that of the learner, or those that were unable to discuss technology in relation to motivation and the classroom setting were excluded from my study.

Theoretical Framework

Self-determination theory has previously been used to frame sources of motivation (both intrinsic and extrinsic), define motivation's role in decision-making processes, and explore conditions that shape the individual experience (Deci, et al., 1991; Deci & Ryan, 1985; Deci & Ryan, 2000; Deci, Koestner, & Ryan, 2001; Ryan & Deci, 2000; Vansteenkiste & Deci, 2006; Nikou & Economides, 2017; Jeno, Grytnes, & Vandvik, 2017).

Self-determination theory's use as a functional framework possesses both expansive and behavior-specific significance for understanding practices and structures that enhance rather than diminish motivation. Self-determination theory provides an approach to human motivation and personality that highlights the importance of humans' evolved inner resources for personality development and behavioral self-regulation. Individuals are continually modifying their understandings to integrate new learned experiences or information that challenges their current perspective of the world. Humans possess a natural curiosity and willingness to seek out challenging learning experiences, and this persists due to the satisfaction that comes from more extensive cognitive organization (Deci & Ryan, 1990). It is important to note that learners are influenced by the tools they use, and many use and rely on mobile technology to access

information.

However, mobile technology's role in influencing learners' motivation can be viewed in two different ways: (1) as an extrinsic force and the ultimate degree of assimilation of an externally imposed regulation (Ryan, 1995), where someone does not necessarily receive pleasure from performing the behavior, but is still happy to do so, as it conforms with their own value system; or (2) as an intrinsic force, where behavior originates from the self and is not controlled by an external force, and a learner feels the behavior is out of their own volition, and not out of coercion (Deci & Ryan, 1990). Additionally, learners' expectations for success, and the value they place in particular on the tools and resources connected to their success, represent important determinations for their motivation type (Wigfield, 1994). Essentially, this implies that mobile technology may actually moderate motivation in achievement-oriented individuals, or those who, more specifically, are intrinsically motivated. Learning environments possess several ways of addressing motivation directly, which is why SDT was chosen as the framework for my study.

Self-Determination Theory (SDT) Studies

Ryan, Kuhl, and Deci (1997) described SDT as an approach to human motivation and personality that highlights behavioral self-regulation. A continuum occurs between behaviors that are self-regulated and those regulated by forces outside the individual (Ryan, 1995; Ryan & Deci, 2000a, 2000b, 2002). According to Ryan and Deci (2000), research guided by SDT has generally focused on the social-contextual conditions that facilitate rather than forestall the natural processes of self-motivation. People are moved to act (or learn, in this case) by very different types of factors, all of which dictate internal processes and behavioral manifestations. Ryan and Deci (2000b) stated that being motivated means being moved to do something. Further

empirical evidence has demonstrated that people can be motivated because they value an activity or possess a choice regarding how to participate within it (Granito & Chernobilsky, 2012).

This is important, as it addresses predictors and behavioral measures of intrinsic motivation, which connect to behavior's regulation. The need for autonomy, a strong regulator of behavior and highly connected to intrinsic motivation, was defined by Ryan and Deci (2006) as "regulation by the self" (p. 1557). The study conducted by Granito and Chernobilsky exhibited how autonomy and freedom of choice led to motivation to use technology in meaningful ways that can be particularly personal to a learner. The results provide an effective example of ways that SDT fits well with technology use and motivation, and why only classrooms that do not dictate mobile usage are preferred for this study. The issue of whether people support a behavior out of their own personal interests or lived values, or whether they behave for reasons external to themselves, is significant to almost all people. This conflict represents the most basic level by which learners make sense of their own and others' behavior (deCharms, 1968; Heider, 1958; Ryan & Connell, 1989), as well as whether they are motivated to internalize and adopt those patterns for themselves. Self-determination theory focuses squarely on identifying what type of motivation is exhibited at any given time, how it is developed and sustained or undermined, and the associated consequences these motivation types convey on learning, performance, experiences, and even well-being (Ryan & Deci, 2000).

Learners' expectations for success, and the value they place on tools or resources connected to their success, represent important determinations for their motivation type, interest level, and curiosity for learning in educational settings (Wigfield, 1994). An experimental study by Jeno et al. (2017) provides a useful example of how tools influence motivation. Their research measured mobile applications' effect on students' intrinsic motivation, perceived competence,

and achievement. When compared to peers who used physical texts, those who utilized mobile applications demonstrated higher intrinsic motivation, perceived competence, and achievement. The research also found that use of mobile applications predicted intrinsic motivation, which then also predicted higher achievement scores. Students identified that the mobile technology application allowed for more choice, provided higher autonomy to learn, and generated higher levels of interest for them. The authors' research showcased that when learners associate mobile technology as a natural part of their interest and curiosity to learn, their motivations and behaviors can be directly influenced by the mobile technology.

Motivation

Learners in higher education are generally interested in what is around them and how it affects them, and they are largely self-motivated (Ryan & Deci, 2000; Schiefele, 1991; Schiefele, 2001). They strive to extend what they know to new levels of insight and apply what they know to influence and change people and processes around them. As Ryan and Deci (2000) described,

> Motivation concerns energy, direction, persistence and equifinality—all aspects of activation and intention. Motivation is at the core of biological, cognitive, and social regulation. Perhaps more important, in the real world, motivation is highly valued because of its consequences: Motivation produces. (p. 69)

Learners are "motivated to persist at authentic problems, meld prior knowledge and experience with new learning, and develop rich domain specific knowledge and thinking strategies to apply to real-world problems" (Blumenfeld et al., 1991, p. 376). Knowing how to tap learners' motivations is vital to helping them find interest and passion for what they are

learning. Additionally, having a process in place that uncovers learner motivation can help to explain students' choice of tools or strategies for specific activities (Schiefele, 1991). However, knowing how to uncover learner motivation is crucial for understanding "motivational orientation, which in turn codetermines level of comprehension, use of (deep-level) learning strategies, and the quality of emotional experience" (Schiefele, 1991, p. 316).

Dembo and Seli (2012) conducted studies measuring both learning and motivation. Through their data, they identified that internal factors (such as students' beliefs and perceptions) represent key factors for understanding behavior. The findings revealed that students' goals, beliefs, feelings, and perceptions determine their motivated behavior. Hurst (2016) further explained that motivation is not something learners carry with them at all times, however, and it is in constant need of conditions by which they need to be challenged and be able to connect to their own success. Hurst also identified free-choice conditions (choice, effort, persistence, value) that indicate what learners are motivated by while performing a particular activity. By focusing on learners within same-subject learning environments, Hurst was able to eliminate enough variables to focus more directly on how the level of achievement is affected by choice, effort, and persistence. Hurst's findings demonstrated that the higher the indices, the higher the motivation, and the more likely task achievement will occur. The studies by Dembo and Seli and Hurst thus revealed that motivation exerts several direct influences on effort, persistence, cognitive process, and performance of an individual.

Hurst (2016) used cases of learners within classrooms at the primary and secondary setting to explore internal and external factors that impact motivation, and to demonstrate how motivation increases the initiation and persistence within a given activity. Research by Vansteenkiste and Deci (2006), meanwhile, focused specifically on internal factors and goal

orientation. They employed a series of experimental studies to explore why college-aged learners perform at higher levels with activities that directly serve the attainment of an intrinsic rather than extrinsic goal. Their findings revealed that these types of activities promoted deeper processing of the learning material and a greater conceptual understanding of it, and that both short-term and long-term persistence within the activities was higher. The results further demonstrated strong correlations between goal orientation and motivation level, where intrinsic goal framing induces a different quality of motivation (i.e., it promotes task orientation).

Importantly, because these findings were obtained across diverse age groups, diverse intrinsic and extrinsic goal contents, and diverse types of learning activities, this suggests that factors affecting motivation level are not necessarily only attributable to single groups, content, or activities. They were also found to apply to individuals, whether or not the individuals were intrinsically oriented in terms of their personal goals. Another recent study by Cetin (2015) explored learning approaches and academic motivation together as predictors of academic success. Similar to the aim of my study, he employed questionnaires to collect information and ran multiple regression to test for any significant correlations between learner motivations and higher GPA. The study revealed a significant correlation between the learner's GPA, their level of motivation, and the learning approach used in the course. Higher learner motivations, when combined with intrinsic approaches to learning, resulted in higher grades. Intrinsic approaches were defined as the "deep approach, which emphasizes understanding learning processes" (p. 172). This was demonstrated to produce greater conceptual understandings in learners, and correlated to higher levels of motivation.

The findings by Hurst (2016), Vansteenkiste and Deci (2006), and Cetin (2015) are important because they clarify how each motivation type is regulated differently, and that they

can generally be categorized into non-self-determined or self-determined categories. Table 2.1 below was developed by Ryan and Deci (2002) to illustrate the connections between motivation type, level of self-regulation, and type of exhibited behavior. The table demonstrates that as learners display characteristics of self-determined behavior, they also tend to intrinsically regulate their learning and become mostly intrinsically motivated by what they are doing. Conversely, as learners become less self-determined, they also tend to be regulated by elements external to their own belief systems and become less motivated in general to be involved. In order to understand each motivation type more thoroughly, Ryan and Deci focused on processes, subject matter, or personal interests, but did not explore the ways in which tools influence these same items. An example of a tool, and of importance to my study, would be mobile technology. Research concerning mobile technology's influence on motivation and learning seems scarce. The purpose of my study is to determine the strength of the relationship between intrinsic motivation and grades when mobile technology usage moderates the two variables.

Table 2.1

Continuum of motivational, regulation, and behavior types

Type of Motivation	Amotivation	Extrinsic				Intrinsic
Type of Regulation		External	Introjected	Identified	Integrated	Intrinsic
Quality of Behavior	Non-self-determined				Self-determined	
(modified from Ryan & Deci, 2002)						

Intrinsic Motivation

According to Ryan and Deci (2000), perhaps no single phenomenon reflects the potential of human nature as well as intrinsic motivation. Intrinsic motivation is defined by the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn. Intrinsic motivation represents human nature in a very real and authentic way: Intrinsic behaviors take place for no other reason than to detail a learner's organizational cognitive structures through assimilating challenging experiences (Ryan & Deci, 2000a, 2000b). These behaviors are internally regulated by nature of their motivations, as presented in Table 2.1. As learners integrate information at a deeper level, they become more autonomous and able to self-regulate their own behavior. Intrinsically motivated behaviors are driven by spontaneity, exploration, and mastery of concepts. These are essential to our development, which is why they are regulated by energy, enjoyment, satisfaction, and vigor (Ryan & Deci, 2000) and result in an individual's impulse to impose his or her organizational cognitive structure. When learners are intrinsically motivated, they seek to find or create what Deci and Ryan (1980) described as "optimally challenging situations" (p. 42). Intrinsic motivation represents a basic tenet of SDT and describes a behavior performed out of volition and self-direction. Research has found that intrinsic motivation is positively related to learning outcomes, whereas extrinsic motivation is generally not (Fortier, Vallerand, & Guay, 1995; Koestner, Ryan, Bernieri, & Holt, 1984; Ryan & Deci, 2009). Intrinsic motivation's influence on learning has been thoroughly analyzed through the SDT lens. Knowing the ways that intrinsic motivation is triggered could prove especially useful in analyzing the motivation factors that impact grades, as my study intends.

Triggers of Intrinsic Motivation While Learning

Zhao, Lu, Wang, and Huang (2011) investigated the ways in which autonomy,

relatedness, and competence affect learners' intrinsic motivation to use the Internet. They discovered that both enjoyment and curiosity lead to a high level of absorption in an activity. However, curiosity rather than enjoyment positively relates to online exploratory behavior, and level of absorption in a process also predicts exploratory behaviors. Fagan et al. (2008), meanwhile, conducted research on intention, exploration, and ease of use. Their results identified a positive relationship between intrinsic motivation and perceived ease of use in a study involving close to 200 college-aged participants. Feelings and emotional states tie closely to motivational level and involvement in processes, which directly correlate to intrinsic motivation.

Brown and Venkatesh (2005) studied the pleasure derived from using mobile technology by investigating the connections between motivation and enjoyment. Their work revealed that pleasure plays an important role in determining technology acceptance and use. Venkatesh, Thong, and Xu (2012) further defined ways that the pleasure one derives from using mobile technology can be employed as a predictor of consumers' behavioral intention to use mobile technology. They demonstrated that this can even be tied to fixed variables, such as cost of technology or the technological tool's ease of use. Empirical evidence from the research by Venkatesh et al., meanwhile, and specifically information gathered directly from populations using mobile Internet technology, identified associations between what was termed as "price value" (learners' cognitive tradeoff between the perceived benefits of the applications of mobile technology and the monetary cost for using them) and "habit" (learners' behavioral intention and use of mobile technology) (Venkatesh et al., 2012, p. 161).

By focusing on these associations, the researchers were able to use a targeted technology and measure the extent to which people display certain behaviors. They connected prior learning with the targeted technology in school settings and determined whether learners were motivated

by other technologies or the perceived benefits of technologies available to them. By doing so, they were able to determine whether learners still chose not to use them due to cost. This relationship was identified as both directly affecting consistent technology use when learning and indirectly affecting technology use through behavioral intention, which was shaped by price value associations. Venkatesh et al. indicated that technology use is driven by pleasure, but that learners' pleasure in using that technology is shaped through habitual use of that technology and the value they associate with it through what they pay to access and use it for learning.

In the learning context, a learner who is intrinsically motivated and engaged in an academic task indicates that the student's participation in the task is an end in itself (Leal, Miranda, & Carmo, 2013). By contrast, for students who are more extrinsic in their motivation, engaging in a learning task represents the means to an end. An extrinsically motivated student would focus more closely on value associations with grades or teacher approval, and is most likely to try and identify only what is necessary to understand in order to earn a grade and not to find enjoyment in asking content-enhancing questions (Sansone & Smith, 2000). Some students are directly motivated to acquire a high grade, whereas other students may be driven more by the fear of failure.

In addition to studies involving pleasure as a motivational trigger for learning, individual interest has also been described as the energizing force behind intrinsic motivation (Alexander et al., 1997). Psychologically, connecting with their own interests and enjoyment can help learners to naturally explore how to obtain higher levels of knowledge, gain more critical understandings of processes, or identify ease of use and applicability of information in practical ways until it becomes clearer why they value it. Research by Fogg (2003) identified elements such as curiosity, sense of exploration, or pursuit for greater ease of use as functional triggers of intrinsic

motivations.

Katz, Assor, Kanat-Maymon, and Bereby-Meyer (2006) conducted a study that tested the hypothesis that interest in a certain topic enables learners to sustain their intrinsic motivation in topic-related tasks. They found that individuals possessing a high level of interest reported more intrinsic motivation than those learners who did not possess a high level of interest. These findings support the view that interest may push the depth of a learner's curiosity, which can serve as a mechanism for coping with varying learning conditions. Renninger (2000) employed the exact reverse of Katz et al.'s (2006) research focus and looked more directly at the significance that an individual's interest and curiosity possesses for understanding intrinsic motivation. Through a mixed-methods study of learners across subjects and environments, Renninger's study found that "individual interest at any given point in time describes an individual's consolidated knowledge of and value for particular subject content" (p. 378), and furthermore that interest can be used "to describe corresponding choice and activity" (p. 379). She was able to establish this connection through conversations with college-aged individuals who self-identified that they "started focusing more on addressing questions they posed to themselves over the course of their study" out of pure curiosity, rather than those that they originally intended to address at the start of their research.

It was these conversations that allowed her to understand the ways that the learners valued consolidating and deepening their knowledge over their desire to simply know content itself. More importantly, Renninger stated that "the role of others and objects in helping to support or shape particular contents of interest is an important, perhaps obvious, and yet subtly complex phenomenon" (p. 379). Although studies have demonstrated that interest alone can push learners to further seek out information (Renninger & Hidi, 2002; Ryan & Deci, 2000; Schiefele,

2001), Renninger illustrated through her research that the objects (e.g., mobile technology) that the learners use can also be "just as critical and meaningful in establishing interest in content learners chose to connect with" (p. 379), and furthermore that "individual curiosity continues to develop because they [learners] seize opportunities" (p. 390) by using the objects that are at their disposal. Also, in the context of the study, Renninger broadly defined an "object" a learner could use as a "text" or "tool" (p. 390).

In today's learning environment, based on the findings from these empirical studies, it is becoming increasingly important to continue investigating mobile technology as an additional object or tool possessing a unique ability to shape interest and curiosity levels in learners. A similar study by Lin, Chen, and Liu (2017) discussed mobile technology's impact on learning motivation. Their investigation used correlation analysis and analysis of variance to study mobile technology's effects on learning motivation and learning outcomes. The results revealed that students positively associate mobile technology with enhanced learning performance, and that mobile technology's inclusion demonstrates "significant differences in intrinsic orientation" (p. 3560). These studies have thus suggested that mobile technology does possess the ability to impact intrinsic motivation. As Renninger (2000) in particular suggested, individual motivation "can appear spontaneously, such as when a person discovers that mobile technology parallels his or her well-developed individual interest" in any topic (p. 392). Mobile technology has furthermore been demonstrated to trigger motivation in the same ways that spontaneity, exploration, mastery of concepts, or ease of use have been (Fogg, 2003).

