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The Influence of Mobile Technologies on Students in Higher Education: A Qualitative Descriptive Case Study

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Abstract

Mobile devices have become a ubiquitous tool for academics by tertiary students. The purpose of this qualitative descriptive case study was to explore college students' perception of the influences mobile technology has had on their education. Koole's FRAME model provided the conceptual framework for this study, which focused on the interrelationship of the mobile device, the learner, and social aspects of the mobile learning process. Data collection included information obtained from 13 graduate students, with the use of a demographic questionnaire, personal interviews, and focus groups conducted via an online web conference site. The research questions that guided this study were— how did these college students believe the three specific aspects of mobile learning (device, learner, & social) had influenced their collegiate experiences? Common patterns emerged during analysis, for example, the students' widespread ownership of mobile devices had promoted greater student learning. The adaptability of mobile technology to specific learning needs proved to be beneficial for students as well. In contrast, a negative social effect of mobile learning was evident from the students' perception of less interaction and collaboration with fellow students and faculty members. The findings in this study that addressed the question of how the three components of mobile learning had influenced these 13 students' collegiate experiences, have provided additional insight on the use of mobile technology in academia.

Keywords: Higher education, Koole's FRAME model, mobile learning, mobile technology, online learning

Dedication

This dissertation would not been completed without God's strength and continuous guidance throughout this journey. I also dedicate this dissertation to my parents, Sally and Donald Lemley who are in heaven, and to my wonderful children, Mike and Nakia, who have always been such tremendous blessings in my life.

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Chapter 1: Introduction

Introduction to the Problem

It has been estimated there are now more mobile phone subscriptions than the number of humans on the earth (Khaddage et al., 2015). Mobile technology is transforming higher education. The advances in wireless technologies have resulted in most college students not only owning several mobile devices (Vázquez-Cano, 2014), but many of the students are now insisting on using this technology in their academic lives as well (Chen & deNoyelles, 2013). Although the increased use of mobile technologies may have been disruptive for educators (Ally & Prieto-Blázquez, 2014), its' rampant use by students are requiring the further development and implementation of mobile learning into universities' strategic plans. The exploration of how mobile technology has affected university students was the focus of this study.

Ally and Prieto-Blázquez (2014) asserted that in the future, mobile learning will become widespread; learners will learn on smart systems all over, yet—the learner will remain mobile. Mobile technology as it continues to evolve, will soon be providing new virtual learning capabilities for the students also (Ally & Prieto-Blázquez, 2014). Daanen and Facer (as cited by Ally & Prieto-Blázquez, 2014) predicted by the year 2020, digital technology that can communicate with one another will be embedded in much of our household items such as clothes, notebooks, and keys. These technological advances have resulted in learning becoming more pervasive on a global scale (Ally & Prieto-Blázquez, 2014).

It was not just the mobile devices that have evolved. The development and sale of educational applications (apps) also has grown steadily, with apps becoming more accessible and affordable for students worldwide (Ng & Cumming, 2016; Wai, Ng, Chiu, Ho, & Lo, 2016). According to Ally and Prieto-Blázquez (2014), "mobile technology in the field of teaching and

learning has recently become one of the most important areas of research" for educators today (p. 143).

Furthermore, this present generation of "digital natives" have become quite accustomed to using mobile devices in every area of their lives (Wai et al., 2016). Bomhold (as cited in Wai et al., 2016) noted that most college students are already utilizing smartphones or applications for educational purposes. Having a clearer understanding of the role of mobile learning in the academic life of tertiary students would be a significant key in implementing mobile learning in curricula.

Mobile learning can be accomplished without utilizing mobile technology; for example, a small book would be quite portable and accessible as well as providing ease of use for the learner. However, for the purpose of this study, the term *mobile learning* refers specifically to students' use of personal mobile devices and software for learning in their college experience.

Background, Context, History, and Conceptual Framework for the Problem

The concept of mobile learning has been around since the invention of the printed book, which allowed a learner to learn in any location (Miller & Doering, 2014). However, it was the technological advances of the 1970s that provided such hardware and software technologies as "the floppy disk, the microcomputer, the VHS videocassette recorder, and the first mobile phone" (Berge & Muilenburg, 2013, p. 11). These technologies became more personalized in the 80's and 90s. Rather than shared desktop personal computers, there were now laptops and personal digital assistants (PDAs) with personal cell phones replacing the land line telephone (Berge & Muilenburg, 2013). However, Berge and Muilenburg felt that these first mobile technologies became problematic also for its users. Such issues like poor processor speed and decreased battery life prevented these tools from having a significant impact on the classroom.

During the 2000s as the technology in smartphones began to offer the same features and functionalities of the PDAs, as well as adding mobile-phone capabilities to the device, which caused PDAs to be used less (Berge & Muilenburg, 2013). Berge and Muilenburg explained that cell phones initially were only owned by those who had the financial means, but today, the cell phone has become the constant companion of millions worldwide. Additionally, because so many students now own their own devices, the cost of colleges and universities providing this technology for the students has decreased or has been abolished completely (Berge & Muilenburg, 2013). With the advent of tablet computers, students have gained greater mobility in their pursuit of a college education (Berge & Muilenburg, 2013).

Consequently, college students seeking ways to enhance their education, have chosen a compact, easily transportable means to store and access multiple references materials and educational apps instead of having to tote numerous cumbersome textbooks class to class (Berge & Muilenburg, 2013). For example, the health care system commonly utilizes different mobile technologies to train healthcare professionals and assist them in providing care to their patients (Ally & Prieto-Blázquez, 2014). A study by Fernando López et al. (as cited by Ally & Prieto-Blázquez, 2014) found that 25% of the students' accesses to the learning management system (LMS) were from mobile devices.

Mobile apps or devices for learning continues to be growing trend for both educators and learners in higher education (Vázquez-Cano, 2014). Additionally, according to Chen and deNoyelles (2013), the students that are using these devices now have the ability to connect and interact with one another worldwide, as well, of having much greater accessibility to more information. The use of mobile technology appears to be transforming education globally also.

These apps or devices have been found to promote learning in students and provide the ability for students to even produce content themselves (Chen & deNoyelles, 2013).

According to Ally and Prieto-Blázquez (2014), mobile learning can be very beneficial for students. Ally and Prieto-Blázquez stated that not only these students are able to learn in the convenience and familiarity of their own learning community, but mobile technology also enables diverse student cultures to learn and collaborate with other communities of learners. Such communities "where learners can tutor and help each other in the learning process, thus resulting in high-level learning" (Ally & Prieto-Blázquez, 2014, p. 146).

The conceptual framework for this research study is based off the Koole's FRAME Model which was originally developed to understand mobile learning and its possible impact on distance learners (Koole, McQuilkin, & Ally, 2010). This model described a relationship between the learner, the mobile technology, the social interaction that occurs in the mobile learning process. The researchers' purpose with this model was "to better understand the complexities of mobile learning, [and] its perceived usefulness" (Koole et al., 2010, p. 62). Likewise, the intent of this study was to further explore the feelings and beliefs of the mobile learner in a university setting.

Statement of the Problem

Whether students attend a traditional brick-and-mortar institution for their college education or a distance learning program at home, students are choosing more to use the mobile apps on smart phones, tablets, and laptops not just in their personal lives, but their academic lives as well (Vázquez-Cano, 2014). While a vast majority of college students are learning with mobile technology currently, the lack of pertinent research remained, on the student perception of the influences of mobile technology use on student learning in higher education.

Purpose of the Study

As technology continues to evolve and impact every area of one's life, the ways and methods students are choosing to learn has also been greatly affected. While research on mobile technology use by college students did exist, there continued to be a lack sufficient research that explored and identified the influence of mobile technologies use from the students' perspectives. The purpose of this study was to expand the existing research on mobile learning by exploring the influence mobile technology has had on students in a university setting.

Research Questions

Koole's FRAME model provided the basis for this study, which identified the interrelation of the three aspects of mobile learning (user, device, & social ramifications; Koole et al., 2010). The research questions that guided this research are as follows:

RQ1: How do college students believe the device aspect of mobile learning influences their collegiate education experiences?

RQ2: How do college students believe the learner aspect of mobile learning influences their collegiate education experiences?

RQ3: How do college students believe the social aspect of mobile learning influences their collegiate education experiences?

To address these research questions, data was collected through questionnaires, interviews, and focus groups of students who were enrolled at [redacted] University. The selection of the participants involved purposeful sampling of students at the university who were already comfortable using mobile devices and applications.

Rationale for the Study

As mobile technologies continue to significantly impact education, it is becoming apparent that educators and professionals in higher education can no longer ignore this emerging technology. It also has become apparent with this growing trend of mobile technology use in the workplace and at home, there is a need to mobilize higher education as well. While some educators may find it a challenge to teach with mobile devices, they need to understand how and why their students are using these devices before any application of an appropriate learning theory in their lesson plans or the integration of mobile devices or apps for the students (Ng & Cumming, 2016). Therefore, further research to investigate the perceptions and attitudes of the mobile learner in higher education was warranted.

The literature included all types of methodologies (quantitative, qualitative, and mixed-method designs), yet, the qualitative approach seemed to be better suited for answering this study's research questions. Quantitative research designs such as a survey would be appropriate for answering the "how many, how much, or to what extent line of inquiry"—into the phenomenon of mobile learning (Yin, 2018, p. 10). However, the research question in this study was asking how mobile technology had impacted student learning.

Prior research seemingly focused more on the influence of mobile technology use in the classroom from the educator's point of view rather than that of the students. Based on the literature (Briz-Ponce, Juanes-Méndez, García-Peñalvo, & Pereira, 2016; Diliberto-Macaluso & Hughes, 2015; Geer, White, Zeegers, Au, & Barnes, 2017; Peacock & Grande, 2016; Stevenson, Hedberg, Highfield, & Diao, 2015; Teri et al., 2014; Vázquez-Cano, 2014), there was a preponderance of data regarding mobile technology in education, however there was a need to get the insight from the user—the student. Insight into the student experience with technology

may offer practitioners valuable perspective that may help them later refine the education experience for better results.

While the qualitative aspect of the mixed-method design would have addressed the hows and whys of mobile learning, the quantitative data from the research, would not. On the other hand, a qualitative case study for this research would provide greater insight into the influence of mobile learning in higher education than other research methods (Yin, 2018). The importance of exploring the how and why questions of mobile learning technology in higher education from the learner's perspective was the primary rationale for conducting this study. The collection of subjective data from the participants was vital for accurately answering the research question of this study. While in the past educators and professionals in higher education have looked at the pedagogical benefits and challenges of mobile learning, the information obtained in this study could be helpful for institutional leaders as they develop instructional strategies to enhance learning (Khaddage et al., 2015).

Definition of Terms

Augmented reality (AR). Augmented reality was defined as "a technology that superimposes a computer-generated image on a user's view of the real world . . . an enhanced version of reality that uses technology to overlay digital information on an image of something being viewed through a device" (McMillan, Flood, & Glaeser, 2017 p. 163).

Digital native. Prensky (as cited by Stockham & Lind, 2018) defined a "digital native" as an individual who had been reared 'with digital technology since birth' (p. 1). Digital technology comprised of the Internet/Wi-fi, computers and mobile devices.

Distance learning. Distance education is comprised any mode of instruction in which "there is a separation, in time or place, between the instructor and student" (*Federal,* p. 2-30).

Technologies used in distant learning include "the Internet; audio conferencing; or one-way and two-way transmissions through open broadcast, closed circuit, cable, microwave, broadband lines, fiber optics, satellite, or wireless communications devices" (*Federal*, p. 2-30).

Koole's (FRAME) model: *The Framework for the Rational Analysis of Mobile Education* (FRAME). A conceptual framework used previously in the evaluation of the use of mobile devices by the distant learner (Koole et al., 2010). According to Koole et al. (2010), "[t]he FRAME model defines mobile learning as a convergence of device, learner and social aspects" (p. 62).

Mobile application. Yan et al. (as cited by Wai et al., 2016, p. 6) defined a mobile app as "a software package that can be installed and executed in the mobile device." Seilhamer et al., as cited by Khaddage et al. (2015, p. 629), described a mobile app as "a software application that is always on; it runs in a smartphone, tablet or other portable device."

Mobile learning (or m-learning). Crompton (as cited by Wai et al., 2016, p. 4) described m-learning as, "learning across multiple contexts, through social and content interactions, using personal electronic devices." Bikumalla et al. (2017) further explained that mobile learning included students who studied using their mobile device, which allowed them to engage in multiple educational activities at any time and in any location.

Mobile literacy. Dudeney, Hockly, and Pegrum (2014) defined mobile literacy as the ability to navigate on the mobile internet– access, interpret, and contribute information on a mobile device as well communicate on the internet.

Mobile technologies. Mobile technologies include both the device and the software in the device. A *mobile device* is any portable electronic device like smartphone, tablets, and e-book readers. The *software* would be any mobile apps, documents, or other resources that has

been downloaded or installed on the device (Wai et al., 2016). Khaddage and Cosío, as cited in Khaddage et al. (2015, p. 629), described a *mobile app* as a software application that is "touch-based, on demand, on the go . . . that runs on a smart mobile device and can perform a variety of tasks."

Virtual reality (VR). Virtual reality is a "computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way . . . using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors" (McMillan et al., 2017, p. 162).

Assumptions, Limitations, and Delimitations of Study

Assumptions. The researcher assumed that the descriptive case study was the most appropriate research design to explore the perceptions of mobile learners in higher education. The study participants were informed they could leave study at any time without penalty as well their identities would not be revealed. The researcher also assumed because the participants volunteered for the study, and with their identities protected, they would feel uninhibited to give complete and honest answers in all phases of study.

Limitations. Several limitations in the study were also apparent. One of which was the study's lack of generalization. The inability of generalization continued to be a common issue with the case study research design (Yin, 2018). Yin (2018) explained that like the findings from a single experiment, the results of a single-case study such as this research, also cannot be generalized to other settings. According to Yin (2018), the same results will need to be replicated in other studies before the findings can be applied to any group of the population.

Additionally, as in most qualitative studies, there was the possibility of the collection of inaccurate data due to some of participants not being forthright during questioning by the

researcher (Baxter, & Jack, 2008). Just as important, this study could have been limited as well by the researcher's own bias or misconceptions acquired before, during, or after conducting the study.

Possible biases of the researcher could be a problem as well in the study. Creswell (2009) stated the researcher's role in a qualitative study was that of the primary instrument for data collection instrument. Therefore, it is essential the researcher remains objective in every stage of the research (Creswell, 2009). According to Creswell (2009), researchers must explicitly identify their own biases, viewpoints, and "personal background, such as gender, history, culture, and socioeconomic status, that may shape their interpretations formed during a study" (p. 177).

Delimitations. However, the delimitations were the boundaries the researcher has set for the study. Not only was the study delimited to students enrolled in one specific university in a northwestern state in the United States, but it was further delimited in that the students had to be mobile learners as well. Having only a total of 13 participants to complete all phases of the research was also a delimiting factor in the study.