Extrinsic Motivation

As presented in Table 2.1, behavior arising from extrinsic motivation is regulated in four different ways, depending on whether the regulating force originated as an external or internal

force. The level of extrinsic motivation closest to what has been described as intrinsic motivation is what is termed as integrated regulation. This occurs when an individual has accepted externally imposed values and goals and has integrated them into his or her personally endorsed set of values and goals (Ryan & Deci, 2000a). When an individual's behavior is regulated in this way, that individual does not necessarily extract pleasure from performing the behavior, but as Ryan (1995) identified, is still happy to perform the behavior because it ties closely to the value systems that individuals carry. For example, although conserving water use during drought is probably not enjoyable in its own right, many people who do so feel a sense of comfort in this because it fits well within their values.

Identified regulation, or the next level of motivation further away from intrinsic behavior in Table 2.1, determines behavior arising from another form of extrinsic motivation, in which an externally imposed behavior is accepted as personally important, though it is not wholly integrated into the person's value and belief systems (Darner, 2009). Again using the water conservation example, one would choose to do so not because they value the idea of water conservation, but rather because they know it is good to do so and are motivated by the notion of positive action.

Introjected regulation comes after identified regulation in Table 2.1, and this determines behaviors of a third type of extrinsic motivation, in which an externally endorsed value is partially assimilated, and thus not truly accepted as the individual's own; for the first time, level of self-esteem is accounted for in the performed behaviors, often to avoid guilt or shame or to attain an ego boost (Deci & Ryan, 1990; Ryan & Deci, 2000a, 2000b, 2002). In other words, introjected regulation is linked to the individual's self-esteem, and an individual performs actions to avoid diminishing self-esteem in some way (Darner, 2009). Therefore, conserving water

would motivate a person by knowing that not conserving would cause negative impacts on the environment or others.

External regulation represents the fourth type of behavioral regulation in Table 2.1 within extrinsic motivation. Consistently, this type of behavior expresses itself in ways in which an individual is motivated purely by external factors, such as the threat of punishment or the possibility of a reward (Deci & Ryan, 1990; Ryan; Ryan & Deci, 2000a, 2000b, 2002). As Darner (2009) explained, this is usually associated with grading, or ways in which learners know they are held accountable for their work and adjust their motivational level in accordance to meet the level of comfort they most desire. Typically, when learners are required to learn specific content in order to receive positive grades or avoid negative ones, they are more likely to perceive learning only as something to help them avoid failure, rather than investing time in learning for the sake of enjoyment or personal interest. Relative to the water conservation example, one would choose to conserve simply to avoid being fined by local government.

One way to view these extrinsic examples relative to higher education is by focusing more directly on grades' influence on learners. Cognitive dissonance theory interprets how extrinsic rewards, such as grades, decrease levels of intrinsic motivation. Deci (1971) coined the term "overjustification" to explain how externally mediated rewards influence intrinsic motivation through cognitive dissonance. Deci explained that by provided a student a positive grade for learning (something they might enjoy naturally), then the fact that they enjoy it can lead them to view their approach as an overjustification, which then results in cognitive tension. Consequently, the student works to relieve such tension by placing less value on intrinsic enjoyment and placing more value on newly learned processes that are now necessary to obtain a high grade. Though grades in this example are demonstrated to suppress the intrinsic motivation to learn, mobile

technology's influence on motivation might open a new perspective regarding how grades are used to measure learning.

Mobile Technology Use in Higher Education

The onset of mobile technology use within higher education has created an opportunity to identify ways in which motivation and mobile technology correlate. A relevant comparative study by Wu, Wu, Chen, Kao, Lin, and Huang (2012) accordingly identified that many studies on mobile technology have focused on mobile learning's effectiveness, and that these studies have evaluated mobile phones' impact on learning outcomes and attitudes. The results demonstrated that the majority (86%) of such studies have reported positive learning outcomes, particularly as it associates with mobile technology's use to support cognitive understanding of materials. A recent meta-analysis by Schmid, Bernard, Borokhovski, Tamim, Abrami, and Surkes (2014) also investigated the effect of learning with mobile technology among higher education students. Their findings similarly suggested that mobile technology's application is highly effective in assisting student learning and supporting higher learning outcomes, and additionally that "most mobile learning studies feature positive outcomes" (p. 823). Johnson, Adams-Becker, Estrada, and Freeman (2015), meanwhile, provided a clear categorization of education technology for higher education in the 2015 NMC Horizon Report, which my study uses to define and categorize mobile technologies.

They identified several distinct categories of technologies, tools, and strategies that are "intended to provide a way to illustrate and organize emerging technologies into pathways of development that are or may be relevant to learning and creative inquiry" (p. 34). The seven categories consist of consumer technologies (mobile apps, tablet computing), digital strategies (bring your own device [BYOD], gamification), enabling technologies (cellular networks,

mobile broadband), Internet technologies (the Internet of things, single sign-on, cloud computing), learning technologies (mobile learning, online learning, open content), social media technologies (social networks, collaborative environments), and visualization technologies (augmented reality, 3-D printing).

When I referred to the definition of mobile technology in my study, the focus was on technology such as iPads, laptops, tablet PCs, PDAs, and smartphones that learners utilize in classroom settings to access information, aid in understanding concepts, or support the completion of work required for classroom sessions. Per the categories that Johnson, Adams Becker, Estrada, and Freeman (2015) defined, my focus falls more specifically around consumer technologies, digital strategies, enabling technologies, Internet technologies, and learning technologies that a learner would employ in a classroom. Though these technologies were originally created for recreational and not educational purposes, they have now woven their way into the institutional framework of higher education and remain vital to expanding learners' information reach, creating less obtrusive environments or classroom settings, and establishing pathways to more personalized learning.

Smartphones are now in the hands of 86% of learners ages 18–24, and cellphones in general are now used by 98% of this same age group. Approximately 50% of these learners also own a tablet, and 78% own computers (PEW Research Survey, 2015). Mobile technology provides learners with the opportunity for real-time, anytime access to information, and it further enables them to take their education and information with them wherever they go. However, it also creates connections to feelings, motivations, and perceptions that make up an individual's sense of self.

Prensky (2010) stated that in order to meet the needs of today's learners, institutions are

adjusting not only the way they build curriculum and offer courses, but also how they identify learners' motivations for accessing information. Students can now perform high-quality work on their tablets or smartphones, as the onset of personal technological devices in the classroom has grown rapidly over the last few years. Williams, Lee, Link, and Ernst (2014) posited that learners today can benefit more than ever before from a more diverse, integrated, affordable, and accessible array of mobile technology, and that technology in particular is establishing patterns within the ways that learners pursue information.

Three longitudinal studies have identified a need for more understanding concerning themes of mobile technology (such as level of enjoyment, perceived importance, and reasons for mobile device use) and motivation, as well as the ways in which mobile technology has transformed learners' motivation within the higher education setting (Callaway, 2012; Gannon-Cook, 2009; McHaney, 2011). A greater understanding of motivational forces concerning learner engagement, motivation, and mobile technology use is necessary to expand on already existing studies. According to Ryan and Deci (2000), human beings can be proactive and engaged or, alternatively, passive and alienated, largely as a function of the social conditions in which they develop and function.

Mobile Technology as a Trigger for Intrinsic Motivation

Mobile technology is both pervasive and persuasive in its ability to push and pull learners as they become naturally curious about learning. As Verbeek (2006) explained, "Technologies help to shape how reality can be present for human beings, by moderating human perception and interpretation; technologies help to shape how humans are present in reality, by moderating human action and practices" (p. 3). Verbeek's research focused on mobile technology's persuasiveness and the ways that learners have applied mobile technology as more than "mere

instruments for realizing human goals" (p. 3). However, this research also investigated tools to go beyond personal goal achievement to help make learners "more aware of what they are actually learning" (p. 11).

Verbeek (2006) established that technology also presents itself broadly as a mechanism by which learners can use autonomously, relate to what they learn, build levels of competence more quickly, and find purpose with knowledge by understanding how to apply it in practical ways. Mobile technology is highly accessible, making it a factor for learning. Technology induces action in each learner by the nature of its availability, and it further allows learners to fit the tool into their own personality. According to well-known behavioral theorists, such as Skinner (1989) or Rogers (1980), personality results from the interaction between the individual and the environment. Technology is very much a part of today's environment, and so plays an increasingly large role in how learners and their peers behave and define themselves.

Technologies can be considered extrinsic elements when regarded as standalone objects or something provided as a reward for particular behaviors. However, studies in post-secondary settings have usually defined technology as either the tools by which learners combine software-interface and higher education structures, or more simply as the physical technology (such as a tablet, PC, or smartphone) individuals can use to access information (Bolliger, Supanakorn, & Boggs, 2010; Bolliger & Inan, 2013; Dunmore, 2013; Huang, Johnson, & Han, 2013). My study aims to determine ways a learner's mobile technology use may influence their intrinsic motivation to learn by focusing on motivational influencers.

Research has demonstrated that some known triggers of intrinsic motivation (interest, exploration, curiosity) and their connection to learning are well documented (Ainley, Hidi, & Berndorff, 2002; Arnone, Small, Chauncey, & McKenna, 2011). Interest has been found to

influence attention (Hidi et al., 2004), goals (Sansone & Smith, 2000) and levels of learning (Renninger et al., 2002). According to Sansone and Smith (2000), the proximal motivator for persistence and subsequent engagement, particularly for long-term activities, is the degree to which one experiences interest and enjoyment in a particular task.

High levels of interest are necessary to engage in and maintain a strong intrinsic motivation for learning (Hidi, 2000). Educators have long known that motivation is what causes students to put in the effort required to learn well (Prensky, 2010), and it is well documented that using technology improves students' academic performance (d'Inverno, Davis, &White, 2003; Poirier & Feldman, 2007; Rehman, Afzal, & Kamran, 2013). Research has also suggested that the most effective way to motivate a student to learn is not only focusing on something they are passionate about, but also understanding why they are passionate about it and what tools they use to maintain motivation and performance. Empirical studies by Gan and Balakrishnan (2016) and Nikou and Economides (2017) accordingly measured factors affecting mobile technology adoption and behavioral intention behind learners' use of mobile technology.

These studies reported positive attitudes regarding the use of mobile devices for anything from assessments to interactive lectures. The importance of intrinsic factors such as satisfaction or the value the learner associated with the mobile application played a large roll in predicting how engaged and involved a student would be in the learning process. They also expressed the need to further explore the factors that drive mobile-based learning. Understanding the connections between learners' motivations to learn, what tools or processes influence particular motivational behaviors, and how mobile technology is a part of that process (Wang, 2013; Ransdell, 2011; Prensky, 2010; McHaney, 2011) should help to broaden the understanding concerning how learners learn in various settings.

Azevedo (2005) supported the notion of technology as a tool that can be used as a bridge for interests, motivations, and higher-level thinking. His research focused on environments that utilize technology and technological tools to help learners achieve learning outcomes for courses. Azevedo identified technology as a metacognitive tool that assists cognitive processes, cognitive load, and enables higher-level thinking skills. In addition, he described technology as a tool that allows learners to engage in activity that would otherwise be outside of their ability and enables easier ideation while problem solving. Most importantly, Azevedo argued that technology possesses characteristics that "model, prompt, and support learners' self-regulatory processes, which may include … motivational (e.g., self-efficacy, task value, interest, effort), or behavioral (e.g., engaging in help-seeking behavior, modifying learning conditions; handling task difficulty and demands) processes" (p. 194). This supports the idea that learners might be more motivated to utilize available mobile technology for learning purposes, and that having mobile technology available may more positively affect a learner's level of interest in learning.

More explicit examples of learner motivation can be found in studies on environments that take advantage of technology, such as gaming and computer-based learning. Papastergiou (2009) conducted such a study to assess the learning effectiveness and motivational appeal of a computer game for learning computer memory concepts, as compared to a similar application, encompassing identical learning objectives and content, but lacking the gaming aspect. The sample consisted of 88 learners at the secondary level who were randomly assigned to two groups, one of which utilized the gaming application, and the other one the non-gaming. Data analyses demonstrated that the gaming approach was both more effective in promoting students' knowledge of computer memory concepts and more motivational than the non-gaming approach. Furthermore, the results also suggested that educational computer games can be exploited as

learning tools that push both motivation and level of interest in the focused topics. Papastergiou's work validates two ideas central to my study: that mobile technology can trigger motivational responses, and that mobile technology can employ motivational influencers such as interest and enjoyment to influence a learner's ability to learn concepts or ideas at greater depth.

A handful of studies have addressed disruptive technology without discussing the relationship to intrinsic motivation or triggers typically associated with intrinsic motivation (Corrin, Bennett, & Lockyer, 2010; Ito et al., 2010; Jones & Healing, 2010; Lohnes & Kinzer, 2007; Smith, 2011; Thomas, 2011). What is clear is that extensive research has been conducted on how software applications in online learning spaces, such as podcasting, discussion forums, web 2.0 integration, or e-books (Bolliger, Supanakorn, & Boggs, 2010; Bye, Smith, & Rallis, 2009; Huang, Hood, & Yoo, 2014; Kissinger, 2013), impact connectedness, satisfaction, or self-determination (Bolliger & Inan, 2013; Callaway, 2012; Vansteenkiste & Deci, 2006). My study seeks to expand this to include mobile technology devices such as iPads, laptops, tablet PCs, PDAs, and smartphones that learners bring with them and use in classroom settings to access information, aid in understanding concepts, support the completion of work required for classroom sessions, and improve learning outcomes.

Mobile Technology and Learning Outcomes

The research on mobile technology's impact on learning outcomes has recently begun to broaden to include aspects of learning design and learner interaction. More studies are now addressing mobile tools' effects on collaborative processes and outcomes (Kim, Lee, & Kim, 2014; Huang, Liao, Huang, & Chen, 2014; Lee, Chae, Kim, Lee, Min, & Park, 2016), and a greater focus is likewise being placed on ways that cognitive process and learning outcomes are tied together (Yen, Lee, & Chen, 2012). Generally, research on mobile technology and learning

outcomes is increasing continuously, demonstrating that mobile technology now possesses a growing influence on learning relative to other more historically traditional computing devices, such as the laptop (Mahmoud, 2008; Briz-Ponce, Juanes-Mendez, Garcia-Penalvo, & Pereira, 2016). In particular, more recent use of mobile learning applications and technologies have illustrated statistically significant impacts on the learning outcomes of students in higher education (Arian, Hussain, Rizvi, & Vighio, 2017, Tsai, Shen, Tsai, & Chen, 2016; Huang, Yang, Chiang, & Su, 2016; Harley, Poitras, Jarrell, Duffy, & Lajoire, 2016; Andujar, 2016; So, 2016).

Additionally, studies have also demonstrated that students' demographical information and learner motivation can be used to accurately predict learning outcomes (Hsieh, 2014). Most importantly, when researching over 100 articles concerning the effects of mobile device integration in teaching and learning, Sung, Chang, and Liu (2016) found statistically positive influences on learning outcomes to be exhibited when integrating mobile technology in place of already known technology, such as desktop computers, or when directly comparing mobile technology integrated into non-integrated environments or those that do not allow mobile technology for learning.

Identified Gaps in the Literature

During this literature review, I identified themes concerning motivation, the triggers of intrinsic motivation while learning, how mobile technology is employed in higher education, ways that mobile technology triggers intrinsic motivation, and the connections between mobile technology and learning outcomes. As I explored these themes, several gaps were identifiable. First, two themes in my study of "motivation" and "the triggers of intrinsic motivation while learning" lacked depth regarding intrinsic motivation and learning as they related to technology

use. Little evidence of studies exploring this relationship at any depth could be found. Second, isolated examples could be found of studies addressing "ways that mobile technology triggers intrinsic motivation," but few examples provided empirical evidence or offered recommendations for future research. Lastly, numerous studies examined the relationship between mobile technology and learning outcomes, but no clear examples could be found of research concerning the relationship between mobile technology's influence on intrinsic motivation and grades together, or the ways in which learners attribute mobile technology to their success or failure in the classroom. Explanations of these gaps, and details regarding how my study addressed them, are provided in the following.

Intrinsic Motivation and Learning

Intrinsic motivation is fundamental to learning, and it is influenced and driven by emotion, interest, or curiosity. People are moved to act by very different types of factors, all of which dictate internal processes and behavioral manifestations. Ryan and Deci (2000b) stated that being motivated means being moved to do something. Further empirical evidence has demonstrated that people can be motivated because they value an activity or possess a choice regarding how to participate within an activity (Granito & Chernobilsky, 2012). My study seeks to add to this knowledge by uncovering more information regarding the value learners place on mobile technology, and by doing so, also hopes to be able to identify a measurable influence that mobile technology may exert on the way that learners' motivation levels connect with the grades they receive in a course.

Lack of Studies Involving Mobile Technology Use and Intrinsic Motivation

Williams et al. (2014) admitted that although mobile technology is becoming ubiquitous within higher education settings, the understanding of how different learning populations

respond to this reality remains limited. It was accordingly difficult to identify research that not only included mobile technology as a tool or mechanism for learning, but also categorized it as something that could moderate intrinsic motivation or even separately be connected to the learners' grades. One recommendation from Dunmore (2013) was to explore mobile technology's use among learners. He stated that this could help determine why these devices were the most needed; understanding the learner's motivation to use mobile technology, in the ways my study intended to, could address this gap.

Recent longitudinal research by Adams-Becker et al. (2017) suggested that mobile technology in higher education should be less about innovation and more about better use of existing technologies. Academic success remains underpinned by face-to-face interactions, and because of the relative recentness of mobile technology as a tool in higher education, instruction dictating or influencing mobile technology's use often fails to be responsive to the students' motivations (Adams Becker et al., 2017). My study intends to more clearly identify whether mobile technology is influencing motivation, and if there are correlations to successes or failures that learners see in the classroom.