Chapter 1: Summary

As the advances in mobile technologies continues to grow, its impact is evident in every area of our society. For example, online shopping can be accomplished with just a "click" on an app. The financial sector now offers apps for "pocket banking" to its customers and libraries, in digitizing massive amount of information, can now provide a "library in everyone's pocket" (Ally & Prieto-Blázquez, 2014, pp. 143–144).

Studies in much of the literature focused on the number of students who owned mobile devices or what specific types of device or app students were using (Burgess & Murray, 2013;

Diliberto-Macaluso & Hughes, 2015; Miller & Doering, 2014). Other studies were primarily centered on the pedagogical implications of mobile technology (Henderson, Selwyn, & Aston, 2017; Selwyn, 2016). The intent of this study, however, was to explore the perceptions of the mobile learner in tertiary education using a qualitative descriptive case study approach. While the mobile devices and apps were a central component of this study, as Ally and Prieto-Blázquez (2014) pointed out, mobile learning was more about the learner, rather than the technology utilized by the learner. The technology provided the learner mobility and allowed learning to occur in any context (Ally & Prieto-Blázquez, 2014).

The chapters that follow will include discussion and description of the different phases of this qualitative study. Chapter 2 included the literature review of relevant research pertaining to the use of mobile technology in academia. Also, addressed in Chapter 2 was the conceptual framework for this study, the methodological issues of previous studies, as well as the assessment and evaluation of past research findings that were relevant to this study.

The statement of the problem, research question, and the rationale for the study was further explained in Chapter 3. Additionally, the explanation of the qualitative descriptive case study, the research design method of this study was discussed. This study's design relating to the participant selection and ethical considerations, data collection and analysis were also addressed in the methodology chapter.

Chapter 4 will describe in greater detail the characteristics of the sample used in the study, the specific results of the data analysis and the interpretation of the findings in the study. Data coding and theme development are fully discussed in this chapter also. Chapter 5 included the summary of the results of the qualitative descriptive case study, in addition to further limitations that were noted during the study. Lastly, implications from the findings pertinent to

academia are addressed in Chapter 5, as well as, any recommendations for additional studies on mobile learning in higher education in the future. Discovering the specific ways mobile technology use had impacted college students should be useful in implementing mobile learning strategies for institutional leaders in tertiary educational programs now and in the future.

Chapter 2: Literature Review

Introduction to the Literature Review

Advances in technology has greatly affected every area in the lives of young adults, especially in how students are learning in higher education institutions today. It seemed that almost all undergraduate students now owned at least one mobile device such as a smartphone, tablet, or laptop to retrieve information on the Internet or access content specific applications. Mobile applications are currently being developed at such a rapid rate, as well to being more accessible, students are utilizing many more apps in their mobile devices (Vázquez-Cano, 2014).

Previous research literature had shown that these continuous technological advances had not only impacted how educators taught, but equally important, how students are learning (Chen & deNoyelles, 2013). For instance, most learners today expect to use technology in their education (Rossing, Miller, Cecil, & Stamper, 2012; Selwyn, 2014). Chen and deNoyelles (2013) also noted that most students enrolled in the colleges and universities were bringing and using their mobile devices in both traditional and online courses. With students' use of mobile devices and apps on the rise, it was imperative that educators and institutional leaders gained a greater understanding of how this usage of mobile technology was influencing students in higher education.

Research had also indicated that most of the mobile app use by college students beforehand had not been for academics but primarily for entertainment and communication (Rossing et al., 2012). Yet the gap in the research literature on the topic of mobile technology had narrowed, as more studies are examining the impact of educational apps on student learning (Bomhold, 2013; Nguyen, Barton, & Nguyen, 2015). Likewise, as educators and institutional leaders continue to integrate more mobile apps into their curricula, so should any influences on

the students be fully explored for both the potential benefits or unfavorable effects of the mobile apps. The purpose of this research study was to explore the influences mobile technology has had on students in higher education.

From presenting pertinent information from prior research studies, a pedagogical shift seemed to be occurring in higher education which had impacted students' achievement, collaboration, and student's motivation to learn both here and abroad. For instance, certain research focused on student app use in smartphones only (Bomhold, 2013) while other researchers looked at a specific mobile device use such as iPads (Miller & Doering, 2014) or tablets (Chen & deNoyelles, 2013). The research literature showed that this pedagogical shift was occurring internationally as well, mobile learners were studied in countries such as Egypt (Mansour, 2016) and the United Kingdom (Green et al., 2015). Research studies had also explored ways that mobile devices or apps were used as an effective teaching tool in a number of different disciplines that were offered in higher education, including such programs as chemistry (Kim, Chacko, Zhao, & Montclare, 2014), pharmacy (Rodis, Aungst, Brown, Cui, & Tam, 2016), and nursing (George & DeCristofaro, 2016).

The following literature review addressed other aspects of mobile learning as well, such as the incidences when devices or apps promoted student learning, or the devices were a distraction instead. Also, included in the research literature were specific areas of the influences of mobile devices or apps such as evolvement of the mobile learning concept throughout history, the increase in the accessibility and affordability of educational apps, and the changes in students' attitudes towards using mobile technology in the educational setting. The conceptual framework of this research, which was based on Koole's FRAME model of mobile learning (Koole et al., 2010), is also discussed in this chapter. Koole's model addressed how the learner,

the technology, the social component of learning interacted in the mobile learning process (Koole et al., 2010).

Conceptual Framework

Potential learning models. Most of the recent research on mobile learning from the viewpoint of the learner, seem to either focus on student ownership of the mobile device or the specific purposes the device was used for. Though several studies were conducted on the extent of mobile device or app use by students (Gavali, Khismatrao, Gavali, & Patil, 2017; Mansour, 2016), further study of the mobile technology user was still necessary. Several of the mobile technology theoretical frameworks had previously been used to evaluate the mobile learning process, as well, such as the TPACK framework by Koehler and Mishra, 2009; The Technology Integration Matrix (TIM), by the Florida Center for Instructional Technology 2013; and Substitution, Augmentation, Modification and Redefinition (SAMR), by Puentedura 2009 (Geer et al., 2017). However, due to the Koole's FRAME model's primary focus on the effectiveness of mobile learning, and the technology involved, this theoretical model appeared the most suitable for this study.

Koole's FRAME model. The Koole's model, *The Framework for the Rational Analysis of Mobile Education* (FRAME) seemed to align with addressing the research of mobile apps' influence on student learning in higher education for several reasons. One of which was that the Koole's model had been used originally to assess the effectiveness of mobile devices for distance learning (Koole et al., 2010). While the FRAME model examined the relationship of between the learner, device (including the apps), and the social interaction that occurs, this model also had described other significant qualities that extend out of the mobile learning process as well (see Figure 1; Koole et al., 2010). In describing this model, Koole and Ally (2006) wrote that:

The FRAME model is the first comprehensive theoretical model to describe mobile learning as a process resulting from the convergence of mobile technologies, human learning capacities, and social interaction. It addresses contemporary pedagogical issues of information overload, knowledge navigation, and collaborative learning. It is hoped that this model will help to guide the development of future mobile devices, the development of learning materials destined for mobile learning, and the specification of teaching and learning strategies for mobile education. (p. 1)

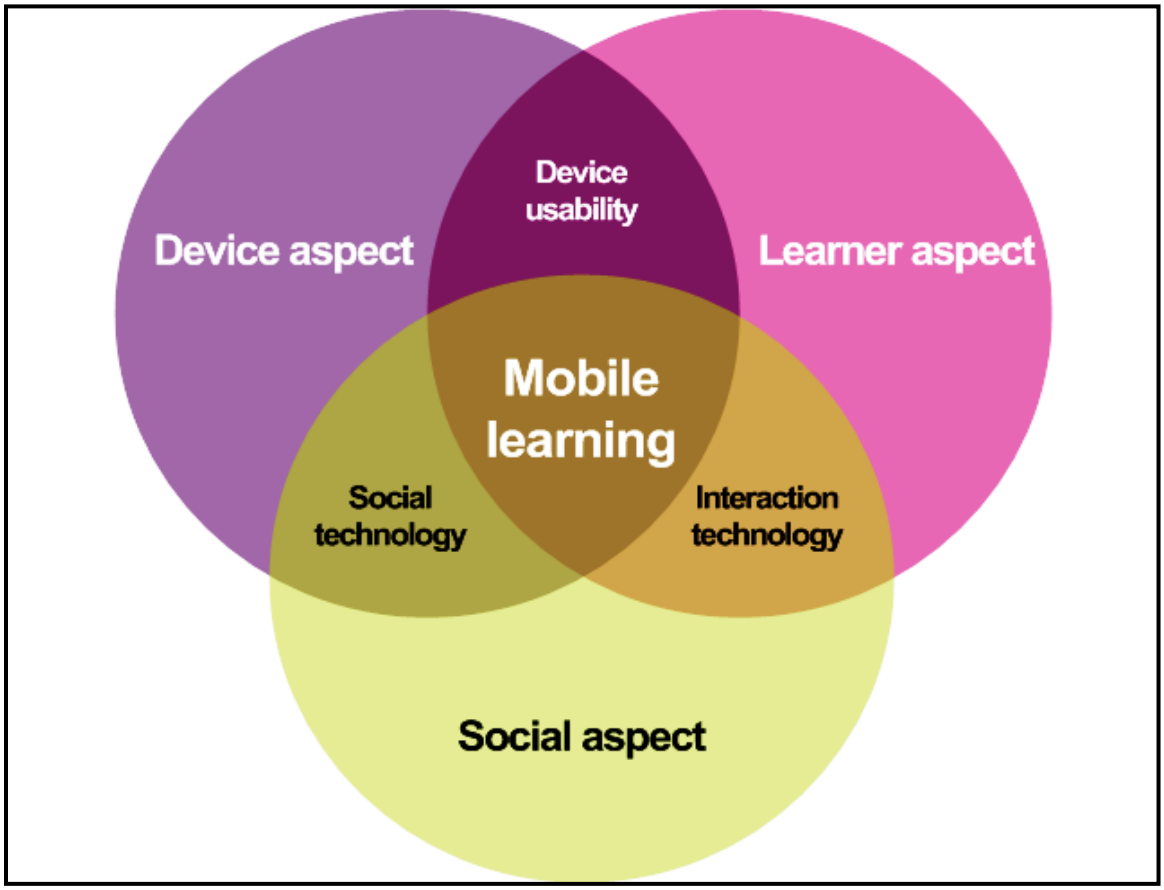

Figure 1. Koole's FRAME Model (Venn Diagram; Koole et al., 2010).

Device aspect of mobile learning. Koole et al. (2010) explained that the device usability aspect of mobile learning process consisted of the medium mobile learners used such as the hardware and software components of mobile devices. Different device factors can affect the

effectiveness of mobile learning such as processor speed or storage capabilities in the device (Koole et al., 2010). Thus, efficient and well-designed mobile devices would greatly enhance the learning experience for the mobile learner.

The learner aspect of mobile learning. This aspect of the mobile learning process referred to the various factors that affect the learners' ability to "learn" such as learners' cognitive abilities, their memory, and how learners utilize prior knowledge (Koole et al., 2010). Koole et al. (2010) explained that environmental factors can also affect the cognitive processes of a learner as well such as transference of knowledge and learning by discovery. Yet, an equally important component in the FRAME model was the human interaction with other learners or the social aspect of human learning (Koole et al., 2010).

The social aspect of mobile learning. Koole et al. (2010) believed that social and cultural factors greatly impacted human learning. Therefore, to fully understand the social aspect of mobile aids, there must be knowledge also of how people communicate and exchange information with one another (Koole et al., 2010). As this aspect of mobile learning is being explored, more ways of assisting learners communicate with one another can also be developed, even if the learners are separated physically and temporally (Koole et al., 2010).

According to Koole et al. (2010), this was the information that provided the backdrop for the FRAME model. For instance, the student's learning environment is the sum of all the information the student obtained from either internal or external stimuli in his or her personal, social, and technological life (Koole et al., 2010). Therefore, in the same context, Koole's FRAME model seem to not only encompassed the interaction that occurred between the technological, the human and social aspects of mobile learning, but also provided a clearer understanding of the process of mobile learning.

Koole and Ally (2006) expounded on this also, stating that the learning model gave researchers and practitioners greater opportunities to develop more efficient and appropriate learning materials for students to use in their mobile devices. While the relevancy of Koole's FRAME model was important in the understanding of the mobile learning process in higher education currently, the following research literature provided even more pertinent information indicative of the profound influence of mobile technology on student learning yesterday, today, and in the future.

Review of Literature

The literature described mobile learning evolving to the ubiquitous use of mobile technology in education today. Yet, while much of the research addressed the pedagogical aspect of mobile learning, it seemed apparent that the viewpoint of mobile learners needed further study. The ensuing sections comprises the various facets of the study of mobile learning– past, present, and future.

Mobile device/application use: A historical overview. Technology and the use of mobile apps in education is undoubtedly a more recent concept, however it was not the first attempt of making learning more accessible and more user-friendly for students. Mobile learning can be traced back centuries ago. The concept of learning in different locations was first introduced with the invention of Gutenberg's printing press (Berge & Muilenburg, 2013; Miller & Doering, 2014). According to Berge and Muilenburg, although the printing press and the movable type had been invented centuries earlier in China, Gutenberg's printed book is now seen as education's first mobile device. Even *Time* Magazine saw Gutenberg's invention of the printing press as the most important event of the second millennium (Miller & Doering, 2014).

Mobile technology in education. According to Berge and Muilenburg (2013), after the introduction of the computer, significant advances had occurred in 1970s with both its' hardware or software technologies, but still this technology seem to lag well behind other instructional pedagogies that were in use. While some schools possessed computers during the 70s, very few of them made use of computer-assisted learning programs (Berge & Muilenburg, 2013). Mobile technology, however, continued to advance with the first mobile phone sold commercially in 1983, as handheld computers and the first laptop computer were introduced in the 1980s (Berge & Muilenburg, 2013). Mobile technology began to finally influence education when cell phones became smaller, more functional, and highly customized to the user (Berge & Muilenburg, 2013). Apparently, compact and multi-functional smartphones seem to be the device students used most commonly today.

Widespread use of mobile devices and apps. Most of the undergraduates in the research literature had access to either a smartphone, tablet, or laptop (Bikumalla et al., 2017; Diliberto-Macaluso & Hughes, 2015; Ng & Cumming, 2016). Most Americans (95%) currently own some kind of cellphone while 77% of Americans now own smartphones, up from 35% from the first survey conducted by from Pew Research Center in 2011 (Pew, 2018). It was also found in the survey, almost 75% of adults in the United States owned either a desktop or a laptop, nearly 50% owned a tablet, and about 20% of adults now owning e-readers (Pew, 2018).

The use of a traditional broadband service in America has decreased in recent years, as well, and subsequently for many, the smartphone has become their primary means of connecting to the Internet (Pew, 2018). Nearly 20% of adults today do not have a broadband service and are using their smartphones to access the Internet at home (Pew, 2018). Additionally, the "hotspot" feature on the smartphone are now allowing its user online access for several mobile devices at

once. Even others (a limited number) are able to connect their tablets and laptops to this one mobile device. It seems that widespread mobile device ownership by college students, especially smartphones, will be no different in the future.