Mobile Technology's Influence on Intrinsic Motivation and Grades

Studies have focused on the way learners extend and exercise their capacities to explore and learn through natural mechanisms, such as cognitive control or executive function, reward-based learning, or goals and habits (Botvinick & Braver, 2015; Adcock et al., 2006; Dolan & Dayan, 2013). However, few have included mobile technology as a tool that could possibly influence motivation and connect it to the level of success that comes after learning has taken place. Mobile technology itself provides quick access to information and can help learners to naturally explore how to obtain higher levels of knowledge, gain more critical understandings of

processes, or identify information's ease of use and applicability in practical ways until it becomes clearer why they value it. My study set out to exhibit the extent to which mobile technology influences intrinsic motivation and grades. It aims to accomplish this by exploring the moderation of the effect of intrinsic motivation (X) on grades (Y) via mobile technology use (M). This was captured through two secondary moderator variables: how frequently mobile technology is used (W1) and the learners' perceived value of technology (W2).

Learner Attribution of Mobile Technology to their Success or Failure

Most studies on mobile learning have focused on effectiveness and system design (Wu et al., 2012). Being able to measure learners' experiences while using mobile technology, knowing more about how they attribute mobile technology to their success or failure in those experiences, and understanding whether they feel they are likely to experience similar results the next time they use mobile technology could enable insights into the motivational forces driving the use of mobile technology. My study aims to address this by employing frequency of use and the perceived value of mobile technology as secondary moderators measuring how often learners use mobile technology and by identifying how highly they value mobile technology for their learning. Borich and Tombari (1997) pointed out that learners are especially interested in antecedents behind their success or failure, and attribute blame or credit in their experiences through situational cues, prior beliefs, and self-perception. Learners use mobile devices frequently, but it is important to know if they are attributing mobile technology to their learning experience or to their own enduring beliefs concerning why they succeeded or failed. If learners attribute mobile technology as directly affecting their experience, then it is possible this could influence their motivational levels, and potentially their grades as well.

Chapter Summary

This chapter provided a review of relevant literature on motivation, mobile technology use, and learning outcomes. The review of existing literature produced themes indicating that, although mobile technology is being used at a greater frequency, little is known concerning how mobile technology use and learner motivation are connected within higher education, whether mobile technology use can influence motivation and grades, or how learners attribute mobile technology to the successes or failures they experience. This chapter also established the theoretical framework employed in my study and highlighted gaps in the current literature. The following chapter provides further information regarding the research question, design considerations, sampling technique, and data analysis plan.

CHAPTER 3: METHODOLOGY

The purpose of my study is to determine whether mobile technology use moderates the relationship between intrinsic motivation and grades. To this end, this study collected data on learners' intrinsic motivation levels, demographics, and grades, as well as data regarding the primary moderators of the mobile technology construct, namely, "frequency of use" and "perceived value of technology." All of the participants consisted of undergraduate students from a four-year urban-serving public university.

Research Design

The research method employed for this study was a quantitative, non-experimental, cross-sectional correlation design. This was intended to measure ways that technology use moderates the relationship between intrinsic motivation and the grades a learner receives. The survey mechanism was deployed across courses within an urban university setting, and was not limited to any specific subject matter or major. This approach helped to ensure that the captured data conveyed a broad representation of the student body. The survey tool focused directly on intrinsic motivation and measured the behavioral indications that help determine the strength of a learner's motivation at any given time. Additionally, demographic data, GPA numbers, and information on mobile technology use by the participants was also collected to enable further indications across the population to be considered. Participants came from across the university, and were all currently studying at the undergraduate level.

Participants

Traditional-aged students (18–24 years old) studying at an urban-serving public university were included in my study. According to the Association of Public and Land-Grant Universities, as well as the Coalition of Urban Serving Universities, urban-serving institutions

represent 68% of colleges and universities in the United States and serve 20 million students, making their campuses essential for implementing transformative change. The digest of educational statistics through the U.S. Department of Education states that traditional-aged learners comprised over 60% of the total fall enrollment in degree-granting postsecondary institutions in the United States in 2017. Not only is this age group largely representative of the overall enrollment of learners in higher education, but smartphones and cellphones are now being carried and used by an overwhelming percentage of them (86% of learners ages 18–29 possess smartphones, and 98% of this same age group at least has a cell phone) (PEW Research Survey, 2015). This study did not similarly limit other demographic categories, such as the participants' declared area of study, year in school, or gender, so that the collected data could establish a broad range of comparisons and insights across the learner population. The survey tool was sent out to as many as 16,000 participants. The survey attempted to generate an accurate representation of the diverse student body that attended the institution.

Inclusion Criteria

Recruitment of individuals was limited to learners in the 18–24 age range in order to collect data relevant to learners largely representative of the overall enrollment of learners in urban-serving higher education institutions (Zerquera, 2016). All undergraduate courses were considered for this study in order to draw the largest response possible, as well as to create a wide, diverse range of data points. A listserv with undergraduate emails was created as a recruitment strategy prior to distributing the survey. My advisor and senior researcher used a third party to populate the listserv with participant emails and sent an initial recruitment email during the middle of the semester. Both the initial email and the ones following it included a link to the Qualtrics survey. Two reminders were sent out to participants following the first request:

one week after the initial survey was distributed, and again two weeks prior to the end of the semester. The last date available to complete the survey prior to it being closed was the last day of classes for the fall semester (December 14th, 2018), and it was not reopened after.

Research Questions

The research questions addressed in this study are as follows:

MAJOR QUESTION: To what extent does learners' use and value of mobile technology moderate the relationship between intrinsic motivation and grades?

SUB-QUESTIONS:

- How much does the learners' perceived value of mobile technology moderate the relationship between intrinsic motivation and grades?
- How does a learner's perception of grades influence the value they place on mobile technology?

Data Collection

An online survey was distributed using a listserv approximately 10 weeks into the semester. Two forms of measurement were employed to collect data. The first was the IMI. This multidimensional measurement survey was modified to determine the strength of participants' intrinsic motivational levels as related to the experience in their course. The IMI is a self-report instrument developed specifically to assess learners' intrinsic motivation and perceptions. This scale was designed to assess several underlying situational dimensions of intrinsic motivation (interest-enjoyment, perceived competence, effort-importance, and pressure-tension). Several studies have demonstrated a high level of internal consistency for the subscales (Duda, Chi, Newton, Walling, & Catley, 1995; McAuley, Duncan, & Tammen, 1989; Seifriz, Duda, & Chi, 1992), and additionally, the scale's validity has been supported by results in line with existing

theories (Duda et al., 1995; McAuley & Tammen, 1989). The subscales, or factors, of this survey specifically assess participants' interest or enjoyment, perceived competence, effort, value or usefulness, felt pressure and tension, and perceived choice while performing a given activity, such as learning. Using the IMI survey in my study provided motivation scores for each participant across the university, which were then used as the independent variable in this analysis. This quantified the learner's amount of motivation into a scale, where the higher the number recorded equaled higher levels of motivation, and conversely, lower numbers equaled lower motivation levels.

Surveys have long been a prominent tool for understanding social problems, trends, or inquiries. Higher education possesses a long history of utilizing surveys to create comparable, categorical, ordinal, and interval statistics for making sense of what takes place within teacher and learner populations. My research employed this form of data collection because distinct categorical areas were in focus, and the population was accessible and distinctly connected to the variables in question. The questions' nature was largely focused on collecting non-sensitive information through closed questions, which included all reasonable possibilities as explicit responses. Terminology was used that was understood throughout the population being surveyed.

The second form of measurement consisted of a set of 18 items regarding demographics, grades, and technology use. The first nine questions asked in the beginning of the survey concerned demographical data. The information collected through these questions was used to identify variables outside of motivation that may play a role in influencing a learner. The remaining nine questions defined the dependent variable of "grades," as well as the primary moderators of the mobile technology construct variable, namely, "frequency of use" and "perceived value of technology." The responses from these questions followed a Likert-type

format. Responses from the IMI were averaged, and the moderator variables were dichotomous in order to measure first-order interactions.

My study used the information collected through these questions to examine whether mobile technology use—and more specifically, how frequently it is used and the value learners place on it—influences the grades that learners receive in a course. In order to measure this relationship, a moderation analysis was also conducted. A moderation analysis measures the way that a third variable affects the strength of the relationship between a dependent and independent variable. The moderator variable, if found to be significant, can cause an amplifying or weakening effect between the dependent and independent variable being studied.

Several assumptions needed to be met in order for this analysis to be run. The dependent and independent variables needed to be measured on continuous scales, and the moderator variable needed to be dichotomous in nature. Additionally, independence of observations across the data was also required, and the continuous measures of intrinsic motivation (independent variable) and grades (dependent variable) needed to be standardized for correlation and regression analyses. This allowed for the "most common observations among the group" to be identifiable and for meaningful associations to be made (Gravetter & Wallnau, 2009). It was also important to be able to see differences across the population. People are different, and these differences are quite central to the meaning behind this study.

Items added to the survey were as follows, and are detailed further in Appendix C:

1. Gender
2. Racial or ethnic identification
3. Estimated family income level
4. Age

5. Year in school (freshman, sophomore, junior, senior)
6. Declared major of study
7. Required as part of a major or minor of study
8. Part-time or full-time student
9. Local resident (Greater Milwaukee), state resident, or out-of-state resident
10. Current grade in the course
11. Expected final grade in the course
12. Cumulative GPA prior to entering the course
13. Devices used for learning
14. Frequency of devices' use for learning
15. Importance of mobile technology to academic success in this course
16. Importance of mobile technology to overall academic success in all courses
17. Value of mobile devices to learning
18. Impact of mobile technology on ability to obtain desirable grades in this course

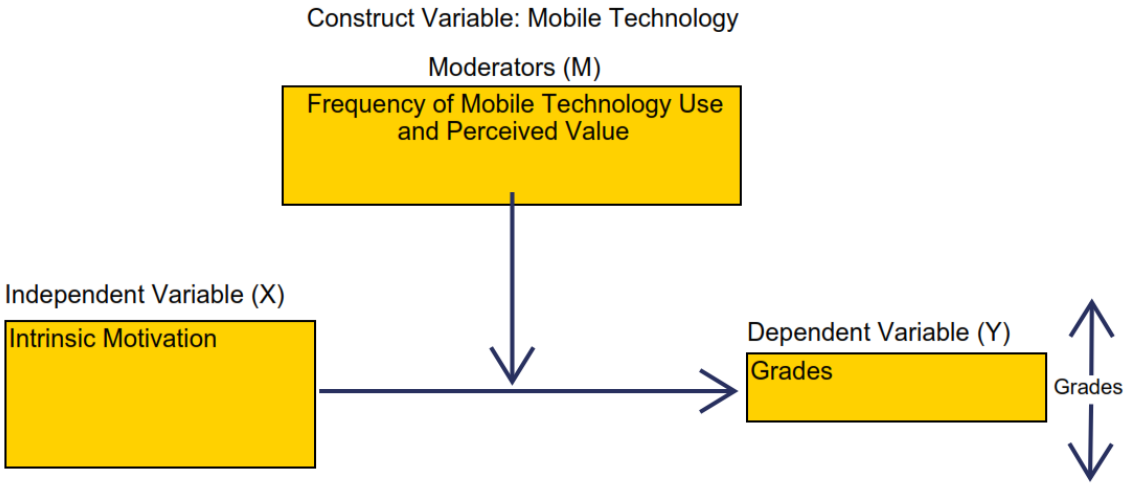
Data Analysis

This study sought to analyze whether the frequency of mobile technology use and the value that learners placed on mobile technology while taking a course influenced the relationship between intrinsic motivation and the grades the learners earn in a course. As a first step, descriptive findings (means and standard deviations) were determined, and correlations for these variables were conducted. Lastly, multiple regression analyses were employed to examine the relationship between intrinsic motivation and grades. To perform such analyses, the SPSS statistical analysis tool was utilized for probing and visualizing the interactions. As seen in Figure 3.1, intrinsic motivation (X) was considered the focal predictor, while frequency of

mobile technology use and the perceived value of mobile technology (M) were the primary moderators. Grades represented the central dependent variable (Y). First-order interactions with intrinsic motivation were determined for each of the primary moderators.

Figure 3.1

Multiple regression analyses examining the relationship between intrinsic motivation and grades



The interactions allow the moderation of the effect of intrinsic motivation (X) on grades (Y) by mobile technology use to depend on how frequently mobile technology was used and the perceived value of technology the learners possess (M). In order to understand the significance of these first-order interactions, inference was addressed through selecting values for use and value (dichotomous variables: high (1) or low (0) use; high (1) or low (0) value) and tested whether the interaction between intrinsic motivation (X) and grades (Y) was statistically different from zero at those values. Several supporting questions were used to provide broader context and meaning to the dichotomous variables in order to determine whether they are significant. If variation in significance of the interactions occurs, it might be important to display

the results of the interactions in separate figures. For example, the first figure might represent the interaction between intrinsic motivation (X) and grades (Y) concerning how frequently mobile technology is used, and the second figure might represent the interaction between intrinsic motivation (X) and grades (Y) for the learners' perceived value of technology.

Protection of Human Subjects

The main risk factor for participants in my study came through the collection of information connected to their emails. Student confidentiality came through the use of an email listserv to help ensure that no identifiers linked individuals to their specific responses. The use of a listserv provided an effective method for protecting the confidentiality of all participants, and it replaced information specific to the learner. In the event that data was lost, stolen, or accessed by an unauthorized third party, having the data protected in this way prevented anyone who may view it from determining the identity of any participant. Since this study needed to involve a large number of learners, the listserv was able to include all learners in the same communications without their knowledge of each other, or my knowledge of who they were. For example, each communication was sent out using the listserv address and placed into the "BCC" section. This approach ensured anonymity of the information collected from participants, as their responses or inquiries were only sent directly to the survey or my email address. The lone risk associated with this approach was that any communication to the listserv from myself to the group would expose students to each other if it was not placed in the "BCC" portion of the email. Unfortunately, one communication was placed in the "TO" portion of the email, exposing learners to each other for a brief period of time. The IRB Board was made aware, and it was determined to not be problematic to the study's results. To maintain information confidentiality, only the main investigator (myself) and the principle investigator (Simone Conceição) had access to responses.

Credibility of the Research Process

As Sword (1999) stated, "No research is free of the biases, assumptions, and personality of the researcher, and we cannot separate self from those activities in which we are intimately involved" (p. 277). In order to ensure I remained self-aware of the personal bias I brought to this study, and ensure that I systematically attended to the effect I had at every step of the research process, I needed to use reflexivity. I understand the ways in which my own knowledge potentially impacts the various aspects of the research process, including how my own understandings affect observations, interpretations, and conclusions. So, it was vital that I repeatedly ask myself where I stood in relation to my research, and "what were the potential ramifications of this position" (Berger, 2013, p. 13) on my research. This approach helped to ensure, as Pillow (2003) stated, that I remained "non-exploitative and compassionate toward the research subjects," and minimized any concerns related to the "researcher-researched relationships" (Berger, 2013, p. 3) that evolved as a result of the research process.

Other specific approaches assisted my research in being reflexive as well. For example, during the write-up of findings from my research, I reflected on how I personally interpreted findings and considered ways in which my own experiences in life may influence what I choose to report on. My own level of motivation, and the value I place on mobile technology, did reflect some of what I saw in the data, and I needed to understand my own positionality in order to prevent it from influencing my analysis. Reflexivity involves being transparent and self-aware, which can make a profound difference in how data interpretation and reporting take place. According to Berger (2013), applying the reflexive process described above results in a higher likelihood of sustained credibility, trustworthiness, and non-exploitative research, and further helps to integrate a continual self-scrutinized mechanism throughout the research practice.

Limitations

While this study hoped to add to the understanding of whether mobile technology moderates relationships between variables such as intrinsic motivation and the grades learners receive, there are limitations inherent in the methods chosen for this study. This survey was distributed via the Internet. Written surveys that are delivered through the Internet can be given to a large number of people at the same time. Validity and reliability can also be quite high when closed questions are used. This study replicated closed questions in the same way for all responders, which further allowed for easily quantifiable and comparable data. However, the survey instruments relied on self-reporting, and the learners choosing to be participants may not have answered honestly, or may not have possessed effective insights into their own habitual practices, and thus may not have answered in line with what might be expected. Although, Pace (1985) found that college students can be relatively accurate at reporting on progress toward academic goals. In order to ensure that honesty is captured, certain questions, scales, and response types can be employed. In particular, a Likert-type scale with no midpoint provides an example of something that helps mitigate the effects of social desirability bias.

In addition, because the research planned to deliver the survey instrument entirely over the Internet, it was possible that learners who were comfortable with or interested in technology might have been more likely to respond than those who were not. To help achieve higher response rates, university-assigned email addresses were used in the listserv to send the invitations. This meant that all learners involved in the study, regardless of their comfort level with technology, possessed an equal chance of receiving an invitation to participate in the survey. A nonresponse bias still existed, though, because responding to the survey was completely voluntary, and those who chose not to respond may be systematically different than

those who did respond. The population used in this study consisted of undergraduate-level learners at different levels of academic experience. This may have therefore meant that their responses varied based on the type of exposures they experienced through previously completed specialized coursework in their chosen majors, or through social interaction with peers over time. Some characteristics differ between first-semester freshmen and first-semester seniors who participated in this study. The goal of the study was to demonstrate causation while also highlighting interesting relationships that merit further study.