Another survey showed that in the United States alone, 92% of teenagers get online every day (Collins & Halverson, 2018). Collins and Halverson stated that of these teens, 75% of them are using their mobile devices for communication and entertainment, as well as for studying. Schneider and Preckel (2017) suggested that college students based on their own merit "are a highly select group," to qualify for college, students already had to be successful in their secondary schools (p. 8). Thus, the assumption was that the students enrolled in college would most likely have better intelligence and learning strategies than the overall population (Schneider & Preckel, 2017). For example, one learning strategy could be to include the use of mobile technology to optimize learning.

Accessible and affordable mobile applications. It seemed undisputable that mobile devices have impacted entertainment, art, commerce, and education. Clearly, today, a student's digital life cannot be separated from his or her real life (Wai et al., 2016). As mobile technologies continue to play such a significant role in academics, researchers will need to continue to examine the factors that affect mobile learning (Chen & deNoyelles, 2013; Vázquez-Cano, 2014).

One such contributing factor was the growing number of applications being developed and used by learners (Wai et al., 2016). According to Wai et al., due to the vast number of apps, 75 billion, that were downloaded from the Apple App Store in 2014, the field of education possessed the third-highest number of mobile applications. This massive growth of mobile applications in the marketplace is continuing, with the number of apps downloaded in the

medical field only was expected to reach 142 million by 2016 (Airth-Kindree & Vandenbark, 2014).

Students in traditional classrooms had been limited previously only to the knowledge of instructors and textbooks (Jayaprakash & Chandar, 2015). However, since so many sources can now be downloaded to mobile devices, Jayaprakash and Chandar maintained that the issue of non-availability of an expert or a specific textbook was no longer a concern. As the number of apps continue to multiply, the amount of mobile applications specifically designed to better higher education will increase as well (Hoffmann, 2015; Jayaprakash & Chandar, 2015).

Wai et al. (2016) investigated the actual use of mobile apps for academic study by the undergraduate students at the University of Hong Kong. Wai et al. found that the 150 undergraduate business, education, and engineering students surveyed were not concerned about the costs of the apps. The students still wanted to use mobile apps often with some of the students who even were willing to pay for the apps, so they could do well in the courses (Wai et al., 2016).

Park, Purnell, Freeman, Reese, and Varga (2017) conducted a study similar to Wai et al. (2016) but the participants were student pharmacists instead. The Park et al. study consisted of first through fourth year pharmacology students from three schools of pharmacology. Yet, the survey of Park et al. only consisted of 13 questions that addressed student preference and the frequency of app use. The students used one to three apps a few times a week to obtain drug information, with some purchasing apps in addition to using the free subscriptions provided by the school (Park et al., 2017). Park et al. reported that affordability of apps did not factor in this study; the pharmacology students had chosen to purchase the apps; they believed the purchased apps had contained more up-to-date information than the free ones.

The United States was not the only country that was implementing more mobile learning into their educational programs. The Higher Colleges of Technology in the United Arab Emirates (UAE) signed a document to ensure that all the school's campuses relied only on iPads for notetaking and information management (Jayaprakash & Chandar, 2015). Mobile learning was seen at Kabarak University in Nakuru, Kenya, where the students utilized Google Apps (*Google Forms*) to share their comments and concerns about the university with the school's administrators (Jayaprakash & Chandar, 2015).

Yet, the costs of the apps may still be problematic for some students, especially in under-developed or developing countries in Asia and Africa, since not all educational apps were free for every student (Jayaprakash & Chandar, 2015). It has been reported that the greatest hurdle in sustaining many of these mobile learning projects was overcoming the costs of the mobile devices, the software, and the charges related to the connection or technical support of the devices (Ng & Cumming, 2016). Jayaprakash and Chandar explained that the future of the mobile learning in education will depend on the availability of not only the simple apps, but those apps that are easily accessible and cost effective as well.

Students' attitudes toward apps. Another consideration affecting mobile learning was how students themselves viewed this mode of learning. Students' preferences, towards entertainment, communication, and learning, especially those of younger students' have changed significantly throughout the years (Bomhold, 2013). Bomhold pointed out that, this current generation has lived their entire lives with the internet, computers, and mobile devices. Consequently, students are more accustomed in obtaining information instantly rather than having "to go" and get the information needed from other sources. However, such an attitude could also be problematic for students, especially if the speed of retrieval usurped the accuracy

of information for them (Bomhold, 2013). Bomhold's (2013) results were limited by the small number of undergraduate students surveyed with the sampling consisting of students in only one course.

Other issues involving mobile devices use in class have been reported in other studies. Not all the students saw mobile devices as a great educational tool, for some, the devices instead resulted in greater incidences of student distraction and disengagement in the classroom (Diliberto-Macaluso & Hughes, 2015). The students also found the use of mobile devices annoying and interruptive at times, voicing complaints such as eye strain from constantly gazing at screens on the devices (Selwyn, 2016). Students in tertiary education today owned an average of about seven devices, but for the most part, most of them felt their mobile devices supported and aided their academic successes (Diliberto-Macaluso & Hughes, 2015). Diliberto-Macaluso and Hughes' research found that despite the occasional annoyances and disruptions reported, most of the students believed the devices helped them stay focused and more efficient in their courses.

Bring your own device (BYOD). Results from Chen and deNoyelles' (2013) research study also suggested that many undergraduate students brought their devices to class, mainly tablets and smartphones, due to their small size and portability. Yet, students rated the laptop (85%) to be the most important mobile device for college, followed by the tablet (45%). The next important device were smartphones (37%) with e-book readers becoming more useful (31%) in recent times (Chen & deNoyelles, 2013).

Another factor to consider is that students really want to use their mobile devices academically. Chen and deNoyelles (2013) found that 67% of the students used their smartphones and tablets to access resources. Yet, even though many students are using mobile

devices in school today, because of their small size, these devices over time may prove to be impractical for learning. Farley et al. (2015) explained that though most students desire to use their mobile devices to support their learning in the classroom and online, doing actual course work on smartphones could be difficult. According to Farley et al. with just scrolling on the small devices, navigating websites and learning management system pages would be challenging for students. Another challenge resulting from BYOD was the need for colleges and universities to update their current internet access policies or information technology (IT) support for the increased student use (Farley et al., 2015).

Brown and Hocutt (2015) in studying students' attitudes towards the use of applications for educational purposes, focused on college students' use of Google Apps for Education (GAFE) in a first-year college composition course. The students perceived GAFE were useful and thought the apps were relatively easy to use; the students reporting that the apps "arouse[d] curiosity and engage[d] creativity" as they learned (Brown & Hocutt, 2015, p. 173). Wai et al. (2016) in examining the usage of mobile apps by undergraduate students in Hong Kong had positive results as well. Wai et al. saw that the students were not only willing to use the apps to learn but those actually used the apps was significant. However, due to the costs of the apps, some of the students were unwilling or unable to purchase the apps even though they really needed the apps (Wai et al., 2016).

Miller and Doering (2014) after observing and interviewing teachers and students in their study who utilized iPads with apps in their classes, reported that particular mobile technology was well received. Neither the teachers nor the students voiced complaints of technical issues or malware or virus problems during the time they had used the iPads (Miller & Doering, 2014). Additionally, both the teacher and student users were pleased with the iPad's features such as the

quickness of the iPads and the touchscreen interface which allowed ease of use (Miller & Doering, 2014).

Burgess and Murray (2013) also examined students' preference to traditional flashcards versus flashcard apps in a General Psychology course. According to Burgess and Murray, students reported the traditional flashcards were helpful for studying while still being portable. The students who did not used the app-based flashcards, cited technical reasons such as the apps drained their batteries, or that the smart phones distracted them which caused them to forget to use the app (Burgess & Murray, 2013). Though the smartphone-based flashcards were found to be more convenient, the students still used flashcards in the app less than the traditional flashcards when both types were provided (Burgess & Murray, 2013). Burgess and Murray also noted that when the students were offered only the app flashcards to study, most of the students chose not to utilize the flashcard app at all which possibly could have improved the students' test scores.

Mobile learning of the future. Mobile device use is expected to dramatically increase in the coming years with the access to digital technology now occurring at a much earlier age, more so, with personal mobile devices (Ng & Cumming, 2016). Even before starting primary school, most children have developed enough computer skills to interact using educational apps, manipulate different levels on video games, or chat on social media (Ng & Cumming, 2016). The fact that there are almost 7 billion mobile phone users globally (Vázquez-Cano, 2014), was an indication that the learning potential of mobile apps needs additional research. Burgess and Murray (2013) explained that the growing popularity of smartphones has also resulted in the development of more apps for education. Interesting enough, even in developing countries

where challenges of affordability and literacy were prevalent, the accessibility to these mobile apps are now almost limitless (Ng & Cumming, 2016).

Ally and Prieto-Blázquez (2014) predicted in the future the mobile devices that students will be using will look quite different from the devices they are using today. Ally and Prieto-Blázquez explained that the students that are enrolled now are the first generation of mobile learners hence, higher education must continue to develop educational plans to meet the learning needs of next generations of students. Ally and Prieto-Blázquez stated that there will technology like a smart system that will allow learning to take place anywhere.

The next generation of mobile technology could have such advanced features as virtual reality (VR) and augmented reality (AR; Ally & Prieto-Blázquez, 2014). "Cloud teaching" could also be utilized, the student could have "access to people, resources and information" regardless of the student's time zone or location (Ally & Prieto-Blázquez, 2014, p. 144). According to Ally and Prieto-Blázquez, this technology will not only be integrated into smartphones, but many other objects like a person's keys and shoes will have these devices embedded in them.

Educational apps: Pedagogical tools. Research studies are concentrating on the teaching aspect of mobile learning as well on the learner's perspective in higher education. Chen and deNoyelles (2013) pointed out the positive outcomes from the usage of mobile devices like the smartphone and tablet in academics. For instance, students now can connect to the world instantly; students have greater access to information, and students can now interact with one another almost at will (Chen & deNoyelles, 2013). According to Chen and deNoyelles, the applications in these devices allowed its users not only to consume knowledge themselves but

also produced additional knowledge, thus transforming how tertiary students learned in both inside and outside of the classroom.

Research initially only explored the general use of apps by college students (Peacock & Grande, 2016; Stevenson et al., 2015; Teri et al., 2014; Vázquez-Cano, 2014), as well the use of apps in specific courses such as anatomy (Wilkinson, & Barter, 2016), chemistry (Kim et al., 2014), and statistics (Ling, Harnish, & Shehab, 2014). Salisbury, Laincz, and Smith (2015) in their study compared gender preferences among student app users. Much of the current research appeared to concentrate more on educational programs in the health field. Research studies in the literature explored app use by student pharmacists (Park et al., 2017; Rodis et al., 2016), chiropractic students (Meyer, Stomski, Innes, & Armson, 2015), and nursing or medical students (Bullock et al., 2015; George & DeCristofaro, 2016; Green et al., 2015; Harmon, 2015).

Green et al. (2015) also studied how MBChB Mobile app (an assortment of medical reference texts) influenced a cohort of undergraduate medical education students. Over 75% of the fourth-year medical students and 83% of the fifth-year students thought that the MBChB Mobile app promoted learning in their clinical assignments (Green et al., 2015). The participants in the study of Bullock et al. (2015) were not undergraduate students, but first year physicians who used an iDoc app for a year on their smartphones. The iDoc app contained five reference medical texts the physicians frequently used including *The Oxford Handbook of Clinical Medicine* and *The Oxford Handbook of Clinical Surgery* (Bullock et al., 2015).

Bullock et al. (2015) saw significant changes in how the physicians utilized information resources at the work site over the year. One change was a marked reduction in the physicians' use of the hard-copy and electronic versions of the texts on their personal computers; however, the inexperienced physicians had also consulted more with the senior medical staff members

(Bullock et al., 2015). Bullock et al. found that the mobile apps enabled a more timely and easier access to key textbooks for first-year physicians. In addition, the inexperienced doctors sought more input from the senior staff, indicating that the mobile apps complemented learning rather than promoting an over-reliance on technology by the physicians (Bullock et al., 2015).

The medical students in the research by Briz-Ponce et al. (2016) also used mobile anatomic apps and the students were found to perform better academically than the students who did not have the apps. Briz-Ponce et al. saw the mobile devices as a beneficial tool for teachers as well, and the challenges that these pedagogical methods might present, will need to be overcome. However, the findings of this study were questionable since the sample size in the research consisted of only 30 participants (Briz-Ponce et al., 2016).

Previous research has demonstrated that integrating mobile learning into higher education curricula is impacting pedagogy. Geer et al. (2017) saw changes such as increases in collaboration and communication among the students in addition to a greater self-reliance seen in the students. Research seemed to indicate that mobile learning has brought about a definitive pedagogical shift in education, therefore necessitating further studies on how mobile learning has impacted students in tertiary education (Geer et al., 2017). While a variety of design methods had been utilized previously in studying the use of mobile technology by students, some of those methodologies seemed inappropriate for this study.

Review of Methodological Issues

Researchers had used both qualitative and quantitative methodologies to research mobile device or app use by students in higher education. While prior studies had focused on topics more related to the mobile technology, such as student mobile device ownership or application use, research now is exploring such areas as student attitudes towards technology and the

influences of mobile learning on pedagogy. The design methods in the research literature were carefully evaluated to ensure that this research study was directed on the perspective of the mobile learner rather than that of the instructor who facilitates mobile learning.

Quantitative studies. The quantitative approach, which was used in the research of Bikumalla et al. (2017), appeared to be beneficial in determining the perceptions, attitudes, and outcomes from mobile device or app use by students. From the responses collected from the questionnaires of 300 dental undergraduate students, Bikumalla et al. were able to infer that the dental students preferred their smartphones rather than the library for obtaining information and study materials. Bikumalla et al. found also that most of the dental students (86%) had smartphones and internet access (95%), yet only about half of the students (53%) had actually downloaded dental education apps on their smartphones. However, the data collected confirmed for Bikumalla et al. of the students' desire to use smartphones for educational purposes.

Bomhold's (2013) quantitative study revealed actual mobile device or app use by undergraduate students in retrieving academic information. An online survey consisting of 14 questions were given to 62 undergraduate students in one information literacy course (Bomhold, 2013). While Bomhold found that most students owned devices as well as frequent use of the mobile computing apps by student, the methodological issue with the study is the relatively small sampling size used.

The study of app use by Briz-Ponce et al. (2016), also a quantitative method design, involved medical students in an anatomy course in both experimental and control groups. Students given pre-tests and post-tests for the course after taught by same instructor and same material (Briz-Ponce et al., 2016). The analysis of both groups' test scores found that the students who studied with the app performed statistical better than the students who used the

traditional method (Briz-Ponce et al., 2016). Briz-Ponce et al. in their research design had so few variables, which may have increased the validity of their research.

The quantitative study of Selwyn (2016) consisted of surveying 1,658 undergraduate students from two Australian Universities. Selwyn (2016) from his study pointed out four specific downsides of mobile device use. The respondents were instructed to cite from available options the reasons the devices were unsuccessful (Selwyn, 2016). However, the methodological issue in this study**,** as Selwyn (2016) acknowledged, was "the limitations of the self-selecting, non-randomized nature of the sample and the lack of complete measurement of all cases in the selected sample" (p. 1010).

While the open-ended questions in the questionnaires were directed at technology's "unhelpfulness" or "not usefulness" in the students' studying, the responses confirmed the researcher's claim (Selwyn, 2016). The same limitations mentioned by Selwyn (2016) could also, be said regarding a later research conducted by Henderson et al. (2017). Both studies utilized the same participants from the same universities, differing only in that Henderson et al. instructed their students to list the benefits of mobile device use instead.

The quantitative study of Al-Emran, Elsherif, and Shaalan (2016) explored the attitudes of both the educators and students regarding mobile learning. Al-Emran et al. utilized a large sample size for the study, 383 students and 54 instructors, from five universities located in Oman and UAE, two countries adjacent to one another in the Arab Gulf region. Significant differences in attitudes toward mobile learning were found in this study among the students "with regard to their smartphone ownership, country and age (Al-Emran et al., 2016, p. 93).

Qualitative studies. Miller and Doering's (2014) qualitative research approach was used to determine how the use of iPads or apps had enhanced student learning. Data from collected

by Miller and Doering from class observations, formal interviews, as well from having informal chats with the teachers. While there were reported instances of distraction from teachers, they still thought the mobile devices were helpful tools (Miller & Doering, 2014). Miller and Doering found that both teachers and students were able to use the iPad and apps easily, which helped the students in completing the tasks assigned to them.

Khaddage et al. (2015) utilized a case study to study the challenges of implementing mobile devices or apps in a primary school in Singapore of about 700 students. The researchers identified four areas of concern: pedagogy, technology, policy, and the previous lack of research on mobile learning (Khaddage et al., 2015). While Khaddage et al. addressed important issues in mobile learning, the use of a case study for this research could have been problematic. For instance, the possible expense of such of a study was concerning as over 700 students in this case study were each given a smartphone to use (Khaddage et al., 2015). The long duration of this case study was an issue, as well, since this case study lasted over three years (Khaddage et al., 2015). However, using a case study the researchers were able to gather the subjective data from the students' mobile technology use.

The qualitative study of Airth-Kindree and Vandenbark (2014) utilized focus groups to explore and evaluate RN-BSN students use of mobile medical applications in a capstone course. Several different medical apps were given to the students and, based on the information obtained from the nursing students, researchers concluded from the RN's, that their greatest need was having mobile apps as a quick-reference tool when answering the patients' various questions. So much so, the researchers believe further investigation is needed to determine if student nurses "having quick-reference tools at the point of care improve[d] patients' perceptions of the quality of care and health outcomes" (Airth-Kindree & Vandenbark, 2014, p. 168).

Mixed-method approach. The use of the mixed design method in the research literature also proved effective in the exploration of student attitudes and perceptions towards mobile devices or app use as well for compiling statistical data on student performance in mobile learning. George and DeCristofaro's (2016) qualitative and quantitative study used surveys, observations and reflective journals to evaluate the learning strategies of nursing students. The nursing students reported using the smartphone apps during class time, in the laboratory, and at the clinical site (George & DeCristofaro, 2016). Using this approach, George and DeCristofaro concluded that the nursing students seemed more engaged and the apps helped them retain more nursing content from lectures.

Brown and Hocutt (2015) were participant-observers in their mixed-method study but also collected data via questionnaires from students in college composition classes. The researchers sought to demonstrate the usefulness of a Google Drive application for the students in the course. Students reported the app's ease of use and its collaborative affordances (Brown & Hocutt, 2015).

The mixed-method research design of Wai et al. (2016) was useful also in exploring mobile apps use by undergraduate students. Wai et al. studied not just the actual usage of the apps, but also the students' perceived usefulness, ease of use, and their overall attitude toward mobile apps in education. After the researchers surveyed and interviewed the students from Business, Education, and Engineering programs, all the students were found to had used the apps in their academic studies frequently to communicate, access available resources, and collaborate (Wai et al., 2016).

Anshari, Almunawar, Shahrill, Wicaksono, and Huda (2017) in their mixed-method study focused more on smartphone use by students in an attempt of demonstrating that the device

should be embraced as a valuable learning tool. The researchers utilizing the instruments of a survey and focus groups, found that the students used their smartphones to obtain information on the Internet, collaborate on group assignments, and contact teachers when not in class (Anshari et al., 2017). Anshari et al. used a mixed-method design study to obtain data on the specific reasons students used their smartphones to learn.

While all three research methodologies, quantitative, qualitative**,** and mixed-method, were well represented in the research literature, not all were seen to be completely reliable or applicable to this research. However, each of the research methods not only addressed the various aspects of mobile learning but also reported both positive and negative findings from the use of mobile technology in academia. Yet, there were other findings in the literature that were indicative of the need for further study on this topic.

Synthesis of Research Findings

Technological advances undoubtedly will continue to impact education therefore, necessitating further research on the influence mobile technology on tertiary students so that effective learning strategies can be developed and implemented for mobile learners. It has been estimated by the year 2019, there will be over 2.7 billion smartphone users globally (Statista, 2018). As these mobile technologies are incorporated more in the curricula of colleges and universities, it is imperative that pertinent data be collected and analyzed on mobile learning which may, or may not, adversely affect student outcomes (Tuncay, 2016).

Selwyn (2016) noted that much of the past research was being directed at the benefits of mobile technologies in education. However, not all findings from studies on mobile technology use were positive for the students. As stated by Selwyn (2016), in mobile learning there was sufficient evidence of differences in engagement "in terms of students' subject discipline and

level of study, and often age, race and/or gender" (p. 75), which should cause additional research on this learning model, a priority for leaders in higher education.

Two opposite perspectives regarding student perception towards digital technology were evident in the studies of Henderson et al. (2017) and Selwyn (2016). Henderson et al.'s "usefulness" of mobile technology study contrasted with Selwyn's (2016) "unhelpfulness" of the technology. However, the findings from Henderson et al. were conclusive in showing that the students' use of digital technologies neither transformed teaching or learning in higher education, nor did the technologies significantly disrupt the student's collegiate experience.

The research literature was comprised of studies on students in different educational locations, disciplines, and levels of study–ranging from the first-year undergraduate students to post-doctorate learners. Tuncay (2016) had researched technology currently utilized in higher education's three learning modalities (traditional, blended and mobile). App use by students in biochemistry and nutrition education courses were the focus by Teri et al. (2014), while Gavali et al. (2017), Green et al. (2015), Harmon (2015), and Lau and Kolli (2017) looked specifically at medical students and their use of course content-related apps.

The research of Bomhold (2013) and Vázquez-Cano (2014) concentrated solely on the potential benefits from using the technology, as Khaddage et al. (2015) explored rather than the possible challenges that might possibly occur during the mobile learning process. Boldhold further explained that to create useful apps, it was equally as important to fully understand the student's use of the device. Consequently, a much greater understanding of the realities of mobile learning in education was warranted, even more so, with our students at the collegiate level.

Critique of Previous Research

Research studies of students' attitudes or perception (Henderson et al., 2017; Selwyn, 2016) towards mobile device or app use in academia could prove useful for curricula development now and in the future for higher education institutions. According to Anshari et al. (2017), the amount of time students spend online was rapidly increasing, as well as the number of the students who now are choosing to connect to the Internet with their smartphones. Anshari et al. acknowledged that students are relying more on technology in their education today that had not been seen in earlier generations of learners. Additional research on mobile learning would be helpful in determining the influences, if any, mobile technology was having on education.

While studies like Henderson et al. (2017) and Selwyn (2016), might answer the question of the "usefulness" of mobile devices, but having a clearer understanding of other aspects of mobile learning might also be of importance for educators, institutional leaders, and policymakers. Though the participants in Selwyn's (2016) study had voiced minor complaints from mobile technology, I felt the reports of diminished student scholarships from technology use was more troubling and should be the focus of additional research in the near future. While the study of Al-Emran et al. (2016) did addressed the attitudes of the mobile learner, those attitudes of participants in Middle Eastern counties could differ greatly from students in other geographical locations, for instance, students attending a university in the Pacific Northwest of the United States.

The research that concentrated on the different learning modalities available to college students such as the study conducted by Tuncay (2016), provided valuable insight into the students' attitudes towards mobile learning and the different successes and experiences using

mobile technology. Tuncay did reveal the students' concerns regarding traditional, blended, and mobile learning, but the exam results did not reveal any significant differences in the groups.

Research centered on specific fields of study such as medicine (Gavali et al., 2017), dentistry (Bikumalla et al., 2017), or biochemistry and nutrition (Teri et al., 2014) seemed quite helpful for confirming or disproving the appropriateness of content applications for students in specific programs. While additional research may be needed to fill gaps of study relating to the physical or mental concerns of students from mobile technology use (Khaddage et al., 2015), the primary focus of this research study, was to explore the influences mobile technologies could have on student learning in higher education. Yet, certain information in the research literature highly supported this research.

Chapter 2: Summary

This research literature addressed areas influencing mobile learning in education such as the historic background of mobile learning, student attitudes and perceptions use in academia, as well as the advantages or disadvantages of mobile technology for learning when used as a pedagogical tool. Mobile learning has evolved indeed, from the first printed book centuries ago the early learners hand-carried to different locales (Berge & Muilenburg, 2013), to the vast assortment of digital technologies widely used by students in higher education today—laptops, tablets and smartphones.

Mobile device ownership has continued to grow rapidly worldwide (Bikumalla et al., 2017; Briz-Ponce et al., 2016; Pew, 2018), in addition to the growing number of easily accessible and affordable educational apps on the market (Wai et al., 2016). The next generation of mobile technology will have even more features like AR and VR for students to use (Ally & Prieto-Blázquez, 2014). Student preference has become a huge factor, influencing mobile learning in

many colleges and universities; with most students expecting to use their smartphones for not just getting online but for educational purposes as well (Anshari et al., 2017).

Students who used apps in one particular course had performed significantly better than students who did not (Briz-Ponce et al., 2016). App use in some instances promoted greater student engagement and improved students' recall of course material (George & DeCristofaro, 2016). App use by students were also found to enhance collaboration, communication, and made accessing resources much easier (Geer et al., 2017; Wai et al., 2016). Yet some effects from the technology were neither helpful nor beneficial for some students—the issue of eye strain being the least (Henderson et al., 2017).

Koole's FRAME model provided the conceptual framework for this research, depicting the unique relationship and interaction that occurred between the learner, the technology, and the social aspect during the mobile learning process (Koole & Ally, 2006). There appeared to be sufficient reasons for thinking that an investigation to examined mobile device or apps use by students in higher education would yield significant findings. Mobile technology undoubtedly will continue to impact education at every level. A greater number of students are using mobile devices when entering college (Pew, 2018). The literature provided strong support for pursuing a research project to further study the influences the use of mobile devices or apps has had on students in higher education.

The following chapter identified and described the problem statement, the research question that guided this study, the research method design chosen for this study, and the rationale for the use of a qualitative methodology. Several studies in the literature portrayed certain weaknesses in the other two research designs, thus, the researcher felt justified in using a qualitative descriptive case study to explore the influence of mobile technology on college

students. Additionally, other methodological aspects of the research such as participant selection, data collection and analyses processes for the study are further expounded upon in the next chapter as well.

Chapter 3: Methodology

Introduction

As the popularity of mobile devices (tablets and smartphones) has continued to rise among students, their use of mobile devices and educational applications in academia had increased steadily, as well **(**Chen & deNoyelles, 2013). The aim of this study was to explore the influence of mobile technology on learning in higher education. The conceptual framework for this study, Koole's *The Framework for the Rational Analysis of Mobile Education* (FRAME) had been used previously to assess mobile device usage by students in distance learning programs. Koole's model was also appropriate to address how mobile devices or apps had influenced the tertiary learner as well. For higher education, it was important to have a clearer understanding of the dynamics and views of the learners regarding of the use of mobile technology in academia.

Questionnaires, interviews and focus groups were used in this study to explore the influence of mobile technologies on students in higher education. Yin (2018) stated that interviews would be especially helpful in finding "the 'hows' and 'whys' of key events, as well as the insights reflecting participants' relativist perspectives" (p. 118). The researcher's use of focus groups was a deliberate attempt in surfacing each student's perspective in the sample group (Yin, 2018).

Statement of the Problem

College students are continuing to use a greater number of mobile applications on their smart phones and tablets for their education (Vázquez-Cano, 2014). A gap in the research existed on how the use of these mobile devices and educational apps had affected students in higher education (Catharine, 2013; Nguyen et al., 2015). It was no longer an option if colleges and universities incorporate technology in their educational programs, for many students not

only expect to use technology in their courses but seemed to insist on it as well (Rossing et al., 2012; Selwyn, 2014).

This study explored how college students enrolled in a university in the Pacific Northwest of the United States perceived the use of mobile technology in their collegiate experience. Newer advances in technology has continued to influence not just how students in higher education learned but equally important, how educators will teach in the future as well (Chen & deNoyelles, 2013). The importance of research on the impact of technology in the field of education may prove to be even greater soon as mobile technologies continued to rapidly advance.

Research Questions

As previously listed in Chapter 1, the research questions that guided this qualitative research was as follows:

RQ1 How do college students believe the device aspect of mobile learning influences their collegiate education experiences?

RQ2 How do college students believe the learner aspect of mobile learning influences their collegiate education experiences?

RQ3 How do college students believe the social aspect of mobile learning influences their collegiate education experiences?

Purpose and Design of the Study

All three design methods (qualitative, quantitative, and mixed-method) were represented in the research literature, however neither the quantitative nor the mixed-method designs seemed appropriate for this study. Primarily, much of the quantitative studies in the literature had focused mainly on college students' extensive use of apps as well as their increased ownership of

mobile devices (Lau & Kolli, 2017; Mansour, 2016; Park et al., 2017). For example, Lau and Kolli's (2017) quantitative research demonstrated how often the medical students in the study used the mobile apps and their app preference. The study of Mansour (2016) reported the percentages of student ownership of mobile devices also.

The quantitative study of Park et al. (2017) focused again on the number of the pharmacy students who used their mobile phone apps for retrieving drug information. Seemingly, the quantitative methodology proved to be ineffective for obtaining data on the actual feelings and attitudes of the respondents for this current study. Likewise, in the mixed-method designs studies, the quantitative portions of the research (Wai et al., 2016) contained similar data, making the mixed-method approach less suitable for this study also.

On the other hand, several qualitative design methods in the literature had focused instead on the students' viewpoint rather than that of the pedagogical perspective. For example, the study of Stevenson et al. (2015) utilized the data that was collected from a qualitative study to explore the effectiveness of app or smart device use by students in learning. Stevenson et al. (2015) found in their research the different ways the use of apps had supported meaningful and student-centered learning. Khaddage et al. (2015) also used a qualitative case study to explore the various challenges of mobile learning that the students and instructors were experiencing. Ally and Prieto-Blázquez, (2014) pointed to four qualitative case studies that were conducted to evaluate a new concept of mobile learning (augmented reality (AR) technology in mobile devices in certain bachelor's and master's degree courses in a university in Spain (Ally & Prieto-Blázquez, 2014).