Another highly impactful limitation was participant completion of the survey. The survey was deployed as the semester was more than half-way completed. The timing meant that some who may otherwise have been available for participation were likely busy completing work for their classes, and thus overlooked the survey's completion. Since a large percentage of individuals started and did not finish the survey, it is clear that some participants lost motivation, resulting in a large number of responses being removed from the analysis and data interpretation.

Adding to this, nearly 65% of survey respondents were female, while the difference between current and expected grade categories in the study was nominal. I do not possess the average grades for undergraduates across the university, so it is difficult to understand whether the response to the study is fully representative of the population even though the number of responses in the sample size satisfies the statistical power for this study. The survey was sent out after week 10 of the semester, so it is also likely that there would not be much change in the learners' current versus expected grades, as much of the semester's work had already completed.

Finally, the last recruitment email was distributed in such a way that participant email addresses were exposed. As a result, all participants on the listserv were recipients of a large number of email responses and some inappropriate discussions. Although the IRB was informed

and deemed the incident non-impactful on the research, it is possible that students may have chosen not to complete the survey due to a lack of trust concerning its research validity or from the commentary they were exposed to as the survey was discussed across the entirety of the undergraduate student population. Additionally, they may have chosen to complete the survey with answers that were not authentic in nature. In such cases when questions with open response selections contained expletives, inappropriate language, or out-of-line commentary, the data from that survey will need to be removed and not considered for analysis.

Chapter Summary

This chapter described the methodology employed in my study and provided detailed information regarding the research design, inclusion criteria, measurement plan, data collection process, data analysis process, measures taken to protect human subjects, process for maintaining a credible research process, and descriptions of the study's limitations. Additionally, this chapter defined the target participant population and also identified the dependent and independent variables that were a part of the moderation analysis.

CHAPTER 4: FINDINGS

Before statistical analyses were conducted, data was screened and coded. Data was then compiled into SPSS. After the data was coded, it was assessed for outliers by inspecting the frequency distributions of the intrinsic motivation scale (and subscales). Furthermore, a cut-off of +/- 3 standard deviations from the mean was used to identify outliers. Then, data was assessed for normality using the Shapiro-Wilk test of normality. A significant *p* value (i.e. < .05) would indicate that the distribution shape significantly differed from the normal distribution, and therefore, that the data was not approximately normally distributed.

After the data was coded, it was cleaned. Data cleaning consisted of removing survey non-completions, surveys that included inappropriate responses, and responses submitted from outside the preferred age group. Next, internal reliability of the intrinsic motivation scale and its six subscales—(1) Interest and Enjoyment, (2) Perceived Competence, (3) Effort and Importance, (4) Pressure and Tension, (5) Perceived Choice, and (6) Value and Usefulness—was assessed using Cronbach's alpha. In this case, a value of .70 or greater is considered acceptable for internal reliability (Nunnally & Bernstein, 1994).

Descriptive statistics for the intrinsic motivation scale and subscales were also calculated and reported on, including the mean (central tendency) and standard deviation (measure of spread). The standard deviation was used to determine how close or how spread apart the responses were for the questionnaire. Additionally, descriptive statistics for the questions pertaining to the frequency of mobile technology use and the value that learners place on mobile technology were also reported on, including the participants' demographic characteristics.

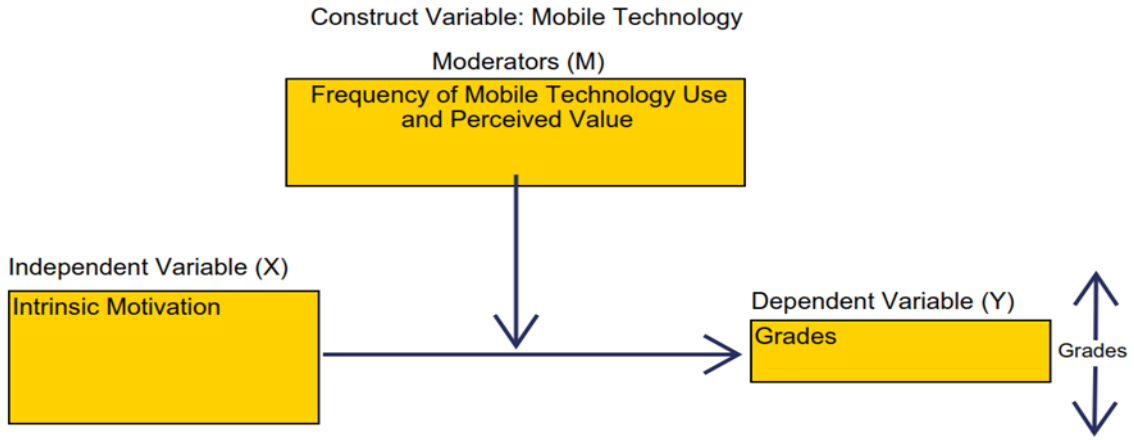
After the findings for demographic characteristics and descriptive statistics were discussed, the research questions were systematically addressed. Correlations among the intrinsic

motivation scale and subscales, the technology use and value questions, and participants' current and expected grades were calculated.

Finally, multiple regression analyses were conducted, treating intrinsic motivation and technology frequency of use and value as predictor variables, as well as the interaction between intrinsic motivation and frequency and value of mobile technology. Participants' current and expected grades were used as the dependent variables. For all predictors and interactions, alpha was set at .05 to determine statistical significance. My research hypothesis posits that participants' frequency and perceive value of mobile technology use will moderate the relationship between intrinsic motivation and grades (See Figure 3.1). As such, it is predicted that the interaction term in the regression analysis (i.e., the interaction between the frequency and perceived value of mobile technology and the intrinsic motivation) will be statistically significant.

Figure 3.1

Multiple regression analyses examining the relationship between intrinsic motivation and grades



The intrinsic motivation, technology use, and demographic questionnaire was distributed

to 980 participants, 512 of whom did not complete the survey and were subsequently removed from the analyses. Eleven students did not provide informed consent and wished to not participate in the present study, and one did not respond to the informed consent item. Therefore, these 12 students were removed from any subsequent analyses. Thirteen participants did not complete any items on the intrinsic motivation scale, and five participants answered two items or fewer. Since my research focused on the relationship between, and moderation of, grades and intrinsic motivation, these participants were removed from subsequent analyses as well. Two more participants were also removed for non-valid responses. Additionally, 28 participants were removed from the analyses because they were older than the age inclusion criteria (i.e., 25 years or older).

A total of 378 participants (260 female, 110 male, 8 other/did not wish to identify) were included in the analyses. This number represents only completed surveys. Though almost 1,000 surveys were started, many were left unfinished or fell outside of the age range for the study. Most participants were full-time students (n = 361; 95.5%) in college. Participants included freshman (n = 91), sophomores (n = 89), juniors (n = 123), and seniors (n = 75) in college. More than half of the participants were taking this course as part of a major or minor requirement (n = 210; 56.3%). Participants' ages were coded as 1 = 18 or 19 years old, 2 = 20 or 21 years old, and 3 = between 22 and 24 years old. The highest percentage of participants fell into the 20–21-year-old age range (n = 165; 43.7%), followed by the 18–19-year-old age range (n = 131; 34.7%), and the 22–24-year-old age range (n = 82; 21.7%). Most participants were white/Caucasian (n = 230; 60.8%). Participants' estimated family income ranged from less than $20,000 per year to greater than $150,000. Over half the participants were local residents (n = 213; 56.3%). A complete descriptive of participants' demographic characteristics can be found in Table 4.1.

Table 4.1

Demographic characteristics

	N	%
Gender		
Male	110	29.1
Female	260	68.8
Other	8	2.1
Age		
18–19 years old	131	34.7
20–21 years old	165	43.7
22–24 years old	82	21.7
Ethnicity		
Asian	43	11.4
Black or African American	22	5.8
Hispanic or Latino	39	10.3
White or Caucasian	230	60.8
Other	5	1.3
Multi	38	10.1
Prefer not to respond	1	0.3
Estimated family income		
< $20,000	50	13.5
$20,000 – $49,000	92	24.9
$50,000 – $79,000	88	23.8
$80,000 – $109,000	59	15.9
$110,000 – $150,000	44	11.9
>$150,000	37	10.0

Missing/no response	8	--
Year in school (undergraduate)		
Freshman	91	24.1
Sophomore	89	23.5
Junior	123	32.5
Senior	75	19.8
Student status		
Part-time	17	4.5
Full-time	361	95.5
Is this course required as part of your major/minor?		
Yes	210	56.3
No	163	43.7
Missing/no response	5	--
Residence		
Local resident (Greater Milwaukee)	213	56.3
State resident (non-Greater Milwaukee	122	32.3
Out-of-state resident	43	11.4

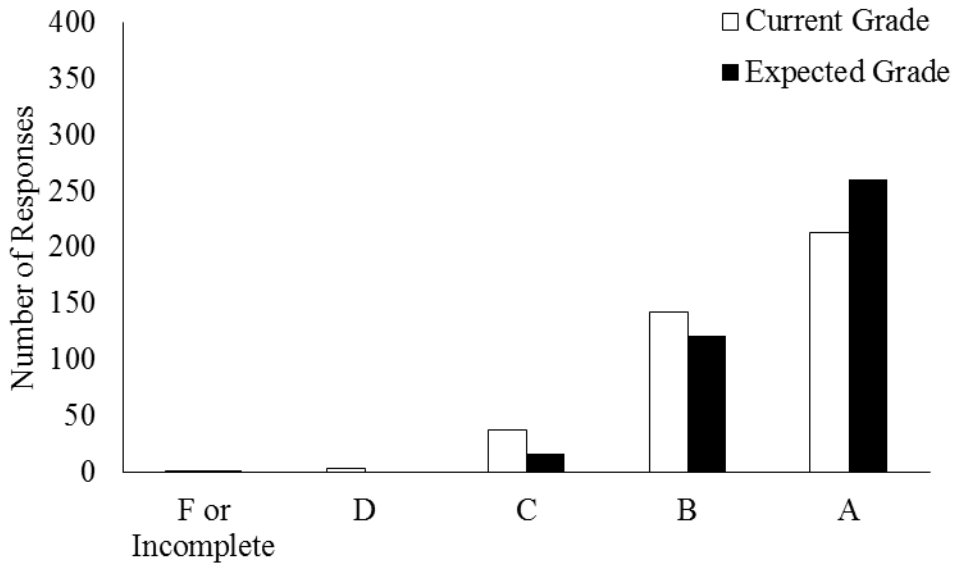
Students' Grades

Participants self-reported their current grades, as well as the final grade expected at the end of the course. Regarding students' current grades, one student currently had an F or incomplete, four students were in the *D* range (D- to D+), 35 students in the *C* range (C- to C+), 131 students in the *B* range (B- to B+), and 200 students in the *A* range (A- to A+). Seven students did not disclose their current grade. Regarding students' expected grades, two students expected an F or incomplete, one student expected a grade in the *D* range, 15 expected grades in the *C* range, 111 expected grades in the *B* range, and 244 expected grades in the *A* range (Figure

4.1). Five students did not disclose their expected final course grade. There is not much variance in responses, which could be attributed to the timing of the survey's release being later in the semester. Much of the school work may have already been completed at this point, resulting in less opportunity for expectations to change positively or negatively.

Figure 4.1

Current and expected grades for participants included in the study



Intrinsic Motivation

Participants completed the 36 item IMI as their measure of overall intrinsic motivation. Embedded within the IMI are six subscales: (1) interest and enjoyment, (2) perceived competence, (3) effort and importance, (4) pressure and tension, (5) perceived choice, and (6) value and usefulness. Internal reliability of the IMI and its subscales was assessed using Cronbach's alpha. Scale scores were computed for the IMI and each subscale. Participants' overall IMI score was calculated by computing the overall mean from all 36 items in the IMI.

Participants' scores on the subscales were calculated by computing the mean of the items associated with each particular scale. The overall IMI scale, as well as each subscale, possessed acceptable internal reliability (i.e., Cronbach's alpha > .70). Descriptive statistics for the IMI and its subscales are reported in Table 4.2.

Table 4.2

Descriptive statistics of the IMI and subscales

Scale	Number of Items	Participants (n)	Mean (SD)	Median	Mode	Range	Reliability (Cronbach's Alpha)
Interest and Enjoyment	6	378	3.97 (0.79)	4.00	4.00	1.67 – 5.33	.826
Perceived Competence	6	372	4.02 (0.74)	4.17	4.17	1.83 – 5.17	.833
Effort and Importance	5	371	4.24 (0.76)	4.40	4.40	2.20 – 5.80	.799
Pressure and Tension	5	373	3.22 (0.90)	3.20	3.40	1.40 – 5.40	.816
Perceived Choice	7	371	3.76 (0.98)	3.71	3.71	1.71 – 5.71	.887
Value and Usefulness	7	369	3.99 (0.80)	4.00	5.00	1.86 – 6.00	.950
Intrinsic Motivation	36	360	3.88 (0.48)	3.92	3.33	2.39 – 4.95	.883

The IMI and its subscales were assessed for outliers using a cut-off of +/- 3 standard deviations from the mean. While a number of different methods can be used to operationalize outliers, three standard deviations is typically considered the default threshold (Spatz, 2011). Assuming that the data is normally distributed, 99% of the data will fall within three standard deviations of the mean. Therefore, an outlier would be any data point located in the 1% region that is more than three standard deviations away from the mean. Four participants were identified as outliers on the IMI overall scale score (scores < 2.39); two outliers were identified on the

interest and enjoyment subscale (< 1.60); one outlier was identified on the perceived competence subscale (< 1.80); two outliers were identified on the effort and importance subscale (< 1.96); and four outliers were identified on the value and usefulness subscale (< 1.59). No outliers were identified on the pressure and tension score or the perceived choice score. Outliers were removed from all the subsequent analyses.

After assessing for outliers, the assumption of normality was assessed using the Shapiro-Wilk test of normality. A significant *p* value (i.e., < .05) indicated that the shape of the distribution significantly differed from the normal distribution. The distribution of IMI scores did not significantly differ from the shape of a normal distribution. However, each subscale did significantly differ from the shape of a normal distribution (See Table 4.3). Because the subscales did not approximate normal distributions, the non-parametric Spearman's rank correlation coefficient was used (instead of Pearson's correlation coefficient) in the analyses of the relationship between intrinsic motivation and students' grades.

Table 4.3

Shapiro-Wilk test of normality for the IMI and its subscales

	Shapiro-Wilk Test of Normality		
Tasks	Statistic	df	*p*
Interest and Enjoyment	.977	363	< .001
Perceived Competence	.962	363	< .001
Effort and Importance	.968	363	< .001
Pressure and Tension	.986	363	.002
Perceived Choice	.984	363	< .001

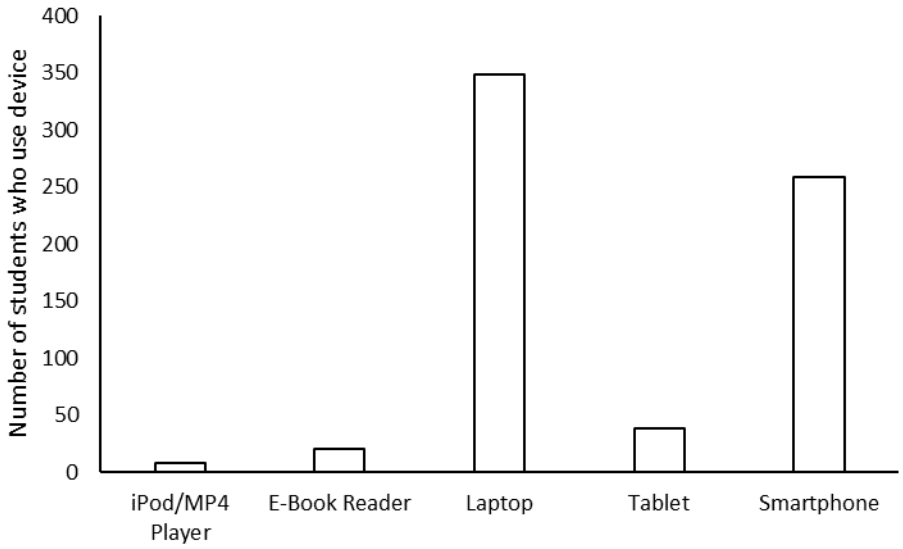
Value and Usefulness	.944	363	< .001
Intrinsic Motivation	.994	363	.136

Mobile Technology Usage

Participants completed several items related to their usage of mobile technology. When asked what technological devices they used in their course, most participants used their laptop (*n* = 349; 92.3%) and/or their smartphones (*n* = 258; 68.3%). Fewer participants used their iPods (*n* = 8; 2.1%), e-book readers (*n* = 20; 5.3%), and/or tablets (*n* = 38; 10.1%) (See Figure 4.2).