The mixed-method design study of Wai et al. (2016) was also used to examine students' usage of mobile applications in their academic studies. The researchers through surveys and

interviews analyzed not only the frequency of usage of mobile learning apps by the students, but also the students' perceived usefulness of the apps and ease of use of them in their courses (Wai et al., 2016). Yet, again, only the subjective data obtained in the study that focused on the learners' perception would have been relevant for this study.

The type of data necessary for answering this study's research questions could not be limited to only the responses from closed-ended questioning or surveys that are frequently used in quantitative studies. With the use of a qualitative research design, the researcher obtained information that described the learner's perception and experience from mobile technology use for educational purposes. Subsequently, having the participants described their actual thoughts, feelings, and beliefs regarding the benefits or challenges of mobile technology also enhanced the validity of the study as well. Data for this case study was obtained from the participants' responses to the questioning from the demographic questionnaire, the interviews, and focus groups sessions (see Appendices A, B, and C).

The researcher decided that the method of inquiry best suited for this study was the qualitative descriptive case study. Yin (2018) defined a case study as "an empirical method that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (p. 15). It seemed apparent in the literature the impact that mobile technologies had on education was quite significant.

Heflin, Shewmaker, and Nguyen (2017) attributed the 360-degree change in the nature of higher education to the rapid technological advances of mobile devices and the Internet. Not only were the students' usage of mobile technology in higher education, an on-going phenomenon, but the case studied the real-life context of students who used mobile technology at

the collegiate level (Heflin et al., 2017). Therefore, both qualifying factors made the case study the most appropriate choice of a research design for this study.

The selection of a single-case study was the most appropriate approach as well for this study rather than a multiple case design. Yin (2018) explained that the single-case design was warranted if the case met specific conditions. As Yin (2018) stated, one of those conditions was that the case must represent a revelatory purpose, which, was the purpose of this study—the exploration of the influence of mobile technology on tertiary students.

The methods of collecting data for this study included the use of a questionnaire, the conduction of interviews with the students singly and focus group discussions. The use of unstructured questioning in the interviews and focus groups (see Appendices B and C) allowed for the researcher to have conversations with the participant(s) rather than only receiving short responses in structured queries (Yin, 2018). Similar questions were presented to the participants in both in the interviews and focus groups, during which time the researcher controlled the lines of inquiry, and when necessary, re-directed the questioning back to subject matter that addressed the research questions in the study.

Population and Sample Selections

A purposeful sampling was required for this qualitative descriptive case study. The sample selected were individuals who experienced the central phenomenon of the study, the usage of mobile technology in academia. The students selected from the university comprised the target population of study and were the participants of the case study. To establish boundaries in the case study, the sample size were 13 mobile learners currently enrolled at the college.

After obtaining the approval from the faculty or department heads and the university's Office of Institutional Review Board (IRB), a brief screening questionnaire was sent to students

currently enrolled at the university (see Appendix E). Volunteers for the study were solicited via emails through the university-provided survey software (Qualtrics) that was available. The participants were selected from the students who responded to the initial request and who met the predefined selection criteria: The participants in the case study had to be enrolled at Avery Collins University (pseudonym) for at least one academic year and were currently using or had previously used mobile technology (devices or apps) for academics.

The goal of this study was to explore how college students in a private liberal arts university in the Pacific Northwest of the United States perceived the use of mobile technology in their collegiate experiences. While most students probably had used their mobile devices or apps in some manner for educational purposes, this study's focus was on those students who relied somewhat heavily on mobile technology in their studies. Having a certain number of participants in the sample also provided a greater opportunity to obtain different student types making a fairer representative of the student body at the university.

Sources of Data

The sources of data for this study included interviews, focus groups, and a short demographic questionnaire. After the initial screening and selection of the final 13 participants for the study, additional data was collected from the participants during the personal interviews and focus group sessions. The rationale for obtaining data from several sources in a case study, Yin (2018) explained, was its relation to the reasons for the choice of the case study design initially, and the desire to do an in-depth study of the phenomenon of mobile technology use by college students in a real-life university setting.

Evidence obtained from different sources was then triangulated during the analysis process which added to the researcher's understanding of what was studied. Yardley (as cited in

Yin, 2018, p. 128) further explained that "[[t]he desired triangulation follows from the principle in navigation, whereby the intersection of lines from different reference points is used to calculate the precise location of an object." The findings in any case study would likely have greater accuracy, thus be more convincing, when the results were attained from multiple sources (Yin, 2018).

Data Collection

Prior to gathering any data in this study, a signed informed consent was received from all persons that volunteered to participate in the case study (Yin, 2018). Each participant was also advised in writing that participation in the case study was completely voluntary and that he or she could leave the study at any time without repercussions. A demographic questionnaire was then completed by each participant (see Appendix A). Interviews were conducted via video conferencing by the researcher, with the duration of each interview lasting approximately 30 to 35 minutes. Each participant was asked 15 identical semistructured opened-ended questions during the interview on Webex™, a web meeting room, and their responses were recorded after the researcher obtained each participant's written consent (see Appendix B).

Two focus groups consisting of four participants in one group and five in the other were also conducted on Webex™. The researcher guided the discussions towards a similar aspect of mobile learning that was previously discussed in the interviews, so that each participant's views or experiences in the focus group were made known (Yin, 2018; see Appendix C). The participants were notified in a timely manner of date and time of interviews or group meetings via email along with detailed instructions on how to join the Webex™ meeting room. The case study analysis that followed, according to Yin (2018), should be a triangulation of all the information collected from the different sources, so to validate the findings of the study.

Identification of Attributes

Narrowed focus and highly detailed are some of attributes that defined this descriptive case study. The case studied involved the researcher exploring the attitudes and opinions of a sample college students in a liberal university regarding their usage of mobile technology for educational purposes. The data collected in study constituted the perceptions as well as the descriptions of the study participants' experiences in the context in which they had occurred, which was from the perspective of the "learner."

Data Analysis Procedures

Even though the concentration of this single-case study's analysis was from the data from mobile learners in higher education, it would include several subunits of analyses as well. Yin (2018) explained that "[s]ubunits of analyses may be incorporated within the single-case study, thereby creating a more complex (or embedded) design" (p. 54). For example, learners from the different age groups or from the opposite genders could be described as embedded subunits of this case. Such subunits could also create opportunities to analyze mobile learners from different angles, providing greater insight into the case study (Yin, 2018).

Analysis for a qualitative case study involved the researcher thoroughly describing the case and the special conditions of the study which could be accomplished from the combination of several procedures, dependent on the type of case study conducted (Creswell, 2018; Yin, 2018). However, Yin (2018) stated that the case study researcher has no set formulas, recipes, or software like statistical analysis, that produced the outcome from the data. Instead, the data had to be studied first for the emergence of meaningful patterns or themes "such as the frequency of codes or code combinations" that were in the study (Yin, 2018, p. 166). Yin (2018) described this "pattern matching" as one of the most

popular techniques for a case study analysis, which made it the most relevant type of coding for this study.

The patterns that emerged for this case study related to the "how's" and "why's" of mobile technology use were the primary focus. Coding in qualitative research was the method of organizing and grouping similarly coded data that shared similar characteristics "into categories or 'families'" (Saldaña, 2009, p. 9). The textual data collected from the participants via the interviews and focus groups was entered into ATLAS.ti, a data management software, for the initial set of codes which were derived from the words and phrases transcribed from each participant's recorded interview and focus group session (Yin, 2018).

While there were several coding methods that could have been utilized for this study, the implementation of in vivo coding method deemed the most appropriate for this study due to its use of the participants' own words (Saldaña, 2009). According to Saldaña (2009), the in vivo coding method could be used for most all qualitative studies but was especially useful for newer qualitative researchers just beginning to code data. As Saldaña suggested, in vivo coding was used in the First Cycle so that the researcher could familiarized herself to the participant's language, beliefs, and attitudes. Additionally, the Second Cycle Coding was used, the pattern coding method for codes for specific patterns (Saldaña, 2009).

Saldaña (2009) explained that the researcher should expect to code, re-code, and re-categorize the data, to refine the codes and categories. Further, Saldaña stated that during the coding process some of the codes in the First Cycle may be later be re-labeled, re-arranged or even dropped during the Second Cycle coding process. Re-classification as well as new categories of coded data can even emerge during this process. Abbott (as cited in Saldaña, 2009,

p. 10) likened this coding process to ‘decorating a room; you try it, step back, move a few things, step back again, try a serious re-organization, and so on.’

Because the Second Cycle coding was necessary in this study, the goal was to obtain further organization of categories and themes from the codes from the First Cycle (Saldaña, 2009). After the data was coded thematically, an interpretation of the meaning of the data was made. The findings of this qualitative case study approach may have added to the understanding of the influence of mobile technologies on learning in higher education, yet, the methodology used for the study also was limited.

While the data collected from the interviews and focus groups was electronically coded to gain further insight, the information from the demographic questionnaires (see Appendix A) proved helpful when comparing the participants’ responses. The researcher noted specific patterns from the students’ specific demographics (see Appendix G). For example, the younger participants would give much different responses to an interview question than the older participants.

Validation

The use of multiple sources of data was essential in validating the findings in this qualitative research design (Yin, 2018). The triangulation of the data sources not only demonstrated the accuracy of the findings but also provided greater insight into the phenomena of the ubiquitous use of mobile technology in higher education (Baxter, & Jack, 2008). In addition, the identification and elimination of the researcher’s personal biases as well as the member checks which assured greater consistency and credibility of the data collected and later analyzed.

Credibility

Yin (2018) suggested following "four principles of data collection" in order to ensure the research's credibility and validity (p. 126). The first of these conditions was the use of multiple sources of data in the study. The importance of the triangulated the data was to ensure that each participant's perspective was depicted accurately in the case study (Yin, 2018). The researcher triangulated the data in this study by using a demographic questionnaire, interviews and focus groups.

The second principle entailed the creation of a case study database in which the researcher used to organize and document the data that was collected from the different sources (Yin, 2018). All data from this study was compiled electronically in this database. For example, all of the participants' demographic information was categorized and filed. After transcribing the participants' recordings in the interviews/focus groups, the researcher placed that data in the database also to retrieve later for the analysis.

Dependability

A third principle to be followed is "to maintain a chain of evidence" to "increase the construct validity of the information" in the study (Yin, 2018, p. 134). Yin (2018) stated that the reader should be able to trace in the case study the steps in both directions, either from the findings back to the original research questions in the study or from the research questions to the findings. Yin also explained the importance of the evidence is reflecting the same concepts at both the earlier stages and later stages of the study.

The fourth principle of data collection involved specific cautions when using of data from social media and/or electronic sources such as permission to use and protection of the participants' identities. After obtaining the appropriate consents, the researcher obtained

electronic data for this study from demographic questionnaire (Qualtrics), as well as from personal interviews and focus groups recorded in Webex.™ All data from each of these sites were deleted immediately.

Limitations and Delimitations of the Research Design

One specific limitation of case study research was the inability to generalize the study's findings to other settings. According to Yin (2018), a single-case study like a single experiment "are generalizable to theoretical propositions and not to populations or universes" (p. 21). Yin (2018) explained that it was only after a set of experiments replicated the same results under different conditions could generalizations be construed.

This study was also limited with the possibility of the participants giving less than honest or incomplete answers to the questions asked in the initial screening, the questionnaires, the interviews, or during the focus groups sessions. The use of member checking during the data collection and analysis portions of the study helped in obtaining more accurate participants' responses (Baxter & Jack, 2008). Member checking involved the researcher sharing her interpretations of the data with the participants, allowing further discussions and clarifications, as well, provided an opportunity to obtain additional information from the participants (Baxter & Jack, 2008). Baxter and Jack (2008) pointed to additional strategies that the researcher could use to increase credibility of the study, suggesting that:

> the reflection or the maintenance of field notes and peer examination of the data. At the analysis stage, the consistency of the findings or 'dependability' of the data can be promoted by having multiple researchers independently code a set of data and then meet together to come to consensus on the emerging codes and categories. (p. 556)

Another concern with a case study design was the possibility of biases of the researcher occurring in the procedural portions, such when compiling the participants' focus group and interview questions, recording the data, and reporting the evidence (Yin, 2018). Creswell (2009) wrote that in a qualitative study, the researcher's primary role was that of a data collection instrument, necessitating the researcher identify their own personal values, beliefs and biases. Therefore, transparency was key for the researcher not just at outset of the study but throughout the research process.

This study was delimited due to the participants were students enrolled in one university, in one region of the United States. Another delimitation included the small sample size (13 participants) that participated in the case study. In addition, the participants in the study had to confirm their use of their mobile devices or apps for communication, for accessing or retrieving information, and for entertainment. Therefore, this study was also delimited to only the students who were mobile technologically literate. Lastly, though not intentional, every participant in the study was a graduate online student at the university. While the limitations and delimitations in this study should be considered, so should the ethical considerations in this study and what implementations are needed to safeguard the rights of the participants' in a multiple source study such as this one.

Ethical Issues

The researcher had to be aware also of the ethical implications during every phase of the study. As in all qualitative research studies, it was imperative that the participants' in this case study always had their rights protected. Creswell (2009) stated that employing certain safeguards had to be in place, such as the articulation of the research objectives to the participants both verbally and in writing so that all participants clearly understood the study and how the collection of data would be used. The researcher, therefore, obtained a signed consent

from each participant before proceeding with the demographic questionnaire, the first phase of the study.

All appropriate forms for this case study first were completed and submitted to the Institutional Review Board (IRB) at Concordia University–Portland for approval. Yin (2018) pointed the interactions during case study interviews were unlike the survey interview's closed-ended questionnaires. Because data collection with case studies were less structured than other designs, obtaining approval might be more challenging for IRB (Yin, 2018). The researcher notified the board of all planned interactions with participants as well the specific protocols for the data collection instruments that would be utilized for the study (Yin, 2018).

Once IRB approval was obtained (see Appendix E), the participants were then informed of the devices and activities the researcher would use to collect the data (Creswell, 2009). Transcriptions from recordings and interpretations from the data were made available to the participants via email. Creswell (2009) emphasized the importance for the study that "the rights, interests and wishes" of the participants were considered first before any decisions "[were] made regarding reporting the data" with the final decision regarding the participant's anonymity always resting with the participant (p. 198).

So, it was equally important that the participants' identifications were well protected during all phases of the study. While the students that participated in the study may already had their personal information (name, address, and telephone number) published in the university's directory due to being enrolled at the university, the researcher still had to have adequate provisions in place to protect the privacy of the participants. Creswell (2018) suggested that the names of the participants be masked, as soon as possible, and composite profiles be created to prevent identification of any of participants from the reports. All participants in study were given pseudonyms to protect their identities. In addition, all data was secured in a locked file on the researcher's computer.

Ethical issues could have arisen during the analysis phrase of research as well. According to Yin (2016), the decision of what data to incorporate into an analysis, was of great importance. Yin (2016) explained, that due to amount of data that was usually collected, some of the data would not be reported. However, the researcher must be careful not to ignore data for other reasons, such as a participant appearing uncooperative or the data exhibiting contrary results (Yin, 2016). It was important that the researcher avoided this type of bias when deciding which data to exclude.

Chapter 3: Summary

The purpose of this study was to explore how the use of mobile technologies influenced student learning in higher education. The primary focus of this study was on the perception of the learner rather than the educator. As identified in Koole's FRAME model (Koole et al., 2010), there were several elements that interacted in the process of mobile learning, most notably, the relation between the learner and the device(s) that are used for educational purposes.

The key actions in the study explored this interaction through the lens of college learners by utilizing concepts of Koole's model (Koole et al., 2010). It was the intent of the researcher by conducting a qualitative descriptive case study, a greater insight be achieved into the influence of mobile technologies on students in tertiary education. Another key action was assuring the board that the student participants had "such protections as informed consent, avoidance of harm, and privacy and confidentiality" by having appropriate forms well documented (see Appendix D; Yin, 2018, p. 89). The next key actions in the study consisted of the questionnaire completion in addition to the conduction of the interviews and focus groups. The last key was that, the coding and analyses of the data collected ensued.

Chapter 4: Data Analysis and Results

Introduction

The focus on this chapter was centered on the findings of the perceptions of tertiary students towards the use of mobile technology for educational purposes. Student ownership of smart devices remain on the rise worldwide (Briz-Ponce et al., 2016; Ng & Cumming, 2016). While the literature had shown students' past use of mobile devices were mostly for communication and entertainment, more and more students are using their devices for educational purposes as well (Rossing et al., 2012). Likewise, the focus of much of the previous research on mobile technology in the classroom was on the educator's perspective rather than that of the student's (Chen & deNoyelles, 2013; Miller & Doering, 2014;).

This study addressed this research gap of the learner's perspective by using a qualitative descriptive case study design to explore how university students believed their use of mobile technologies had influenced, or not, their collegiate education experiences. Based on Koole's FRAME model, mobile learning involved the interrelationship of the learner, the device, and social aspect (Koole et al., 2010), therefore the students' perceptions of these mobile learning components were addressed in the study through the interviews and focus group sessions. This chapter first started with the data obtained from the participants' demographic questionnaires. However, the researcher used this information primarily for providing a description of the sample of the study for comparison purposes.

This study with the use of a demographic questionnaire, personal interviews, and focus groups discussions provided data on how the use of mobile technology in higher education had affected student learning. As attested by Yin (2018), a case study analysis should involve the triangulation of data from several sources so to validate the results of the research. Description

of a qualitative case study, the research design of the study, was discussed in this chapter also, as well, as the coding methods used, and the presentation of the findings obtained from the analyses of collected data. After the researcher collected, coded, and analyzed all relevant data, the findings subsequently giving valuable insight for answering the research questions of study which were centered around Koole's FRAME Model of mobile learning:

RQ1: How do college students believe the device aspect of mobile learning influenced their collegiate education experiences?

RQ2: How do college students believe the learner aspect of mobile learning influenced their collegiate education experiences?

RQ3: How do college students believe the social aspect of mobile learning influenced their collegiate education experiences?

Description of the Sample

Potential participants. The participants in this case study were students enrolled at a university located in the Pacific Northwest. The students were selected and contacted via email from the list of respondents from a recruitment email sent using Qualtrics (see Appendix F), who had both met the study's criteria and expressed an interest in participating in the research. These criteria included both enrollment at the university for at least one academic year and previous use of mobile technology (devices or apps) for educational purposes. The response rate in the first 24 hours from the recruitment email was approximately 200 students with over 100 confirmations to participate in the study.

The participants. While over 100 students had initially expressed a desire to participate and met the criteria, approximately 50 respondents were recontacted via email, of which, 15 students emailed back a signed consent. The selection of the respondents was in no specific

order from original list, the respondents were selected from different areas on the contact list. Therefore, the researcher recontacted students equally from all over list, no matter if the student responded first or last to the recruitment email that was sent to the study body in Qualtrics. From the 15 respondents, 14 completed the demographic questionnaire via Qualtrics, the first phase of the study (see Appendix A). The researcher had to remind three of the participants to complete the questionnaire, while for one, a second reminder email had to be set. Thirteen of the14 participants did complete their interviews (the second phase); however, only nine of the 13 participants took part in the focus groups and completed the third phase of the study.

Demographics of sample. In the sample, only one participant was a campus-based student; that participant quit after completing the first phase of the study. The remaining 13 participants were all online students. All 13 completed the second phase, and nine students participated in all three phases of the case study. The participants ranged from 26 to over 50 years in age, including four male participants and nine female participants.

All the students that participated in study were graduate students (masters or doctorate). While both undergraduate and graduate were recruited by the first email in Qualtrics, no undergraduate students at the university had responded when recontacted by researcher. Until the respondent signed and returned the consent for the study and then completed the demographic questionnaire on Qualtrics did the researcher have knowledge of the participant's demography. Appendix G has further demographic information on the study participants.

Research Methodology and Analysis

Research design. A qualitative descriptive case study was utilized to obtain insight regarding the participants' beliefs on how the use of mobile technology has influenced the device, learner, and social aspects during the process of mobile learning. The researcher had

collected informative data using questionnaires, interviews, and focus groups, which detailed the participants' viewpoints and experiences regarding their mobile technology use. After the participants completed the demographic questionnaires (Phase I; see Appendix A), the personal interviews (Phase II), and focus groups (Phase III) were then scheduled and conducted by the researcher via Webex™ using pre-determined open-ended questions (see Appendices B and C).

Scheduling process. After emailing the participants a list of the interview times that were available both during the day and evening, the participants were instructed to select their first and second choices of interviews dates and times that were convenient for them. If the listed dates were not conducive to a participant's schedule, he or she was then given the opportunity to schedule a different time that would be. After obtaining feedback from several of the participants during the interview sessions, both focus groups were intentionally scheduled on an upcoming federal holiday, when a significant number of them would be off from work.

To accommodate the participants' different time zones, they were given a choice of two focus group times, one mid-afternoon, and the other, late evening. The participants were also instructed to contact researcher if unable to do one or both times. Yet, out of seven confirmed participants, only five took part in the first focus group, while only four out of the six took part in the second group.

Reminders sent. To minimize confusion with the Webex™ meeting times, the researcher sent each participant a reminder email one day prior to his or her scheduled interview or focus group. Even so, due to differences in time zones of both the researcher and the participants, several (4) of the participants had either entered the meeting room on Webex™ an hour earlier for interview or an hour later than their email confirmed time. While this "time zone confusion" remained a prevailing issue throughout the field experience portion of study, the majority (9 out

of 13) of the participants completed both their interview and focus group sessions on their scheduled day and time.

Participant inquiry process. Each participant was asked to confirm his or her permission again for researcher to either audio or video record his or her responses prior to conducting those phases of study. After explaining to the participants that there were no "right or wrong" answers to the interview or focus group questions of the session, they were given the opportunity and ample time to share their views and thoughts on mobile technology use with the researcher and with each other. The interview questions were centered on Koole's FRAME Model, and addressed the device, learner, and social aspect of mobile learning with the participant (Koole et al., 2010; see Appendix B). The interviews were conducted over a two- week period with the participants. The focus groups were scheduled and conducted two weeks after all the interviews were completed.

The focus group questioning (see Appendix C), while not identical to the interview questions, allowed the participants in the groups to further elaborate on the topic of students' mobile technology use that was previously shared by the participants in the interviews. To promote relaxed and free-flowing conversations amongst the participants, the researcher's role in the focus groups was only to guide the discussions on the topic of mobile learning in higher education. For accuracy of information being obtained, the researcher repeated the participants' responses back to them during the discussions.

Even though the researcher had asked the participants the exact questions for each interview, the duration of the interviews did vary. For example, the longest interview recorded had lasted over 30 minutes, while the shortest only 14 minutes. Each interview and focus group session were audio and video recorded, respectively on the Webex™ website. In addition,

Microsoft™ OneNote was used to back-up the recordings during interviews and focus group sessions.

Transcription process. The data from the interviews and focus groups, which reflected the students' perceptions of how the use of mobile technology impacted their learning at the university, was transcribed, sorted, and then later analyzed. Each audio and video file from sessions were uploaded to an online transcription service. This service proved to be very useful, providing not only a quick turnaround (in minutes) of the transcription but also charged very reasonable fees.

The transcripts were then reviewed audibly and corrected as needed on the website as well. To *member check* and thus increase the credibility of data collected, the researcher emailed the transcripts to the participants to review for any discrepancies in the information he or she had shared. The participants were given the opportunity to either confirm accuracy of information, or add greater clarity to what was previously stated, if they felt it was warranted.

Protection of participants. To protect the participants' identities, each participant in the study was also given a pseudonym by the researcher. All media files and transcript documents were labeled with only the pseudonyms names of the participants also. Every audio and video recording of both the interviews and focus groups were permanently deleted immediately after the transcriptions were completed on Webex™ and the transcription service's website.

Additionally, transcript documents of all recordings were kept secured in a locked file on computer as well. It is important to note, some of the participants had more to say about a particular topics(s) than others. However, due to irrelevancy of some of the data, though coded and analyzed by researcher, not every response of the participants was used in study.

Data analysis. The ample data collected from interviews and focus groups was coded using ATLAS.ti, a qualitative analysis software, so to identify similar "patterns, insights, or concepts" in the data (Yin, 2018, p. 167) from the participants' responses to the questioning. As stated by Saldaña (2009), just one cycle of coding is usually not sufficient. Saldaña (2009) explained that "[t]he second cycle (and possibly the third and fourth, and so on) of re-coding further manages, filters, highlights, and focuses the salient features of the qualitative data record for generating categories, themes, and concepts, grasping meaning, and/or building theory" (p. 8). The main goal of the Second Cycle coding, Saldaña stated, was the development of concepts, themes, or categories from the collection of First Cycle codes.

The researcher used in vivo coding first on the data and then those codes were then colored coded, matching the participants' responses to the three components or categories of mobile learning. Quotations from the data were first placed in three broader thematic categories such as: "the mobile learner influences," "the influences of mobile device(s) or apps" and the "social aspect influences" with the use of mobile technology in academia. Then, the similar codes (patterns) were sorted into subcategories or themes that were pertinent to that particular aspect of mobile learning.

As explained by Yin (2018), the analytic technique of *pattern-matching* was "one of the most desirable techniques" being used in case study analyses (p. 175). Yin (2018) wrote that in an explanatory case study, "the patterns may be related to the *how's* and *why's* of your case study" (p. 175). The relevant data that addressed the participants' perceptions of how mobile technology had influenced their higher education experiences was reviewed and organized using ATLAS.ti.

There were several thematic code groups that emerged from the data during the Second Cycle coding that focused specifically on the research questions in this study. Using the code manager and group code manager tools in ATLAS.ti., each of the participant's codes were placed in these thematic groups. This data was then transfer to Microsoft Excel for analysis, to determine the similarities or differences in the participants' responses that were noted in the interviews and focus groups. Charts and tables were created in Microsoft Excel of specific results for ease of visualization for the reader. The data from both the interviews and focus groups data were coded in the same manner during the analysis process.

Summary of the Findings

Below each of the three categories of influences of mobile technology use with the nine thematic codes which are representative of the participants' perceptions on the use of mobile technology in academia. Each of these perceptions are addressed in the subsequent sections of this chapter.

Thematic Code Category 1: The Influence From the Device

- Widespread device(s) ownership
- The device(s): A necessity
- Mobile device the facilitator

Thematic Code Category 2: The Learner Influences

- Adaptive to learning needs
- Learning with mobile technology
- Educators use of technology

Thematic Code Category 3: Social Influences

- Bridging the communication gap

- A tool for collaboration
- Loss of personal connection

Presentation of Data and Results

Thematic code category 1: The influence from the device. According to Koole et al. (2010), the mobile device component was one of the three facets influencing the mobile learner. Different factors, such as the capabilities (features) of the device and the specific applications, used could affect the learning process (Koole et al., 2010). It was evident from information obtained in the interviews and the focus groups that mobile devices (laptop, tablet, or smart phone) played a huge part in the participants' personal and academic lives.

The study participants enrolled in a Pacific Northwest university shared their views on the mobile device(s) or apps they were using, and which features they thought aided their learning. While all the participants had used mobile technology frequently, their ages and prior educational experiences varied, and they all resided in different locations in the United States. All participants' names listed in the following sections are pseudonyms.

Widespread device(s) ownership. The findings in this study supported that the majority of participants either owned or had access to at least one mobile device (smartphone, tablet, or laptop). However, in one of the focus group discussions, several of the participants had shared that they did not use much mobile technology as an undergraduate. Aaron explained that as undergraduates, "we had no technology that was before computers. So, [for] Grad school my experience was really minimum in terms of getting access to research online."

Cara, also in her description of her undergraduate experience, stated that "there was no technology. It was all brick and mortar. I was on campus the whole bit." She went on to say, "I didn't do any online work until I did my masters' final and everything I did was on a laptop.

And I typed it, which was the first time I had ever typed in my entire life." Martin, on the other hand, in describing his more recent undergraduate experience with technology, told the group that "we, got started, to get into PowerPoint and things like that. [But] we didn't really use a lot of email for communication amongst peers or faculty."

However, every participant in their interview sessions told the researcher that they owned and currently use— a smart phone and at least one laptop. Eight of the participants (62%) also affirmed one or more tablets they were using on a regular basis, while two even included smart watches as frequently used mobile devices (see Table 1). From the responses, it was found that the participants were using a variety of operating systems (iOS, Android, Windows) in their mobile devices.

Table 1

Participants' Mobile Device(s) Ownership

***Participant pseudonyms**	Laptop(s)	Tablet(s)	Smart Phone
1. Elise	1	0	1
2. Sarah	1	0	1
3. Cara	1	1	1
4. Ethan	1	1	1
5. Martin	2 (laptops)	2 (tablets)	1
6. Leah	1	2 (tablets)	1+smart watch
7. Wanda	1	1	1
8. Aaron	1	1	1
9. Caitlynn	1	0	1
10. Jeffrey	1	0	1
11. Yvonne	1	1	1+ smart watch
12. Amy	1	1	1
13. Alexi	1	0	1
Totals	100%	62%	100%

Important device features. Not only did the participants believe it was important for them to own or use their mobile devices, the participants also felt that their mobile devices needed to possess specific features (see Figure 2). For example, for one participant, the security

capabilities like *face recognition* were the most important feature of the device, while for the majority, the ability to *text* and connect to *Internet or Wi-fi* were much more important features. A recent study had showed that 78% of students had "considered Wi-Fi extremely valuable to their academic success" (McQuiggan, McQuiggan, & Sabourin, 2015, p. 50).