Figure 4.2

Number of students who use technological devices in learning for this course

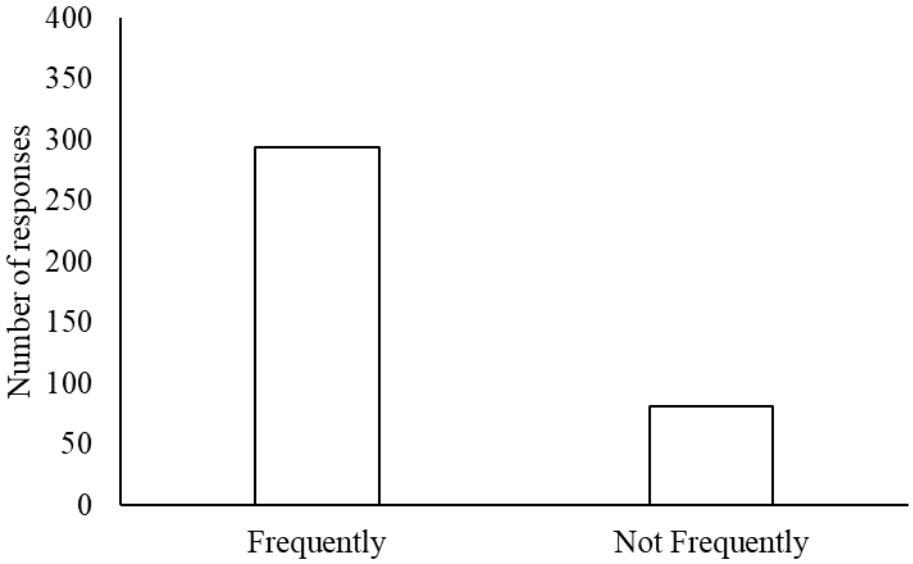


Participants were also asked whether these devices were used frequently or not frequently. Most participants (*n* = 294; 77.8%) responded that these devices were used *"frequently,"* while fewer participants (*n* = 82; 21.7%) did not frequently use mobile technology

devices in learning for this course (See Figure 4.3).

Figure 4.3

Frequency of usage of technological devices for academic work in this course



Participants were also asked to judge the technology's importance for achieving academic success in their course. The majority of participants (*n* = 321; 79.1%) rated technology as moderately (*n* = 133; 35.2%) or extremely important (*n* = 188; 49.7%) in their academic success in their course (Figure 4.4). Fewer participants were not sure (*n* = 27; 7.1%) or felt the usage of mobile technology was not very important (*n* = 22; 5.8%) or not important at all (*n* = 8; 2.1%) for academic success in their course.

Similarly, participants were asked, *"Do you perceive mobile technology as valuable to your learning in this course?"* The majority of participants (*n* = 310; 82.0%) perceived mobile technology as valuable to their learning in their course. Fewer participants (*n* = 67; 17.7%) did not perceive mobile technology as valuable for their course (Figure 4.5).

Figure 4.4

How important do you perceive that mobile technologies are to academic success in this course?

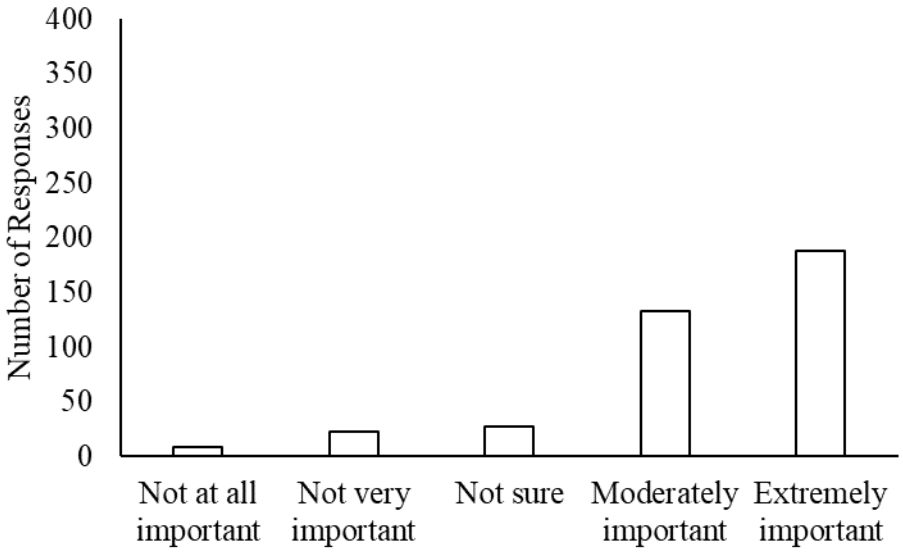
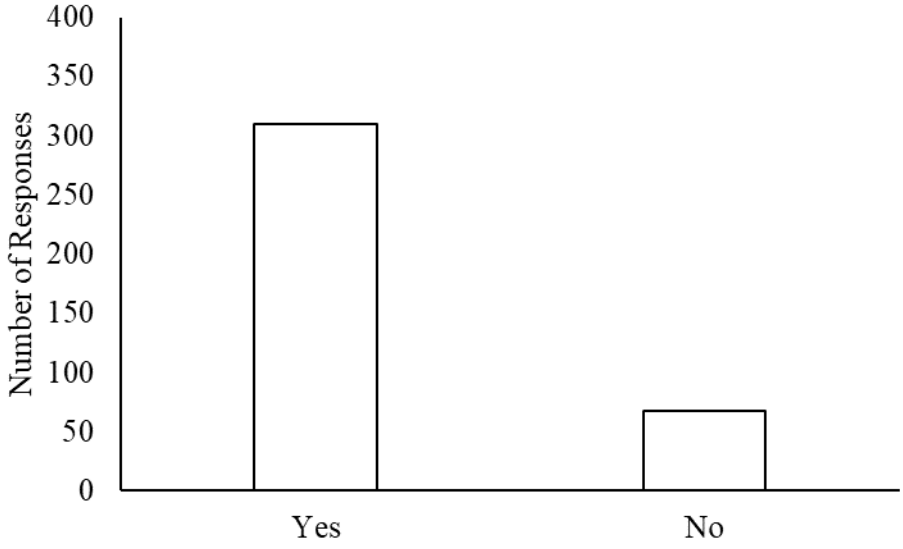


Figure 4.5

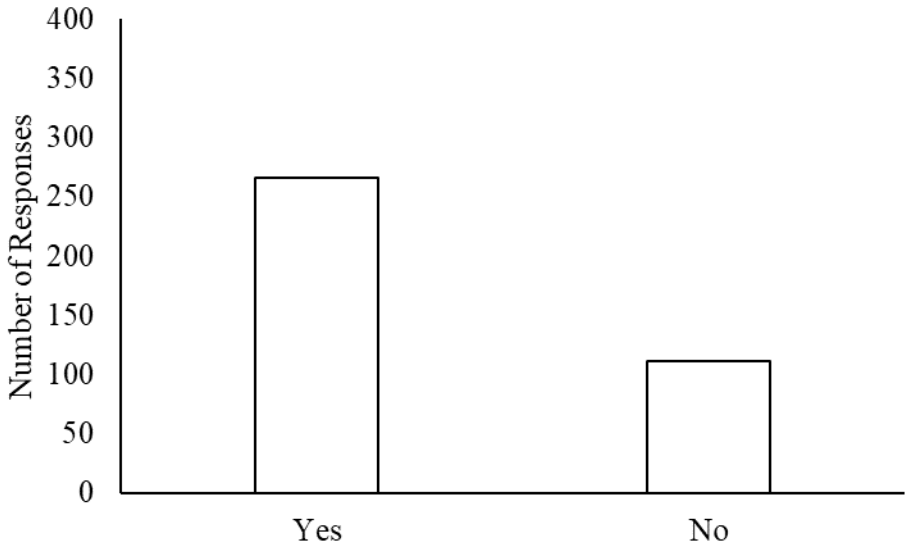
Do you perceive mobile technology as valuable to your learning in this course?



The final question participants were asked regarding their perception of mobile technology in the classroom was whether they felt that mobile technology use affects their ability to obtain desirable grades in their course. Most participants (n = 266; 70.6%) answered *"Yes,"* and fewer (n = 111; 29.4%) answered *"No"* (Figure 4.6).

Figure 4.6

Do you feel that mobile technology use affects your ability to obtain desirable grades in this course?



Analysis of the Research Questions

This study's primary research question was assessed in two steps. First, the relationship between students' grades (current and expected) and their intrinsic motivation levels, and the relationship between technology usage and students' grades, were assessed separately. Then, a multiple regression analysis was conducted, including the interaction between intrinsic motivation and technology use as a predictor.

Because the IMI and its subscales were not normally distributed, Spearman's rank order correlation coefficient was determined to be the most appropriate correlation analysis.

Spearman's rank order correlation coefficients between participants' intrinsic motivation and their current and expected grades was analyzed first. A significant positive correlation was identified between participants' overall intrinsic motivation and current grades. As participants' intrinsic motivation increased, so did their current grade ($r_s = .181$, $p < .001$). Positive correlations also existed between two of the intrinsic motivation subscales and participants' current grades: (1) participants' interest or enjoyment and their current grades ($r_s = .208$, $p < .001$), and (2) participants' perceived competence and their current grades ($r_s = .497$, $p < .001$). A negative correlation was found between participants' pressure and tension and their current grades ($r_s = -.222$, $p < .001$). The correlation between participants' perceived competence and their current grades was the strongest.

A significant, positive correlation also existed between participants' overall intrinsic motivation and their expected (final) grades. As intrinsic motivation increased, so did the expected grade ($r_s = .228$, $p < .001$). Positive correlations were additionally found between four of the intrinsic motivation subscales and participants' expected grades: (1) participants' interest or enjoyment and their expected grades ($r_s = .252$, $p < .001$), (2) participants' perceived competence and their expected grades ($r_s = .494$, $p < .001$), (3) participants' perceived choice and their expected grades ($r_s = .107$, $p = .04$), and (4) participants' perceived value and usefulness scores and their expected grades ($r_s = .106$, $p = .043$). A significant, negative correlation was identified between participants' pressure and tension and their expected grades ($r_s = -.261$, $p < .001$). The correlation between participants' perceived competence and their expected final grade was the largest (See Table 4.4).

Table 4.4

Correlations between IMI (and subscales) and students' current and expected grades

	Current Grade	**Expected Grade**
Interest and Enjoyment	.208***	.252***
Perceived Competence	.497***	.494***
Effort and Importance	.006	.078
Pressure and Tension	-.222***	-.261***
Perceived Choice	.057	.107*
Value and Usefulness	.079	.106*
Intrinsic Motivation	.181***	.228***

The relationships between the frequency of mobile technology's use for academic work in this course, and mobile technology's perceived value in learning for this course, with students' current and expected grades for this course were also assessed. Similarly, because of the nature of the technology items, Spearman's rank order correlation coefficient was determined to be the most appropriate correlation. Two significant correlations were found between (1) how important participants perceived mobile technology to be for achieving academic success in this course and students' current and expected grades ($r_s = .115$, $p = .027$), and (2) how frequently participants used devices for academic work ($r_s = -.112$, $p = .032$). The relationship between importance of mobile technology for academic success and current grades was small and positive ($r_s = .115$, $p < .027$), as was the relationship between mobile technology's importance for academic success and expected final grades ($r_s = .124$, $p < .017$). The relationships between how frequently students

used their devices for academic work and current grades (r_s = -.112, p = .032), as well as expected grades (r_s = -.116, p = .026), were small, negative correlations. All correlations between technology items and students' current and expected final grades can be found in Table 5.2.

Table 4.5

Correlations between technology items and students' current and expected grades

	Current Grade	**Expected Grade**
Frequency of mobile technology's use for academic work in this course	-.112*	-.116*
Do you perceive mobile technology as valuable to your learning in this course?	.073	.066
How important do you perceive mobile technology to be for academic success in this course?	.115*	.124*
Does mobile technology use affect your ability to obtain desirable grades in this course?	-.055	-.037

When narrowing the testing to demographic traits, some more correlations came forward in the data. A significant correlation was found for 21–22-year-olds regarding their perception that mobile technology use affects their ability to obtain a desirable grade in this course and their current and expected course grades (r = .423, p = .001; r = .283, p = .011). None of the other correlations of interest for other ages were significant. When limiting by year in school, no significant correlations that differ by year in school (e.g., freshman, sophomore, etc.) occurred. Additionally, when looking at each level of reported family income, no significant correlations were found between technology perception questions and grades.

Next, a multiple regression equation was used to further analyze the primary research question, namely, how does learners' use and value of mobile technology moderate the

relationship between intrinsic motivation and their grades. Four possible outcomes were considered for this calculation. One possibility is that students with higher intrinsic motivation would possess higher grades when they used technology more frequently and perceived mobile technology as valuable to learning for their course. Another possibility was that students with higher intrinsic motivation would possess higher grades when they used technology more frequently regardless of whether they perceived technology as valuable for their course. A third possibility was that students with higher intrinsic motivation would possess higher grades when they perceived mobile technology as valuable regardless of how frequently they used it for their course. Finally, the last possibility was that students with higher intrinsic motivation would possess higher grades regardless of whether or not they used technology frequently for their course and regardless of whether or not they perceived mobile technology as valuable for learning in their course.

Two sets of multiple regressions were conducted, treating intrinsic motivation scores, technology usage frequency, perceived value of technology, and their interactions as predictors. The dependent variables consisted of students' current and expected final course grades. First, participants' intrinsic motivation scores were centered (i.e., subtracting the mean from each case so that the new mean is zero). Cohen and Cohen (1983), as well as Aiken and West (1991), stressed the importance of centering the predictor variables that represent the main effects in the model. Centering continuous predictor variables did not actually change the model's meaning, but made the results more interpretable. Frequency of technology's usage for academic work in this course, and perceiving technology as valuable to learning in this course, represented categorical predictors.

A multiple linear regression was calculated to predict students' current grades based on

their (centered) scores on the IMI, their frequency of technology usage for their course, their perception of technology as valuable for their course, and all of their interactions. As seen in Table 4.6, a significant regression equation was found ($F(7, 361) = 7.604$, $p < .001$), with an R^2 of .128. Participants' predicted GPAs were equal to 4.559 + 0.817(Intrinsic Motivation) – 0.757 (Frequency of Mobile Technology Use) – 0.034 (Perceived Value of Mobile Technology Use) + 0.689 (Frequency X Perception Interaction) – 0.619 (Frequency X Intrinsic Motivation) – 0.526 (Perception X Intrinsic Motivation) + 0.578 (Frequency X Perception X Intrinsic Motivation), where intrinsic motivation was centered; frequency of use was coded as 0 = Not Frequently, 1 = Frequently; and perceived value was coded as 0 = No, 1 = Yes. Participants' intrinsic motivation score significantly contributed to students' predicted current grades ($t = 2.83$, $p = .005$).

Table 4.6

Multiple regression on current grade in the course

Variable	**B**	**SE**	**t**	***p***
Intercept	4.559	.124	36.681	**.001**
Intrinsic Motivation (Centered)	0.817	.289	2.826	**.005**
Technology Frequency	-0.757	.175	-4.328	**.001**
Technology Perception	-0.034	.162	-0.208	.836
Frequency X Perception	0.689	.208	3.316	**.001**
Frequency X Intrinsic Motivation	-0.619	.342	-1.808	.071
Perception X Intrinsic Motivation	-0.526	.377	-1.394	.164
3-Way Interaction	0.578	.429	1.348	.178

As participants' internal motivation increases, so does their predicted current grade. The frequency with which participants used their devices for academic work also significantly contributed to predicted current grades (t = -4.328, p < .001). Participants who reported using their devices frequently possessed lower predicted current grades than participants who reported not using their devices frequently. Participants' perceived value of mobile technology in terms of learning for this course did not significantly contribute to predicted current grades (t = -0.208, p = .836). However, a significant interaction existed between the frequency and perceived value of mobile technology use (t = 3.316, p < .001), such that participants who perceived the importance of mobile technology as valuable, and used their devices more frequently, possessed higher predicted current grades than those who did not. The interactions between intrinsic motivation and frequency of use, and between intrinsic motivation and technology perception, were not significant predictors of students' current grades. Furthermore, the three-way interaction between frequency, perception, and intrinsic motivation did not significantly predict students' current grades.

A multiple linear regression was calculated to predict students' expected final grades based on their (centered) scores on the IMI, their frequency of technology usage for this course, their perception of technology as valuable for this course, and all of their interactions. As seen in Table 4.7, a significant regression equation was found (F(7, 362) = 8.041, p < .001), with an R^2 of .135. Participants' predicted GPAs were equal to 4.713 + 0.663 (Intrinsic Motivation) – 0.619 (Frequency of Mobile Technology Use) – 0.013 (Perceived value of Mobile Technology Use) + 0.547 (Frequency X Perception Interaction) – 0.481 (Frequency X Intrinsic Motivation) – 0.430 (Perception X Intrinsic Motivation) + 0.547 (Frequency X Perception X Intrinsic Motivation), where intrinsic motivation was centered; frequency of use was coded as 0 = Not Frequently, 1=

Frequently; and perceived value was coded as 0 = No, 1 = Yes.

Table 4.7

Multiple regression on expected final course grade

Variable	B	SE	t	*p*
Intercept	4.713	.108	43.572	**.001**
Intrinsic Motivation (Centered)	0.663	.252	2.635	**.009**
Technology Frequency	-0.619	.152	-4.068	**.001**
Technology Perception	-0.013	.141	-0.091	.928
Frequency X Perception	0.547	.181	3.024	**.003**
Frequency X Intrinsic Motivation	-0.481	.298	-1.615	.107
Perception X Intrinsic Motivation	-0.430	.328	-1.309	.191
3-Way Interaction	0.547	.373	1.466	.143

Participants' intrinsic motivation score significantly contributed to students' predicted expected grades ($t = 2.635$, $p = .009$). As participants' internal motivation increases, so does their predicted expected grade. The frequency with which participants used their devices for academic work also significantly contributed to predicted expected grades ($t = -4.068$, $p < .001$). Participants who reported using their devices frequently possessed lower predicted expected grades than participants who reported not using their devices frequently. Participants' perceived value of mobile technology in terms of learning for this course did not significantly contribute to predicted expected grades ($t = -0.091$, $p = .928$).