Table 2

The Applications Used by Participants for Courses

Application	Participants	Application	Participants	Application	Participants
Email(s) apps	3	Texting apps	2	MS Office Word, Excel, PPT	4
Music app	1	Internet browsers app	1	Bookshelf	4
Dropbox	1	Facebook	2	Twitter	1
Box	1	Kindle	4	Scanning app	1
Google apps	3	Zotero	1	Blackboard app	4
Slack Bot	1	iBook	1	Mendeley	2
Audible app	1	Amazon	1	YouTube	1
Calculator	1	Dictionary	1	SPSS	1
Natural Reader	1	Beeline Reader	1	LinkedIn	1

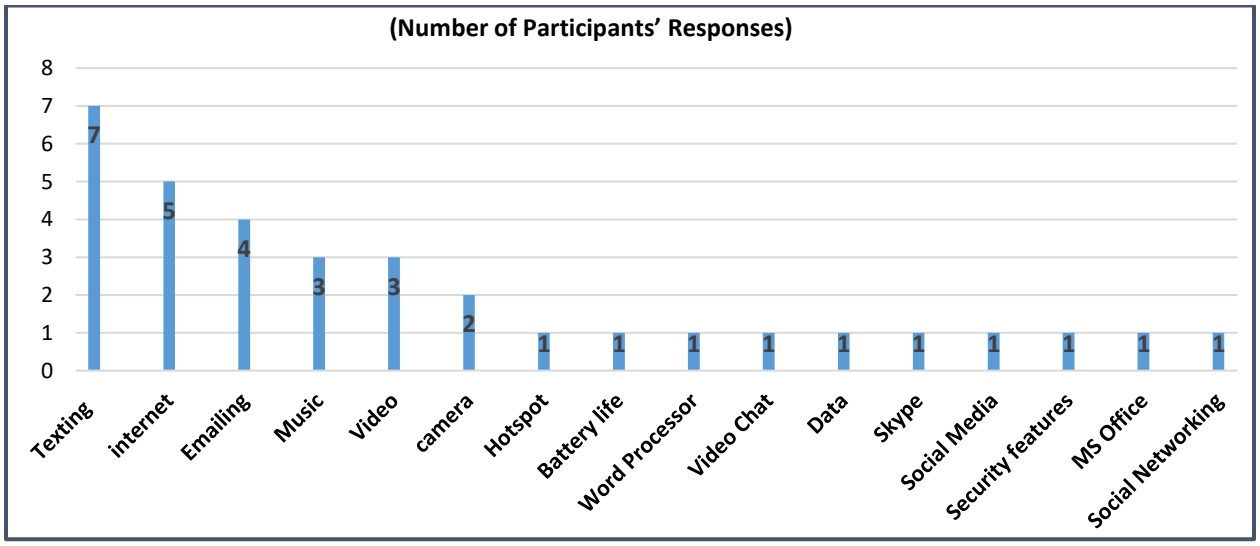

Figure 2. The participants' most important device features.

Though not all of the features that the participants had discussed the interviews are listed above, they are indicative from the participant' perspective that mobile devices not only must be capable of such basic functions as communication, but the device needed to provide organizational and entertainment capabilities for the mobile learner also.

For example, Participant Martin stated that the "texting, emailing, messaging" features were important to him because he "communicat[ed] quite a bit with a wide diverse group of people like on LinkedIn . . . with a lot of other professionals, exchanging information, [and] feedback on different things." He felt that it was just more convenient to text, email, or message that person rather than return a phone call. Martin further explained that the importance of having those features was "mainly the communication aspect, the ability to exchange information . . . in a timely manner."

On the other hand, for Alexi, "the battery life" and "portability" of the device were key, stating, "like can I grab it and take it with me" and "I [can] do course work writing, research basically anywhere." However, from many of the participants' responses, it was apparent that having specific features on their mobile devices were equally important as well.

Using apps in education. The 13 participants in the interviews listed nearly 30 different applications that they used regularly on their mobile devices for educational purposes (see Table 2. There was a wide variety in the types of apps the participants used, ranging from statistical analysis software to social media apps used for collaboration with other students. Microsoft Office, Kindle, Blackboard, and Bookshelf apps were the most widely used apps (4 participants), Email and Google apps were used by three of the participants.

It was highly probable that more of the participants were using the same apps, for example, an application like Microsoft® Word is commonly used in writing courses at the

university as well as many of the social media apps. Yet, evidently, some of the participants failed to recall these particular apps during the interview sessions. Since the researcher had recorded 12 of the 13 participants had included at least one social media application (Facebook) on their devices when answering the social app question in the interview. Several of the participants who could not remember their apps actually took time during the interview to checked which apps were installed on their devices. None of the participants were aware of the other participants' answers.

Additionally, several of the apps the participants used on their devices were entirely user specific for them. For instance, one participant had several e-readers apps downloaded on his mobile devices that assisted him with his reading disorder. For Participant Elise, Google Suite was important to her. She stated as a Google certified educator, she used classroom doc or anything Google related.

Table 3

Age Ranges of Participants

Participant pseudonyms	Age Ranges (years)	Participants	Age Ranges (years)
Amy	26–35	Caitlynn	36–49
Alexi	26–35	Martin	36–49
Leah	26–35	Elise	36–49
Jeffrey	26–35	Cara	50 and >
Yvonne	36–49	Ethan	50 and >
Wanda	36–49	Aaron	50 and >
Sarah	36–49		

The device(s): A necessity. Since all the participants in the study were over the age of 25 (see Table 3), most of them had not entered the educational system as a "digital natives." Prensky defined (as cited by Stockham & Lind, 2018) "a digital native is an individual who has been exposed to digital technology since birth" (p. 1). Yet, many of the participants in the interviews and focus groups, had emphasized how using mobile device(s), more specifically,

their smart phones, had now become almost "second nature" to them. The researcher determined from the demographic data that the majority (6) of the participants were between the ages of 36 and 49 years old, four were between 26 and 35 years old, with the three remaining participants, 50 years old or over.

Though it also became apparent in the focus group discussions that none of the participants in the study had been reared using technology, all had confirmed in their initial responses in the recruitment email that they were now comfortable and proficient using mobile device(s). Additionally, all the participants stated that they owned and regularly used both a smart phone and a laptop (see Table 1). Two of the participants had access to four different mobile devices as well (laptop, tablet, smartphone, and smartwatch).

The smart phone. From the participants' perspective having access to mobile devices, more so, their smartphone was a necessity. Martin in discussing his use of his smart phone, stated that "I would probably be lost without it. I don't know when the last time was, I remembered a phone number." Elise concurred in her focus group, stating, "I use my smart phone for my alarm clock. I use my smart phone for banking. I use my smartphone for pretty much everything."

For Ethan, his cell phone had become one of his best tools, having "access to immediate information." Ethan added, that he had "the big screen, [a]cell phone with the biggest memory and that's, that's my tool." Jeffery pointed to the speed by which information can be accessed now on smart phones, stating how they "almost makes laptops and computers useless." Jeffrey added, "[i]f we had a keyboard and if the apps for Blackboard and things like that worked well, I probably won't even need a laptop. . . . But yeah, my, my mobile phone almost acts like my own level mini laptop."

Aaron, however, shared with the group, what he called a "contrary opinion." Aaron believed that the strongest attachment to his phone was "the camera feature." Aaron stated that "I am often without my phone." He explained, "I spent 30 years in the military where I was up in a room where I wasn't allowed to have a phone because of security issues. So, it's like, okay, the phone is not attached to my hip." Though Aaron was one of the three participants who was over the age of 50 (see Table 3), the lack of his attachment to his phone seemed to be more related to Aaron's previous occupation rather than generational. While each participant shared their point-of-views regarding how important his or her smart phone was, it was also apparent their laptops and tablets were valuable tools in their education experience as well.

Table 4

The Participants' Collaboration Experiences at the University

*Participants Pseudonyms	Collaboration Experiences
Amy	Communicated with classmates in courses on FB and IG
Elise	Communicated with faculty chair via email or smartphone. Did not communicate with other students except on discussion boards.
Sarah	Communicated with dissertation faculty and with several of peers on FB and SC.
Leah	Communicated with faculty chair. Also stated "On FB, there's a bunch
Ethan	"I used the computer fairly often to do that (connect) . . . I've just recently used my cell phone. I think I've used it twice in the last year to contact a classmate."
Alexi	Communicated with "professors at the [university] . . . my dissertation chair." She stated she "don't really communicate with other students."
Yvonne	Stated only "one student" was on her "social media."
Caitlynn	"I did speak with one person via *WhatsApp* in one of my groups before in class.
Cara	Used "FT to have conversations with my dissertation chair."
Martin	"When I email other colleagues in classes, most of the time it's done on my phone"
Wanda	To connect "with my dissertation chair, we use . . . Web ex. And then I also use FT on my iPhone." Also reached out to a few fellow dissertation students by email.
Aaron	Spoke of communication with other students with the messaging on the LMS.
Jeffrey	Worked with other students "on discussion boards or emails, group projects, things of that nature . . . depending on the course."
	FB= Facebook IG= Instagram SC= Snap Chat FT= Facetime

Note. All the participants when asked, had worked with other students several times previously. Examples of each participant's collaborating experiences with faculty members or other student(s) are listed in Table 4. All the occurrences were when the participants were attending either this university or when enrolled in prior education institutions.

The tablet/laptop. While all the participants stated they owned and used regularly a laptop for their coursework, 62% of them said they owned or used a tablet also (see Table 1). Participant Ethan, in describing his mobile device use stated:

> I use my laptop a lot. I'll print out all kinds of different stuff. So, when we get transcripts of things and PDFs, for just mainly so I have them on hand. Because when I'm on the phone or I'm on my iPad, you can't really do as much as you can on the

> laptop. . . . My iPad is useful for certain things, but it's not as useful . . . it won't allow you to save.

Sarah stated that she had a laptop that was more "like a tablet" on which she had done most of her schoolwork. Wanda stated that she used her laptop also, however, her mini tablet was what she used to read all her "books on and do some research on the Internet." Leah, on the other hand had a laptop and two mini tablets, stated that she did not use her laptop "as frequently." She said the laptop was "more like when I sit down at the coffee shop to actually type stuff." Leah added that there were "three PC's" that were accessible to her as well, that she went "back and forth with." Leah was the only participant that mentioned the use of a desktop computer also for her schoolwork.

Ethan spoke of his frequent use of both his laptop and tablet, stating "I'm on the computer daily . . . the phone, hourly, the iPad maybe two or three times a day." Aaron in explaining his use of his laptop while researching, stated:

> [S]o the laptop is my primary device, to do my research gathering . . . that is going to the library and pulling down documents. [Also]in storing them, I use it as a conduit to the cloud because I like to store a lot of my things on the cloud versus a hard device as a backup. . . . But yeah, I use the devices primarily for gathering research, and storing, and cataloging the research I'm drawing together.

It became apparent from the participants' responses in interviews and focus groups, that having easy access to their mobile devices was key to the participants. However, equally important to them, was that the mobile device performed adequately. According to several of the participants, their mobile devices would act at times as the facilitator in their learning as well.

Mobile device: The facilitator. McQuiggan et al. (2015) explained that because of the "on-demand perpetual connectivity of mobile devices," learners are now constantly connected to their resources (p. 50). Thus, learners are no longer tied to just their teachers and classrooms, but learning can occur anywhere (McQuiggan et al., 2015). Several of the participants shared instances where their devices have taught actually them. For example, Participant Ethan spoke of using a virtual textbook program to read the text to him while he reads along. Elise described a similar studying routine with her mobile devices, stated that she actually [had] the Audible app. She said, "where even if I'm not reading, it reads to me online. That is basically how I read now on my smartphone, my laptop, and my Kindle." Continuing, Elise said:

> It becomes so natural that we just depend on the mobile devices to do what we used to sit down and do. I don't sit down and read a lot. I let the books play and I still get the information that I would've normally had to sit down and glean. Notes . . . I don't sit down and write notes. I'll highlight something and copy and paste it to a document. I mean, just what it's come to at this point.

About learning with her mobile device(s), Leah had stated, "I used all of those [apps] on my phone and, of course, Google. If, I've needed to look up a definition, a concept or something . . . I usually went to Google to ask for clarity, probably before I asked my instructors. Also, Martin seemed to feel strongly regarding the role of his devices in gaining knowledge, saying, "So that's very critical thing, I think. Probably well over 90% of my knowledge and information come from one of my media sources." From the participants' viewpoint, not only the mobile device itself impacted the "where" and "when" mobile learning took place but also, how the use of mobile technologies had influenced both positively or negatively the participants during the learning process.

Thematic code category 2: The learner influences. The learner aspect of mobile technology according to Koole et al. (2010), was comprised of "the situations and tasks in which the learner wishes or needs to succeed" (p. 2). Koole et al. (2010) explained that an individual's learning was influenced by factors such the cognitive ability of the learner as well as his or her prior knowledge. Cognitive processes can be affected by different environmental factors related to the physical, cultural, demographical, and economical background of the student. Such factors apparently had impacted several of the participants' education journey.

Although not a criterion for selection for the case study, all the final 13 participants in the study were both online and graduate (master or doctoral) students at the university (see Appendix G). Consequently, each participant had previously at some point had attended post-secondary education institution. Only from the information obtained in the demographic questionnaires, interviews and focus groups, did the researcher know of the participants' prior collegiate experiences or technology literacy. While the participants were of the same rank (graduate) and of the same learning model (online) at the university, their age ranges were not. For comparing the learning experiences of the participants using mobile technology, each of the participant's age range was listed in Table 4.

Adaptive to learning needs. The participants had shared in the interviews and focus groups specific instances of modifications of their use of mobile technology, so to make it more suited for their learning needs. Some changes were made to accommodate the changing time constraints in the lives of the participants, while for others, only a hardware or software change was required. For example, Leah spoke of her evolution from a flip phone to a smartphone during a focus group session. She explained when she was in undergraduate (college), technology was not used much, saying, "only because we didn't have smartphones yet. They

(cell phones) were just the ones that you flip open and you have to like push "A" five times, I mean, five times to get the correct letter." However, Leah believed, even though she lived near university, how she was learning currently had changed as well. Leah told the group:

> [W]hen I got into my master's program, my school was right down the road from me, but I still took everything online and just went to the campus for the different social events and to use the library to get some periodicals that they wouldn't let us check out online. So, I did everything with my computer, my phone and my iPad, for my whole master's program.

One of the other participants had used specific applications on his devices to assist him in reading. Participant Ethan, referred to a software program that he used that read his textbooks to him while he read the text simultaneously. Ethan shared with the group, "that's always been an actual plus. Cause I tend to learn much more from an oral sense as opposed to the visual."

In contrast, Jeffrey adapted his mobile devices more so for his learning comfort. His device(s) needed to have such capabilities as an adequate WIFI, Bluetooth, and a touchscreen. Additionally, Jeffrey spoke of having a "good operating system," "good speed," and a "good keyboard" on his devices, whether a tablet or laptop. In explaining the reasons for this rationale, Jeffrey explained:

> I want to be able to use my device quickly, without having to troubleshoot problems or wait too long. . . . I want to have a good connection so that I could do video and audio without poor quality. . . . I like quality items that work well and suit the applications that I need it for.

Learning with mobile technology. While all the participants were mobile learners, they obviously did not all learn with their mobile devices the same way (see Figure 3). Their learning

practices in the use mobile technology for coursework varied greatly which seemed to be mostly dependent upon the type of course and the participant's learning style (see Table 5 in Appendix G). The following paragraphs were the perspectives of each participant in this study on how the use on mobile technology had or had not aided him or her in their learning experiences at higher education institutions both past and present.