However, a significant interaction occurred between the frequency and perceived value of mobile technology use ($t = 3.024$, $p = .003$), such that participants who perceived the importance of mobile technology as valuable, and used their devices more frequently, possessed higher predicted expected grades than those who did not. The interactions between intrinsic motivation and frequency of use, and between intrinsic motivation and technology perception, were not significant predictors of students' expected grades. Furthermore, the three-way interaction between frequency, perception, and intrinsic motivation did not significantly predict students' expected grades.

Chapter Summary

This chapter outlined the processes used for data collection, screening, and the coding and cleaning of data. Descriptions were also provided regarding how internal reliability was measured, and descriptive statistics were additionally reviewed. Furthermore, correlations among the intrinsic motivation scale and subscales, the technology use and value questions, and participants' current and expected grades were calculated and related findings were explored. Lastly, the results of the multiple regression analyses treating intrinsic motivation and technology frequency of use and value as predictor variables, as well as the interaction between intrinsic motivation and frequency and value of mobile technology, were detailed and related findings provided. These findings support the theory that students with higher intrinsic motivation will possess higher grades regardless of whether or not they use technology frequently for this course, and regardless of whether or not they perceive mobile technology as valuable for learning in this course. Correlations were found between students' intrinsic motivation, and multiple facets of their intrinsic motivation, with their current and expected grades. Furthermore, frequency and value of mobile technology use, individually, formed

significant predictors of students' current and final expected grades. However, the interaction with intrinsic motivation and technology usage was not significant. This suggests that students' perceptions of technology do not moderate the relationship between intrinsic motivation and academic success. However, these results must be interpreted cautiously. My study reveals that increased frequency of mobile technology use, when measured alone, adversely impacted expected grades. However, a significant interaction occurred between the frequency and perceived value of mobile technology use ($t = 3.024$, $p = .003$), such that participants who perceived the importance of mobile technology as valuable, and used their devices more frequently, possessed higher predicted expected grades than those who did not. This is perhaps this study's most interesting finding. In the next chapter, I discuss what the findings of this study mean; identify implications for learning, practice, and research; and develop recommendations for future research.

CHAPTER 5: DISCUSSION, IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Discussion

The purpose of my study was to determine the strength of the relationship between intrinsic motivation and grades when mobile technology usage moderates the two variables. Mobile technology use in higher education environments is continuing to rise at a rapid rate (Dahlstrom et al., 2015). Similar to the study conducted by Hernandez and Perez (2014) regarding the rising use of mobile technology in higher education environments, my study found that 77.8% of study participants responded that they used mobile devices "frequently" for their learning. Additionally, my study aligned with previous research (Harris Poll, 2015) revealing that laptops and smartphones were the mobile devices most highly used by learners (92.3% and 68.3% of the time). Mobile technology is fully ingrained in learners' lives, and clearly, most students are inclined to use mobile technology (Kvavik, 2005) for their learning. The trend of increased frequency of mobile technology usage for learning is an important one to address.

Mobile technology and classrooms are becoming more synonymous with each other, but recent studies have suggested that mobile technology use in the classroom is associated with poorer learning outcomes (Lepp, Barkley, & Karpinski, 2015a; Lepp, Li, & Barkley, 2015b). My study added to the body of knowledge by demonstrating high levels of mobile technology usage in the classroom, but my study also challenges previous conclusions concerning mobile technology's impact on outcomes. In this chapter, I discuss ways my study suggests that more research is needed to fully understand the relationship (either positive or negative) between increased mobile technology use and learning outcomes among undergraduate learners aged 18–24.

Major Research Question: Learners' Use and Value of Mobile Technology

The main focus for my research was examining the extent to which a learners' use and value of mobile technology moderates the relationship between their intrinsic motivation and grades. Research has found that intrinsic motivation is positively related to learning outcomes (Fortier, Vallerand, & Guay, 1995; Koestner, Ryan, Bernieri, & Holt, 1984; Ryan & Deci, 2009), and the findings from my study support established longitudinal data suggesting students with higher intrinsic motivation will possess higher grades regardless of whether or not they use technology frequently for their course, and regardless of whether or not they perceive mobile technology as valuable for learning in their course. Similarly, Jeno et al. (2017) measured positive effects of mobile applications and indicated that those who used mobile applications possessed higher intrinsic motivation, perceived competence, and achievement compared to peers who used physical texts.

Similar to Cetin (2015), my study found correlations between students' intrinsic motivation, and multiple facets of their intrinsic motivation, with their current and expected grades. Participants' intrinsic motivation score significantly contributed to students' predicted current grades ($t = 2.83$, $p = .005$) in my study. My study also identified four other positive correlations between intrinsic motivation and participants' expected grades. This expands on and even provides greater detail to findings, such as those by Cetin (2015), that explored learning approaches and academic motivation together as predictors of academic success. Similar to the aim of my study, he employed questionnaires to collect information and ran multiple regression to test for any significant correlations between learners' motivations and higher GPA. Cetin's study revealed significant correlation between a learner's GPA and their motivation level. In this case, my study demonstrates that learners' higher values placed on mobile technology positively

correlate with learners' higher current and expected grades.

In addition, a significant, positive correlation was also found between participants' overall intrinsic motivation and their expected (final) grades. As intrinsic motivation increased, so did the expected grade ($r_s = .228$, $p < .001$). Positive correlations also existed between four of the intrinsic motivation subscales and participants' expected grades: (1) participants' interest or enjoyment and their expected grades ($r_s = .252$, $p < .001$), (2) participants' perceived competence and their expected grades ($r_s = .494$, $p < .001$), (3) participants' perceived choice and their expected grades ($r_s = .107$, $p = .04$), and (4) participants' perceived value and usefulness scores and their expected grades ($r_s = .106$, $p = .043$). A significant, negative correlation was also identified between participants' pressure and tension and their expected grades ($r_s = -.261$, $p < .001$). The correlation between participants' perceived competence and their expected final grade was the largest (See Table 4.4). These findings provide additional depth and support to existing studies demonstrating that mobile technology use continues to increase among students, and that students are aware that use of mobile technology can, at times, increase their levels of achievement (Chen et al., 2015; Benoit, 2016; Jeno, Grytnes, & Vandvik, 2017).

Although mobile technology was not revealed to moderate the relationship between intrinsic motivation and grades, my research did uncover a significant interaction between the frequency and perceived value of mobile technology use ($t = 3.024$, $p = .003$), such that participants who perceived mobile technology's importance as valuable, and used their devices more frequently, possessed higher predicted expected grades than those who did not. Related to this, recent longitudinal research by Adams-Becker et al. (2017) suggested that mobile technology in higher education should be about better use of existing technologies. My data aligns directly with those suggestions, even to the point of identifying that grades decrease when

frequency of usage increases, that grades subsequently increase when value increases, and also that high value and high usage result in higher predicted grades. Although mobile technology is becoming ubiquitous within higher education settings, the understanding of how different learning populations respond to this reality remains limited (Williams et al., 2014). Perceptions that learners carried relative to mobile technology's value for their learning were consistent across learners regardless of their gender, age, ethnicity, family income level, year in school, or whether their course was required as a part of their major. My study's sub-questions further indicated that learners are extremely willing to adopt mobile technology for learning regardless of any positive or negative correlation to their academic success.

Research Sub-Questions: Perceived Value and Perception of Grades

The secondary questions in my study sought to answer how much the learner's perceived value of mobile technology moderates the relationship between intrinsic motivation and grades, and whether a learner's perception of grades influences the value they place on mobile technology. Brooks (2016) found that when compared to the general populous, undergraduates aged 18–24 are exceptional in their adoption of digital world technologies. He also discovered that students view mobile technology as "critical to their learning experiences" (p. 8). Likewise, more than 79% (n = 321) of students in my sample perceived technology as being at least moderately important to their academic success, and 82% (n = 310) of students perceived technology as being valuable to learning in their course.

Similarly, research has indicated that students perceive that mobile technology will enhance their academic achievements (Alrasheedi, Capretz, & Raza, 2015b; Cheon, Lee, Crooks, & Song, 2012; Dahlstrom, 2013; Nassuora, 2012). Specifically, a study conducted by Shonola, Joy, Oyelere, and Suhonen (2016) found that 93% of students studying at universities

believed mobile technology improved their academic performance. The data from this study adds greater depth to this area. Results suggested that the relationship between students' technology use and their grades was weaker than the levels of value or importance placed on mobile technology when it came to the learners' own academic success. Although the interaction(s) between intrinsic motivation, frequency of use, and perceived value of mobile technology scores were not significant predictors of students' expected grades, each separately exerted a measurable impact.

First, the frequency with which participants used their devices for academic work also significantly contributed to predicted expected grades (t = -4.068, p < .001). Participants who reported using their devices frequently possessed lower predicted expected grades than participants who reported not using their devices frequently. In addition, participants' perceived value of mobile technology in terms of learning for this course did not significantly contribute to predicted expected grades (t = -0.091, p = .928). Second, a significant interaction occurred between the frequency and perceived value of mobile technology use (t = 3.024, p = .003), such that participants who perceived mobile technology's importance as valuable, and used their devices more frequently, possessed higher predicted expected grades than those who did not.

A significant correlation was also found for 21–22-year-olds regarding their perception that mobile technology use affects their ability to obtain a desirable grade in this course and their current and expected course grades (r = .423, p = .001; r = .283, p = .011). This suggests there may be more to uncover concerning this age demographic, even though none of the other correlations of interest for other ages were found to be significant.

Implications for Practice

Metros and Sipher (2013) suggested that higher education should be adapting to the opportunities and challenges presented by the ubiquity and pervasiveness of mobile technology. My study identified three specific areas possessing such implications for practice: (1) participants' intrinsic motivation scores significantly contributed to their predicted expected final grades, (2) participants who reported using their devices frequently possessed lower predicted expected grades than participants who reported not using their devices frequently, and (3) participants who perceived the mobile technology's importance as valuable possessed higher predicted expected grades than those who did not. It seems necessary for instructors and researchers alike to continue critically examining the relationship between participants' mobile technology use, and the ways in which instructors regulate the use of devices can shed further light on mobile technology's impact in higher education environments. The data from my study indicated that when mobile technology is valued highly, this often results in higher grades, but that if it is used too frequently, or perhaps even relied on too much for learning, this may negatively affect the learners' ability to obtain the grades they desire.

A study by Lee, Kim, McDonough, Mendoza, and Kim (2017) concerning the effects of cell phone use on college students' learning obtained findings that support incorporating strict cell phone policies in the classroom. Specifically, they found that by targeting learners' cell phone use and evaluating learners' characteristics, instructors can ensure that mobile technology is used to the learners' greatest benefit and avoid technology being used for reasons lacking value to the learning experience and learning environment. Faculty needs to be in tune with ongoing research and likely needs to consider providing learners with clear policies and expectations regarding classroom mobile technology use, best practice, and why that is important

to their success. Learners are clearly motivated to use mobile technology, but if they are not provided a clear set of expectations regarding how to use it and why it is important to their own success in the classroom, the result is likely to reflect what I have found in my study: high frequency of use and lower grades for learners who could otherwise benefit from structure.

Research by Meadows, Soper, Cullen, Wasiuk, McAllister-Gibson, and Danby (2016) revealed that student and instructor expectations concerning mobile technology's use in the classroom often differ. Alrasheedi et al. (2015b) conducted a systematic review on the factors deemed critical to the success of student mobile learning in the classroom, and the "factor judged to be the most important was the involvement of the university administration in providing clear access, goals, and guides" (p. 271). However, they also found that instructors were divided regarding what they perceived to be critical factors for mobile learning's success. This becomes problematic when studies such as one by Kim (2017) also indicated that a majority of college students do not perceive that using a personal mobile device during class represents a substantial distraction, and that most students use their personal mobile devices in the classroom for activities not related to the class content. In this scenario, learners are clearly unaware of their devices' effects as distractors to their learning, and would thus benefit from instructors and administrators setting clear expectations regarding mobile technology usage.

Additionally, my study revealed that it is going to be important for learners themselves to be provided more opportunity to learn about mobile technology's impact on their own learning. As found in my study, participants who reported using their devices frequently possessed lower predicted expected grades than participants who reported not using their devices frequently. Thus, two suggestions should be considered to address this within the institution in which the study was conducted.

First, instructors and administrators at the institution should consider adopting scaffolded learning approaches to the way they incorporate mobile technology into their learning environments. As exemplified in research conducted by Huang, Wu, and Chen (2012), the importance of providing additional support or scaffolding to facilitate learners' cognitive development while using mobile technology can result in better outcomes. Their research indicated that when instructors provide conceptual guidance on using mobile technology in a course, offer learners advice regarding how to think while using mobile technology, and discuss how to leverage technology to improve approaches to problem solving in their course, then the participants in experimental groups using such scaffoldings achieved better learning outcomes than their counterparts. In order to minimize the negative impacts found in my study resulting from the overuse or over-reliance on mobile technology, adopting a scaffolded approach to mobile use in classrooms is likely to help.

Second, universities need to consider broadening curriculum and foundational experiences for all learners to include coursework on effective mobile technology use and practice. We need to continue prioritizing pedagogy over technology, and in many cases, a more direct inclusion of coursework or experiences guiding learners on how to best use their devices is required. An excellent example of how to leverage sound pedagogical practice to prepare learners for using mobile devices in focused, meaningful ways can be seen in research by Hanbidge, Sanderson, and Tin (2015). These authors provided evidence that "mobile information literacy training for students, especially mobile learners, will enhance mobility and flexibility in learning, as well as enable students to be spontaneous, personal, informal, contextual, portable, ubiquitous, and pervasive" (p. 118).

It can be alluring to design courses around mobile technology, or to ignore that mobile

devices are as pervasive as they are. However, technology is a tool, and not the means by which learners find success. The data in my study indicates that institutions are perhaps not doing enough to prevent students believing that simply using technology will make them smarter and more successful in the classroom. If that was the case, then my data would perhaps not indicate that more frequent use of mobile technology actually results in lower grades. Administration needs to work more effectively with faculty to design consistent rules, expectations, and forms of learning on the front of degree programs that do a better job of preparing learners to use mobile technology.

Studies have indicated that when universities set clear distinctions and expectations for device usage (Gillies, 2016), and understand the faculty's ability to link mobile technology use to pedagogy (Biddix, Chung, & Park, 2016), that learners' habitual distraction with technology can be mitigated (Aagaard, 2015). With a greater focus on curriculum design, and a universal set of expectations regarding mobile usage in classrooms, instructors can avoid simply accepting or retrofitting technology to fit their instructional needs. As a result, learners might experience a more defined path by which to find success when it comes to using their mobile devices while learning, and we can therefore ensure that increased mobile technology use actually exerts a positive influence on learners.

Lastly, as my study indicated, intrinsic motivation scores were found to be a significant predictor of students' current grades; as participants' internal motivation increased, so did their expected final grade. Identifying ways to use motivation and mobile technology in harmony should help to establish practical ways of testing new methodologies in the classroom and find new avenues for bridging the gap between the perceived value of mobile technology and outcomes in courses. Accordingly, Dahlstrom et al. (2015) observed that "mobile technology has

rarely been a strategic differentiator in higher education, but this may be changing" (p. 34). Students' expectations are growing, and so is both their reliance on mobile technology and the value they place on it for access to information.

Recommendations for Future Research

Though this study did not establish a statistically significant relationship between intrinsic motivation and grades when mobile technology usage moderates the two variables, opportunities for continued research still exist. First, the majority of participants (n = 321; 84.9%) rated technology as moderately or extremely important to their academic success in their course. Most participants (n = 266; 70.6%) also answered *"Yes"* when asked whether they felt that mobile technology use affected their ability to obtain desirable grades in this course. My study has thus uncovered that the higher the level of value or belief that learners associated success or grades with their mobile devices, the more likely they were to actually obtain better grades. However, my data also makes clear that as the frequency of use increases, a negative impacts on learners occurs. This would suggest that the quality of mobile device use is far more important than the number of times a learner actually uses it.

In order to unpack this phenomenon, future research should focus on applying what is known as suspension of disbelief. Factors that contribute to a learner's ability to suspend disbelief include emotional buy-in and how learners assign value or meaning (Muckler, 2017). According to Muckler (2017), the concept of emotional buy-in applies across disciplines. Emotional buy-in occurs when participants experience an emotional attachment, and this emotional connection allows participants to assign meaning to educational experiences (Rutherford-Hemming, 2012). A study focusing on "why" learners associate so much meaning and value with mobile technology would add greater depth to the findings from my study. In

order to do so, such a study should explore the level of emotional attachment to devices and identify what allows a learner to become so engrossed with them to the point that as their valuation of the tool increases, so does the tool's impact on their learning. As a tool, mobile technology can be persuasive by making target behavior easier (Fogg, 2003), which may be why the data from my study simultaneously indicates a disconnect between how frequently a learner uses mobile technology and its actual impact on learning outcomes in courses. Knowing how learners' motivations are influenced by mobile technology's persuasive nature can help with understanding how learners learn and further help determine the ways in which mobile technology may impact their grades.

Other potential avenues for research could be to recreate this study while focusing on the use of only a single technology, or focusing on an older age group as a comparison. For example, such a study could focus on whether a statistically significant relationship exists between intrinsic motivation and grades when only mobile phones or only tablets are used. My study has established a greater understanding concerning the ways in which learners attribute multiple types of mobile technology to their success or failure. However, I was unable to identify which device they focus on or prefer to use. Over 60% of participants in this study used mobile phones for learning, as an example.

Additionally, prior to adjusting the data to remove respondents aged 25 years and older, the findings suggested that the results were far less significant. A comparative case study to determine what variables may impact the perceptions and values of older-aged undergraduates might provide entirely new avenues for research regarding how mobile technology may impact the motivations, use, or perceived value possessed by a broader range of ages. Other studies could similarly explore the analysis of demographics within this study. For example, in my

study, nearly 65% of respondents were female. Running a study to compare gender against performance, motivation, or mobile technology use could result in a broader understanding of the learner population and help identify learner characteristics that could be important to understand at a greater depth. A similar study could also be conducted exploring the participants' area of study to understand more about the ways learners use mobile technology in the sciences versus the humanities, for instance. This may produce information that is helpful in determining whether learners from different campus areas are approaching mobile technology in different ways.

Kalissa and Picard (2017) reported that mobile phones represented one of the mobile devices most frequently used by learners in higher education settings. Findings by Crompton and Burke (2018) found that 16 of 23 studies focusing on mobile learning's impact on outcomes indicated that mobile device use resulted in increased student learning. Narrowing the focus of my study to address the impacts of mobile phones, for example, may establish a statistically significant relationship between intrinsic motivation and grades. For higher education learners as well as faculty to make informed decisions regarding which mobile technologies to use for learning and teaching, it is important that future studies explore all specific mobile technologies in order to understand which mobile technologies may be best suited for classroom use. Another approach to my study could similarly be repeated with specific courses or subjects being investigated. It is possible that content from different subjects influences the way that mobile technology moderates motivation and grades.

Additionally, my study was fully quantitative and assumed a fixed and measurable reality. If qualitative approaches were applied to this study, a mixed methods approach could investigate and describe themes concerning "how" devices are used while learning, observe times when

participants access their devices, understand from participants what triggers them to use mobile technology as a resource in learning, and provide a better understanding regarding the behavior behind the statistical inferences that my study uncovered. Future studies could focus on understanding more about why learners perceive mobile devices so highly in relation to their grades and outcomes, and why they choose to use them frequently or infrequently as they relate to their learning. A study by Harpur (2017) provides a useful example of blended research that was able to increase academic effectiveness by using qualitative methods to find congruence between lecturer and student opinions on mobile productivity. Qualitative research could add depth to my study in similar ways by drawing on the experience and perceptions of faculty in addition to that of learners.

Finally, part of the reason there may have been a lack of significant findings could be limited variability or range of some of the variables in the study. For example, almost all of the students expected an A or B in the course (> 93% of the sample). It might thus be difficult to find factors that determine or differentiate what students expect their grades to be when the majority expect good grades already. Future studies should focus on finding ways to ask questions that provide greater variability in particular, as well as explore ways to broaden findings from this study.

Conclusions

What is most surprising in this study is the overwhelming number of learners who use mobile devices frequently, but obtain lower grades on average compared to their peers who use such technology less frequently. What was also somewhat of a surprise was that, at the same time, those learners who place higher value on mobile technology for their learning receive higher grades than their peers who do not place as much value on it. This essentially means that

the value a learner places on mobile technology is highly meaningful, but their grades will all come down to how effectively they use mobile technology rather than how often. Over 70% of participants felt that mobile technology use affects their ability to obtain desirable grades in their course, and over 84% rated technology as moderately or extremely important to their academic success in their course. Findings clearly suggest that more time needs to be spent on measuring mobile technology's impact on motivation and outcomes. Additional exploration is further necessary for the approaches taken by administrators and faculty to establish standards of practice for mobile technology in teaching and in learning to become more effective. There also needs to be better support and guidance provided for learners regarding how to use their devices in ways that support their classroom success.

Mobile technology is attractive, as it empowers each of us to leverage a world of data in mere seconds for any question or purpose we intend. That power is real, but it can have dire consequences if we allow it to dilute critical thinking, exploration and inquiry, and self-reliance. As evidenced in my study, learners perhaps do not realize that the elasticity of mobile technology is in reality more a detriment to their ability to learn than they may know.

As I stated in the beginning of this study, we know now that mobile technology is a tool that learners rely on. Understanding the relationships between learners' motivations and mobile technology's influence on motivation (Wang, 2013; Ransdell, 2011; Prensky, 2010; McHaney, 2011) could enable institutions to more effectively support learners in connecting mobile technology use with their own motivations and values, and to ultimately find greater success. Now more than ever, universities need to work to understand what can be done to embrace mobile technology in meaningful ways, empower learners to use it freely and effectively, and allow it to positively influence the way they digest information.

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APPENDIX A: Online Consent Form

University of Wisconsin-Milwaukee
Informed Consent to Participate in Research

Study title: Mobile Technology Use as a Moderator for Understanding the Relationship Between Intrinsic Motivation and Grades

Researcher[s]:

- David Seckman, Doctoral Student, Administrative Leadership
- Dr. Simone C.O. Conceição, Ph.D., Professor
  Chair, Department of Administrative Leadership

I am inviting you to participate in a research study. Participation is completely voluntary. If you agree to participate, you can always change your mind and withdraw. There are no negative consequences, whatever you decide.

What is the purpose of this study?
The purpose of this study is to determine if mobile technology use influences the relationship between intrinsic motivation and grades.

What will I do?
This survey will ask questions about the extent that you use and value of mobile technology. Questions on how much value you place on mobile technology for your learning, how much mobile technology ties to your success as a learner, or whether you feel grades may influence your perceptions of mobile technology use. It also includes several questions around your motivations for learning, interest in what you are learning, and the level of effort you feel it takes to learn.

Risks

- Some questions may be very personal to your learning style. You can skip any questions you don't want to answer, or stop the survey entirely.
- Online data being hacked or intercepted: This is a risk you experience any time you provide information online. We're using a secure system to collect these data, but we can't completely eliminate this risk.
- Breach of confidentiality: There is a chance your data could be seen by someone who shouldn't have access to it. We're minimizing this risk in the following ways
    - Data are fully confidential.
    - Data will be stored on a password-protected, encrypted computer.
    - During the data collection phase, your emails will not be connected through your responses as the Survey Link will be anonymous.
    - IP addresses will be collected, but will be removed and replaced with a code.

Possible benefits: There are no anticipated direct benefits to the individual participants who choose to take part in the study and complete the survey. There are, however, several benefits that the study will produce for educators, as well as society.

The study will aim to uncover more information about the value learners place on mobile technology. By doing so, it may identify the extent to which mobile technology influences intrinsic motivation and grades. Additionally, knowing more about how learners attribute mobile technology to their success or failure, and understanding whether they feel they are likely to experience similar results the next time they use mobile technology could allow for insights into motivational forces driving the use of mobile technology.

Estimated number of participants: 500-700

How long will it take? 10-20 minutes.

Costs: None.

Compensation: None.

Future research: De-identified data (all identifying information removed) may be shared with other researchers.

Confidentiality and Data Security
We will not collect any identifying information outside of email for the research, as it is not necessary. A listserv will be created by the Principle Investigator that will be used to distribute communications. Student Investigator will only have access to the listserv address; all communications will ensure emails are placed into the "BCC" line in order to maintain confidentiality.

Where will data be stored? Data will be stored on a password-protected, encrypted computer, as well as on the servers for the online survey software (Qualtrics).

How long will it be kept? Three years.

Who can see my data?

- We (the researchers) will have access to alphanumerically coded data (names removed and labeled with a randomly assigned study ID). This is so we can analyze the data and conduct the study.

- The Institutional Review Board (IRB) at UWM, the Office for Human Research Protections (OHRP), or other federal agencies may review all the study data. This is to ensure we're following laws and ethical guidelines.
- We may share our findings in publications or presentations. If we do, the results will be aggregate (grouped) data, with no individual results.

Contact information:
For questions about the research, complaints, or problems: Contact David Seckman, 1-608-320-1242, dseckman@uwm.edu.

For questions about your rights as a research participant, complaints, or problems: Contact the UWM IRB (Institutional Review Board; provides ethics oversight) at 414-229-3173 / irbinfo@uwm.edu.

Please print this screen if you want to be able to access the information later.
IRB #: 19.047
IRB Approval Date: 9/6/2018

Agreement to Participate
If you meet the eligibility criteria below and would like to participate in this study, click the button below to begin the survey. Remember, your participation is completely voluntary, and you're free to withdraw at any time.

- I am at least 18 years old
- I am enrolled as an undergraduate student

Hit the "Submit Button" to acknowledge consent to participate, and continue to the survey.

APPENDIX B: IRB Exemption and Amendments

UNIVERSITY of WISCONSIN
UWMILWAUKEE
Department of University Safety & Assurances

Melody Harries
IRB Administrator
Institutional Review Board
Engelmann 270
P. O. Box 413
Milwaukee, WI 53201-0413
(414) 229-3182 *phone*
(414) 229-6729 *fax*

http://www.irb.uwm.edu
harries@uwm.edu

Modification/Amendment Notice of IRB Exempt Status

Date: December 4, 2018

To: Simone Conceição, PhD
Dept: Urban Education

CC: David Seckman

IRB#: 19.047
Title: Mobile Technology Use as a Moderator for Understanding the Relationship Between Intrinsic Motivation and Grades

After review of your proposed changes to the research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol still meets the criteria for Exempt Status under Category 2 as governed by 45 CFR 46.101 subpart b, and your protocol has received modification/amendment approval for:

- Adding recruitment email

This protocol has been approved as exempt for three years and IRB approval will expire on September 5, 2021. If you plan to continue any research related activities (e.g., enrollment of subjects, study interventions, data analysis, etc.) past the date of IRB expiration, please respond to the IRB's status request that will be sent by email approximately two weeks before the expiration date. If the study is closed or completed before the IRB expiration date, you may notify the IRB by sending an email to irbinfo@uwm.edu with the study number and the status, so we can keep our study records accurate.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. The principal investigator is responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records and promptly reporting to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

As Principal Investigator, it is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation and best wishes for a successful project.

Respectfully,
Melody Harries

Melody Harries
IRB Administrator

UNIVERSITY of WISCONSIN
UWMILWAUKEE
Department of University Safety & Assurances

Leah Stoiber
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lstoiber@uwm.edu

New Study - Notice of IRB Exempt Status

Date: September 6, 2018

To: Simone Conceicao, PhD
Dept: Urban Education

CC: David Seckman

IRB#: 19.047
Title: Mobile Technology Use as a Moderator for Understanding the Relationship Between Intrinsic Motivation and Grades

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol has been granted Exempt Status under Category 2 as governed by 45 CFR 46.101(b).

This protocol has been approved as exempt for three years and IRB approval will expire on September 5, 2021. If you plan to continue any research related activities (e.g., enrollment of subjects, study interventions, data analysis, etc.) past the date of IRB expiration, please respond to the IRB's status request that will be sent by email approximately two weeks before the expiration date. If the study is closed or completed before the IRB expiration date, you may notify the IRB by sending an email to irbinfo@uwm.edu with the study number and the status, so we can keep our study records accurate.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. The principal investigator is responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records and promptly reporting to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

As Principal Investigator, it is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation, and best wishes for a successful project.

Respectfully,
Leah Stoiber

Leah Stoiber
IRB Administrator

APPENDIX C: Survey Tool

1. What is your gender?
    a. ☐ Female
    b. ☐ Male
    c. ☐ Non-binary/ third gender
    d. ☐ Prefer to self-describe _____
    e. ☐ Prefer not to say
2. What is your racial or ethnic identification? (Select all that apply)
    a. ☐ American Indian or Alaska Native
    b. ☐ Asian
    c. ☐ Black or African American
    d. ☐ Hispanic or Latino
    e. ☐ Native Hawaiian or Other Pacific Islander
    f. ☐ White or Caucasian
    g. ☐ Other
    h. ☐ I prefer not to respond
3. Estimated Total Family income level
    a. ☐ Less than $20,000

b. ☐ $20,000 to $49,999

c. ☐ $50,000 to $79,999

d. ☐ $80,000 to $109,999

e. ☐ $110,000 to $150,000

f. ☐ Over $150,000

4. Age
   a. ☐ 18-19

   b. ☐ 20-21

   c. ☐ 22-23

   d. ☐ 24 and above

5. Year in school (freshman, sophomore, junior, senior)
   a. ☐ Freshman

   b. ☐ Sophomore

   c. ☐ Junior

   d. ☐ Senior

6. Declared Major of Study
   a. Please Type Here _____

7. Is this course required as part of your Major or Minor of Study?

   a. ☐ Yes

b. ☐ No

8. Part-time or full-time student
    a. ☐ Part-time

    b. ☐ Full-time

9. Local resident (Greater Metropolitan), State Resident, or Out-of-State Resident
    a. ☐ Local resident (Greater Metropolitan)

    b. ☐ State Resident (non-Greater Metropolitan)

    c. ☐ Out-of-State Resident

10. Current grade in the course
    a. ☐ A – to A

    b. ☐ B – to B+

    c. ☐ C – to C+

    d. ☐ D – to D+

    e. ☐ F or Incomplete

11. Expected Final grade in the course
    a. ☐ A – to A

    b. ☐ B – to B+

    c. ☐ C – to C+

    d. ☐ D – to D+

e. ☐ F or Incomplete

12. Please indicate your cumulative GPA coming into this course, by marking one of the categories below:
    a. ☐ 1.0-1.9 GPA

    b. ☐ 2.0-2.4 GPA

    c. ☐ 2.5-2.9 GPA

    d. ☐ 3.0-3.4 GPA

    e. ☐ 3.5-4.0 GPA

13. Please indicate which (if any or several) of the following devices you use for your learning in this course:
    a. ☐ iPod or other mP4 player

    b. ☐ E-book reader

    c. ☐ Laptop PC or Mac

    d. ☐ Tablet

    e. ☐ Smartphone

14. How frequently have you used these devices for your academic work in this course (e.g., access library resources, look up course related materials or information, capture class activities by recording or taking pictures, interact with peers on social media around course-related materials or content)?
    a. ☐ Frequently (each time I am in this class)

    b. ☐ Not Frequently (sparingly or not at all during this class)

15. How important do you perceive your mobile technologies are to your academic success in this course?

a. ☐ Extremely Important

b. ☐ Moderately Important

c. ☐ Not Sure of How Important

d. ☐ Not Very Important

e. ☐ Not at all Important

16. Do you perceive mobile technology as valuable to your learning in this course?
    a. ☐ Yes

    b. ☐ No

17. Do you feel mobile technology use affects your ability to get desirable grades in this course?
    a. ☐ Yes

    b. ☐ No

(Below are listed the 36 items that will be used to determine level of Intrinsic Motivation. These questions will be randomized, starting at question #18 as they are presented to the participant through the Qualtrics survey tool and will be answered by using a likert-scale rating)

For each of the following statements, please indicate how true it is for you, using the following scale:

1	**2**	**3**	**4**	**5**	**0**
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	I Don't Know

Interest/Enjoyment

18. I enjoy doing this course very much. It is fun to do.
19. I think this is a boring course. (R)
20. This course does not hold my attention at all. (R)
21. I describe this course as very interesting.
22. I think this course is quite enjoyable.
23. While I am in this course, I am thinking about how much I enjoy it.

Perceived Competence

24. I think I am doing pretty good in this course.
25. I think I am doing pretty well in this course, compared to other students.
26. After working on this course for awhile, I feel pretty competent.
27. I am satisfied with my performance in this course.
28. I am pretty skilled at this course content.
29. This is a course that I can't do very well. (R)

Effort/Importance

30. I place a lot of effort into this course.
31. I don't try very hard to do well in this course. (R)
32. I try very hard in this course.
33. It is important to me to do well in this course.
34. I don't put much energy into this course. (R)

Pressure/Tension

35. I do not feel nervous at all while doing this course. (R)
36. I feel very tense while doing this course.
37. I am very relaxed while doing this course. (R)
38. I am anxious while working in this course.
39. I feel pressured while doing work in this course.

Perceived Choice

40. I believe I have some choice about taking this course.
41. I feel like it is not my own choice to take this course. (R)
42. I don't really have a choice about taking this course. (R)
43. I feel like I have to do this course. (R)
44. I am doing this course because I have no choice. (R)
45. I am doing this course because I want to.
46. I am doing this course because I have to. (R)

Value/Usefulness

47. I believe this course will be of some value to me.
48. I think that doing this course is useful.
49. I think this course is important to do.
50. I would be willing to do this course again because it has some value to me.
51. I think this course will help me to succeed.
52. I believe this course could be beneficial to me.
53. I think this is an important course.

APPENDIX D: Figures and Tables

FIGURES

Figure 3.1

Multiple regression analyses examining the relationship between intrinsic motivation and grades

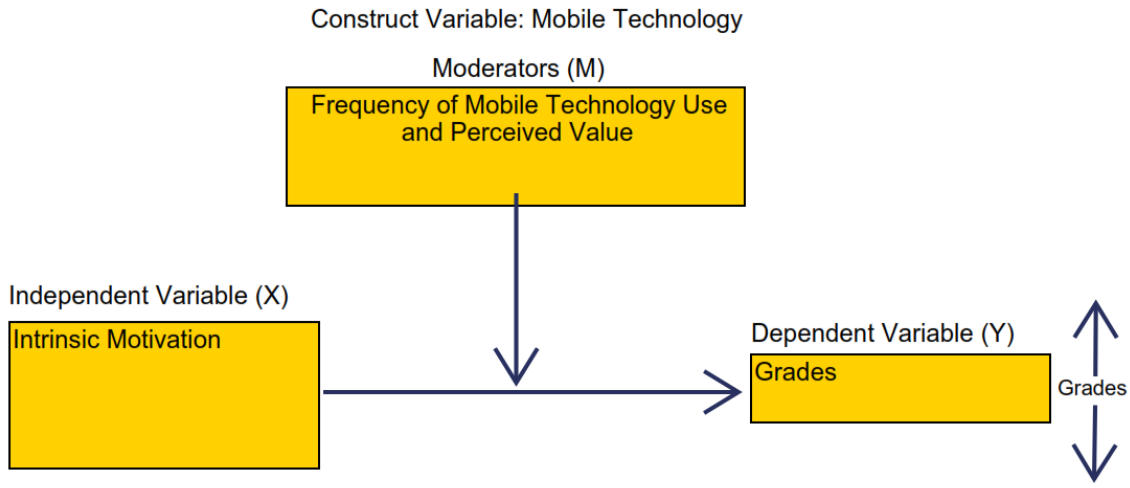


Figure 4.1

Current and expected grades for participants included in the study.

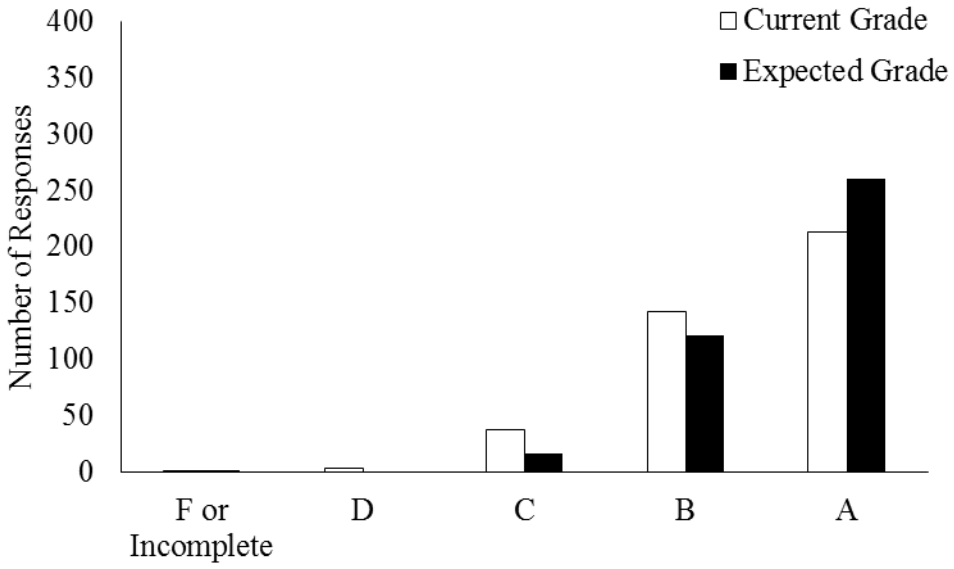


Figure 4.2

Number of students who use technological devices in learning for this course.

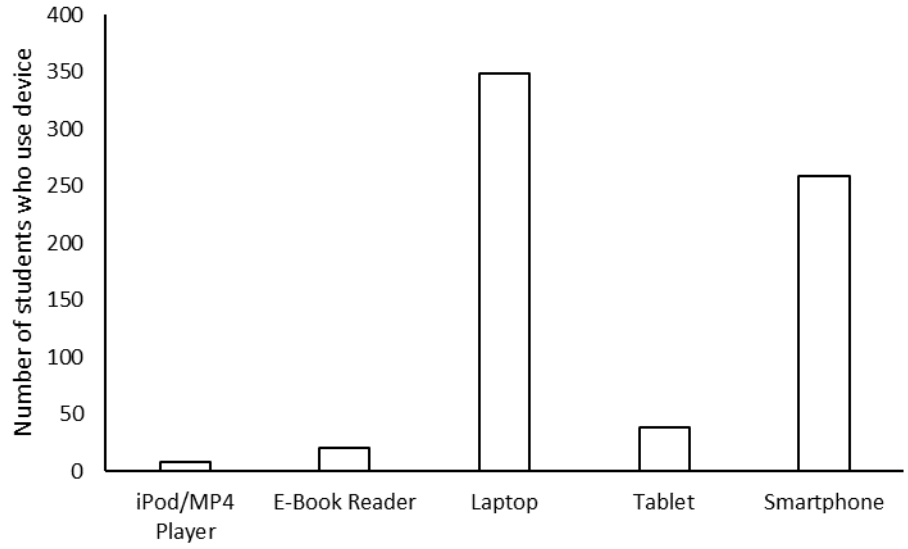


Figure 4.3

Frequency of usage of technological devices for academic work in this course.

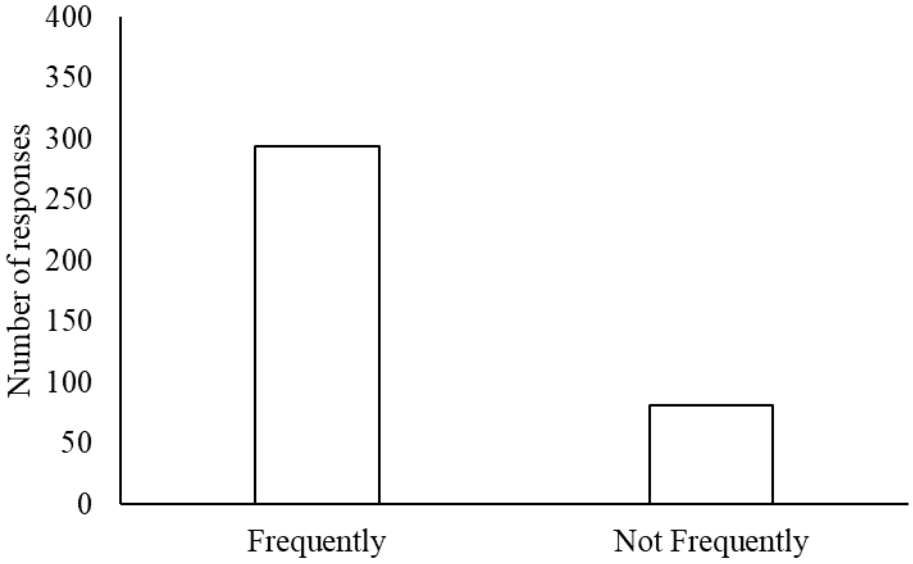


Figure 4.4

How important do you perceive mobile technologies are to academic success in this course?

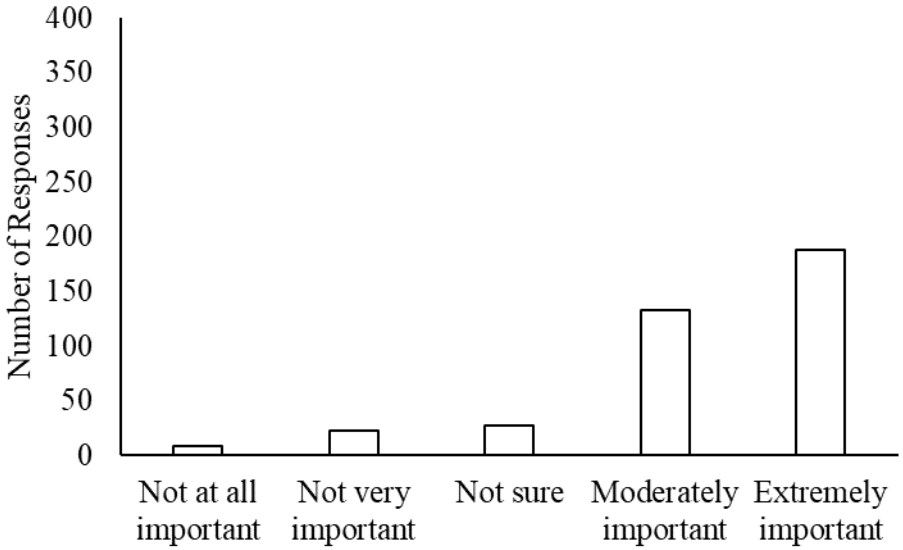


Figure 4.5.

Do you perceive mobile technology as valuable to your learning in this course?

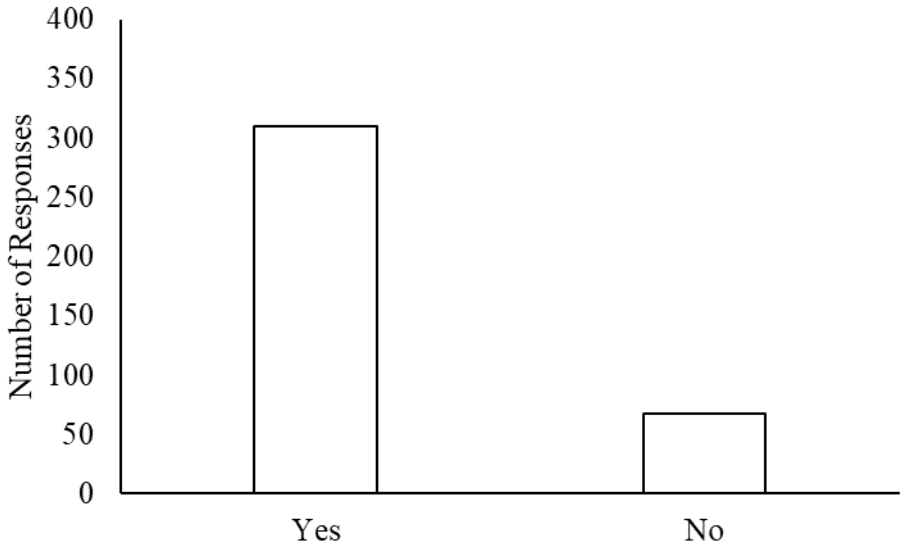
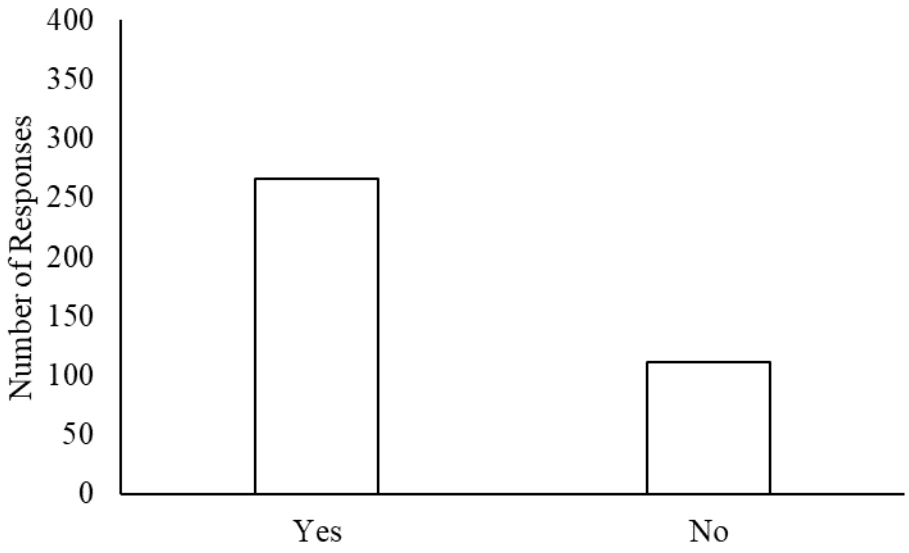


Figure 4.6

Do you feel mobile technology use affects your ability to get desirable grades in this course?



TABLES

Table 2.1

Continuum of motivational, regulation, and behavior types.

Type of Motivation	Amotivation	Extrinsic				Intrinsic
Type of Regulation		External	Introjected	Identified	Integrated	Intrinsic
Quality of Behavior	Non-self-determined				Self-determined	
(modified from Ryan & Deci, 2002)						

Table 4.1

Demographic characteristics.

	N	**%**
Gender		
Male	110	29.1
Female	260	68.8
Other	8	2.1
Age		
18-19 years old	131	34.7
20-21 years old	165	43.7
22-24 years old	82	21.7
Ethnicity		
Asian	43	11.4
Black or African American	22	5.8
Hispanic or Latino	39	10.3
White or Caucasian	230	60.8
Other	5	1.3

Multi	38	10.1
Prefer not to respond	1	0.3
Estimated Family Income		
< $20,000	50	13.5
$20,000 - $49,000	92	24.9
$50,000 - $79,000	88	23.8
$80,000 - $109,000	59	15.9
$110,000 - $150,000	44	11.9
>$150,000	37	10.0
Missing/no response	8	--
Year in School (undergraduate)		
Freshman	91	24.1
Sophomore	89	23.5
Junior	123	32.5
Senior	75	19.8
Student Status		
Part-Time	17	4.5
Full-Time	361	95.5
Is this course required as part of your major/minor?		
Yes	210	56.3
No	163	43.7
Missing/no response	5	--
Residence		
Local Resident (Greater Milwaukee)	213	56.3
State resident (non-Greater Milwaukee	122	32.3
Out-of-state resident	43	11.4

Table 4.2
Descriptive statistics of the Intrinsic Motivation Inventory (IMI) and Subscales.

Scale	Number of Items	Participants (n)	Mean (SD)	Median	Mode	Range	Reliability (Cronbach's Alpha)
Interest and Enjoyment	6	378	3.97 (0.79)	4.00	4.00	1.67 – 5.33	.826
Perceived Competence	6	372	4.02 (0.74)	4.17	4.17	1.83 – 5.17	.833
Effort and Importance	5	371	4.24 (0.76)	4.40	4.40	2.20 – 5.80	.799
Pressure and Tension	5	373	3.22 (0.90)	3.20	3.40	1.40 – 5.40	.816
Perceived Choice	7	371	3.76 (0.98)	3.71	3.71	1.71 – 5.71	.887
Value and Usefulness	7	369	3.99 (0.80)	4.00	5.00	1.86 – 6.00	.950
Intrinsic Motivation	36	360	3.88 (0.48)	3.92	3.33	2.39 – 4.95	.883

Table 4.3
Shapiro-Wilk Test of Normality for the intrinsic motivation inventory and its subscales.

	Shapiro-Wilk test of normality		
Tasks	Statistic	df	*p*
Interest and Enjoyment	.977	363	< .001
Perceived Competence	.962	363	< .001
Effort and Importance	.968	363	< .001
Pressure and Tension	.986	363	.002
Perceived Choice	.984	363	< .001
Value and Usefulness	.944	363	< .001
Intrinsic Motivation	.994	363	.136

Table 4.4

Correlations between Intrinsic motivation inventory (and subscales) and students' current and expected grades.

	Current Grade	**Expected Grade**
Interest and Enjoyment	.208***	.252***
Perceived Competence	.497***	.494***
Effort and Importance	.006	.078
Pressure and Tension	-.222***	-.261***
Perceived Choice	.057	.107*
Value and Usefulness	.079	.106*
Intrinsic Motivation	.181***	.228***

Table 4.5

Correlations between Technology items and students' current and expected grades.

	Current Grade	**Expected Grade**
Frequency of use of mobile technology for academic work in this course	-.112*	-.116*
Do you perceive mobile technology as valuable to your learning in this course?	.073	.066
How important do you perceive mobile technology to academic success in this course?	.115*	.124*
Does mobile technology use affect your ability to get desirable grades in this course?	-.055	-.037

Table 4.6

Multiple Regression on current grade in the course.

Variable	**B**	**SE**	**t**	***p***
Intercept	4.559	.124	36.681	**.001**
Intrinsic Motivation (Centered)	0.817	.289	2.826	**.005**
Technology Frequency	-0.757	.175	-4.328	**.001**
Technology Perception	-0.034	.162	-0.208	.836
Frequency X Perception	0.689	.208	3.316	**.001**
Frequency X Intrinsic Motivation	-0.619	.342	-1.808	.071
Perception X Intrinsic Motivation	-0.526	.377	-1.394	.164
3-way Interaction	0.578	.429	1.348	.178

Table 4.7

Multiple Regression on expected final course grade.

Variable	**B**	**SE**	**t**	***p***
Intercept	4.713	.108	43.572	**.001**
Intrinsic Motivation (Centered)	0.663	.252	2.635	**.009**
Technology Frequency	-0.619	.152	-4.068	**.001**
Technology Perception	-0.013	.141	-0.091	.928
Frequency X Perception	0.547	.181	3.024	**.003**
Frequency X Intrinsic Motivation	-0.481	.298	-1.615	.107
Perception X Intrinsic Motivation	-0.430	.328	-1.309	.191
3-way Interaction	0.547	.373	1.466	.143

CURRICULUM VITAE

David Seckman

Education

B.A University of Missouri-St. Louis Major: Anthropology	May 2005
M.S. University of Wisconsin-Milwaukee Major: Administrative Leadership	May 2008
M.S. Kaplan University Major: Instructional Design	May 2010

Dissertation Title: Mobile Technology Use as a Moderator for Understanding the Relationship Between Intrinsic Motivation and Grades

Awards

2014-15	**2015-16**
Chancellors Scholar – UW Milwaukee	Chancellors Scholar – UW Milwaukee
Sydney Hambling Scholar	Elsie Eagan Scholar
A&M Singer Scholar	Teachers for a New Era Scholar
	Tessmer Scholar

Publications

"Alarmingly Shallow: The effects of internet on our culture, community, and social well-being."

eLearn Magazine/June 2014

"Why Higher Education's pursuit of eLearning technology fails minority learners."

***Journal of Computer Technology and Application*, 4 (9) /2013**

Job History

2018-Present	Abbott Labs	Global Sr. Manager, Learning and Development
2016-2018	National Restaurant Association	Sr. Manager, eLearning Development
2014-2016	Pearson Education	Manager of Instructional Design
2010-2014	Kaplan University	Curriculum Program Manager
2006-2010	Herzing University	Curriculum Production Specialist