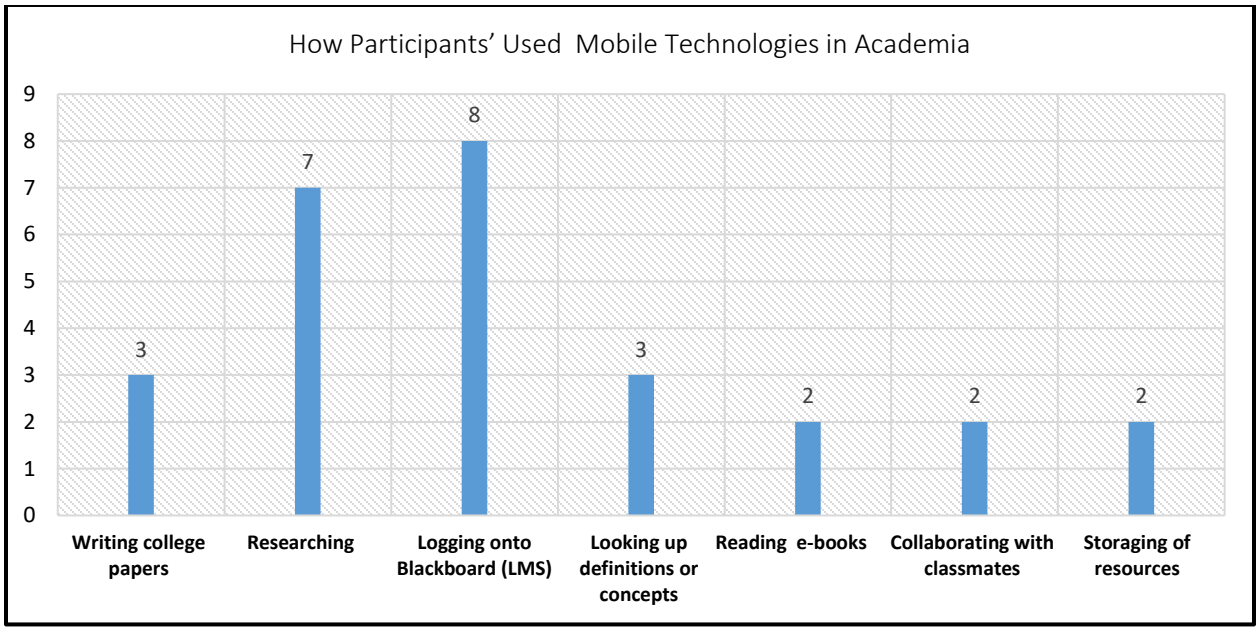

Figure 3. How the participants' used mobile technologies in academia.

> ***Amy:*** It helps me learn because like I said, I'm always on the go, so sometimes I don't like sitting at the computer and I know as an online student, that's what comes with it. But I don't always like sitting at a computer or being at a screen. So sometimes it's easier to be at the gym and read my book or writing my papers while I'm traveling for work. Because I travel for work as well, it's just much easier to have a smaller device where I still have the capabilities of doing every single thing that I need to do for my programs and still maintain my GPA. So, I would just say if you did want to percentage it would be like 100%. I wouldn't be able to function if I didn't use my phone for my program.

Ethan: Well, they've (mobile technologies) been very helpful actually. . . . I'll have it read to me while I'm reading the text. And I've learned that the actually doing both of those at once helps me to retain more of the knowledge they're trying to communicate. So, it's been helpful in that respect. I use it to double. I use the read back function on Microsoft Word to check for any incoherence when I'm writing paragraphs, writing papers and so forth.

Martin: I think it plays a very vital role . . . [in the] increase of knowledge. Because if I'm somewhere and I overhear something that is of interest to me, I can get on a mobile device at that time . . . and research it. I can Google things . . . like Wikipedia. . . . just the ability to be able to type something in and search . . . is very critical in today's time . . . it's very critical when it comes to increasing knowledge, being educated, being more familiar, even informed, informed in different things that's going on.

Alexi: I don't know if I would be able to learn as efficiently without it (mobile technology) so very, very much. . . . I don't know what it's like to have to engage in learning without mobile devices. I've had a laptop since my sophomore year of college. I've always had the ability in terms of post high school work to grab my technology and go. So, I guess I don't know if I can say how much is, has helped me because it's always been a part of my academic experience. I would say as technology has evolved, so has my efficiency to get work done.

Yvonne**:** I think it's (mobile technology) beneficial in learning. It's really important to me. Whenever I need to know something, I will grab my phone and Google it immediately. I can be in church and the pastor may mention a word or something

I'm not familiar with and I'll pull up my phone and Google it just to find out what does that mean or how it relates to the sermon or something along those lines.

Wanda: well I think that I don't know how much they (mobile technologies) helped me learn, but they're definitely like at the root, they are a tool for assisting my learning . . . because it's, I always have it with me and it's, you know.

Sarah: Because there's a difference in learning and I'm finishing my tasks of my assignment. But I mean it, it still helped me learn quite a bit because I'm accessing, I'm able to access things immediately, you know, anytime I want, anytime of the day, no matter where I am. I can look at an article via email, so I think it's helpful. It has helped me learn better than before we had this kind of technology just because it's so convenient.

Leah: It's (mobile technology) very important for me. I use everything I do for school. If have something I need to do with my computer or my phone or something . . . especially because I'm an online student, right? I never go into a class physically. Even when I go to the library to do research and I have a book . . . I grab a book because I have a university right near my house. So, I'll go to the library there, but I'll always have my phone or something. I use my phone to take pictures of books or pages to scan pages in books. But I need to have my computer. If I didn't have a computer or mobile device of some sort, I would not be able to do anything at all. That's so sad, but no, I really wouldn't be able to.

***Elise*:** (mobile technologies) helped me learn a lot. I can't even put it in a percentage because I don't want to say 100%. Because that's not factual. My mobile device

has helped me learn . . . God, I get the news first thing in the morning from my smartphone, via email. I get notifications as soon as I get online on my laptop. Social media, I don't even know how to answer that.

***Cara*:** If I did not have my mobile device, I would not be doing what I'm doing right now. It has given me access to a completely different state, with a completely different university. And so, at this moment while I have access to the university's library, it is invaluable to me. Because a lot of the things that I want to look up for my work, my schoolwork, not just my coursework, but just things at school, I use the university's library for as well. And so, I'm always pulling information and sharing information through the university . . . It's been amazing. So, I don't know that I would be learning nearly as much for my work and my school, as I do, if I didn't have my mobile devices.

Jeffrey: That's the only way I got through. Yeah . . . so in terms of importance, my mobile devices helped me learn immensely. I mean that's my, that's my main method of textbook material . . . even when I was an undergrad doing . . . my other stuff, I consistently used mobile devices for basically everything. Yeah, because I did my master's degree online too. So, I use my mobile devices also for viewing lectures and asking questions. I mean my mobile devices basically my college.

Two of the participants, however, held opposite views regarding the use of mobile devices for facilitating learning. *Caitlynn* stated that, "It (mobile technology) doesn't really help me learn, but I use it to be able to continue my education outside of, not having a computer right

in front of me." *Aaron*, when asked "[w]hat are the ways the use of mobile device(s), if any, has helped in the learning process," responded with:

> How's has the device helped me learn? You know, I don't think it does. I mean I know I'm a doctoral candidate in education. [But] I don't think that the device itself helps me learn. I think the device helps me get to information that develops knowledge. The device itself, honestly, because I live near the campus . . . if I go to the library at the campus, I would be just as pleased walking up and down the stacks there and spending an afternoon looking through articles. Now it would take me longer, but at the end of the day what the device does . . . it's is a funnel that it lets me bring information somewhere I can look at it, digest it and then learn from it. But the device itself, is different from a simulator, like in a flight simulator where the device itself has led me to learn how to fly. In this context, it's not. It's really more of an outlet or an inlet for information.

Each of the participants had shared their thoughts and opinions on the ways mobile technology had enhanced, or not enhanced their learning experiences in higher education. While both internal and external factors had shaped the individual learning styles of the participants, having instructors who lacked information technology (IT) competences were also a concern to the several of the participants.

Educators use of technology. The participants shared a wide range of views on their prior experiences with their instructors' use of technology. Most of the participants either had no comments or were neutral on the question if instructors resisted or embraced technology. Participant Wanda found no resistance and thought instructors were trying to find more ways to use technology. "The topic had not come up" for Jeffrey, he stated he "had no knowledge of it." He did speak of minimal use of technology by instructors, "[i]t was basically just discussion

boards and posting documents for essays and stuff. And no, that was about it. I never saw a teacher use videos, even just a simple web video of themselves. No, I never saw any of that."

Martin's view of his instructors' technology skills, was that, it was "maybe a 50–50." He added, "some of them you can probably tell maybe they're a little more comfortable using things like, they embedded videos and certain things, whereas others, you know, might just provide a link." Elise commented that she did not "remember a professor that didn't embrace technology." Sarah as well, when she thought back, felt neutral. She said, "I don't know that I felt any type of resistance from any of the instructors, but then I also didn't get any major learning experiences . . . So, it's just kind of neutral."

Aaron alluded to instances when his professors may have encouraged the use of technology, stating that:

> might have pointed to the library for information, but not really introduced any more than simply formatting the papers the way it should be formatted and knowing where the library resources are. I haven't really had any professors say, here's how you can do this more effectively." Really, maybe the early writing classes we did that a little bit and that was more for managing Word a bit better and learning some of the tricks is right there. But since then I wouldn't say any of them have really, amplify my own knowledge of technology.

In contrast, Yvonne had a more positive view on her instructors, feeling she had "not really found an instructor who, did not embrace the use of technology. Pretty much all of my instructors allowed us . . . to utilize what we need . . . technology or utilizing devices or laptops." Also, Cara stated for the most part, she thought her instructors embraced the use of technology. Leah, on the other hand, held a less positive view, stating that "some of them just don't, don't

know how. They don't know how to use some applications, or they don't really know how to use their technology. I mean, I think, they think, they do." Regarding instructors' use of the university's Learning Management System (LMS), Leah commented, "[o]r even on like Blackboard. Okay, some are like barely active on there and then others are like on there all the time, like embedding links, embedding videos, doing those things."

Alexi, also in sharing her frustration on this topic, stated that:

> I have encountered more faculty members that struggle with technology use which I found to be particularly frustrating. So, whether it's efficiency with turning around email communication or feedback on a draft or just like using Blackboard correctly, I have found more often than not, that it's not that they don't want to use it, it's that they're not either trained or they don't have the proficiency with the technology to utilize it in a way that we as students are utilizing it. Oftentimes, I've experienced myself being more proficient at the technology at hand than my professors have been and that's been frustrating.

Yet, from the participants' perspectives of the use of mobile technology for their higher education revealed other social ramifications as well.

Thematic code category 3: Social influences. According to Koole et al. (2010), the human interaction was an important aspect in learning. Even though none of the participants in this study did not share the same physical environment, they were able to share views and beliefs with one another. For this study the social aspects of learning, specifically, the participants' communication and social interaction with mobile technology was addressed.

Bridging the communication gap. For the participants, one of the primary purposes of mobile device, especially their smartphone, were to communicate with others. They were found

to have a variety of other ways of communicating or sharing information besides texting and calling on their phones. This communication entailed the use of different text, email, phone, and social media applications on their mobile devices. Some of the participants used multiple social media apps while one stated she used none.

All the participants confirmed using email apps on their mobile devices. One of the participants, Yvonne stated that she used email for "[p]retty much . . . for everything." Alexi stated she also used "email a lot," saying, "[a]ctually, it's like one of the primary methods, for work anyways." Martin mentioned that he had several (work and personal) "email accounts routed to [his] phone." Jeffrey stated that other than sending emails, he sent "pictures" and "videos" regularly on his device(s).

Nearly all the participants had at least one social media app on their device (see Figure 4). The most widely used social platform was Facebook, Instagram was second. It seemed that many of the applications that the participants used to interact socially were user specific as well as device specific. For example, several spoke of only utilizing video chat apps, like Facetime and Skype. Another participant used Messenger on Facebook to send messages and other media.

The participant, Sarah stated she had previously taken part in the video conferencing websites, both Zoom™ and Webex,™ while Wanda had used Webex™ previously in another course. Leah had mobile payment applications like *Venmo* and *Cash App* downloaded on her smartphone, that allowed her to share payments with her friends when dining out. It was apparent during the sessions with the participants that whatever task or function that particular app performed, necessitated it to remain on the device. Yet, for these participants, it was found that the mobile devices or apps were not only helpful in their personal and professional lives, but in their academic lives as well.

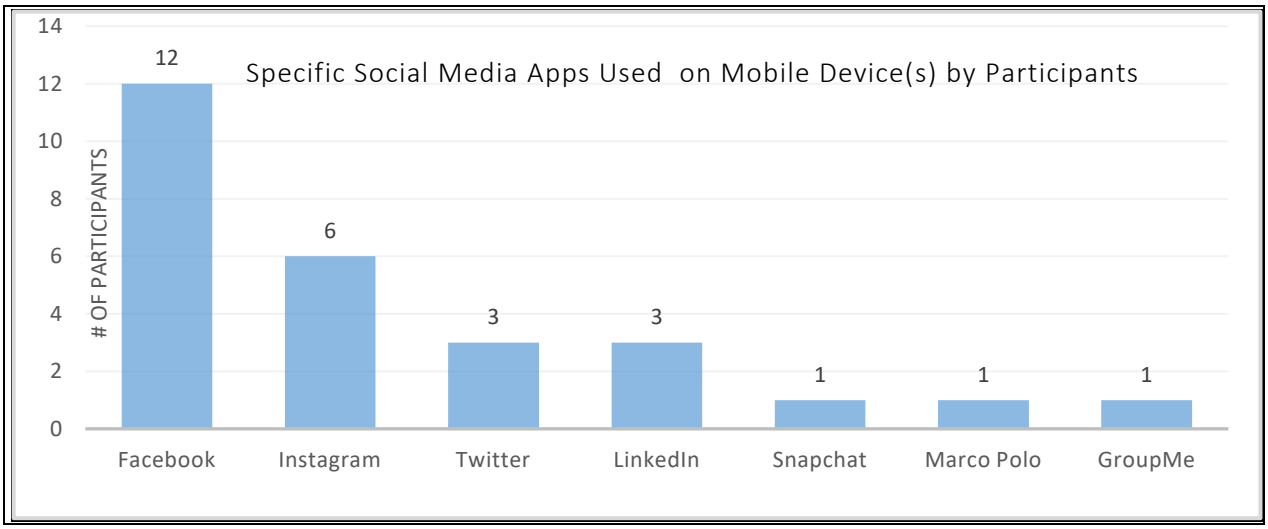

Figure 4. Social media apps used by participants.

A tool for collaboration. All the participants in the study were online students enrolled currently at the university where this study was conducted. However, they did not all attend the same undergraduate or masters' programs nor did they attend their programs in the same time periods. Again, like with modes of communication, the participants had used a variety of means by which to connect and share with other students and their faculty members. They did not used only email and phone calls for collaboration purposes but utilized social apps on their mobile devices as well.

Facebook was found to be the social platform that the participants had used the most. Farley et al. (2015) wrote that "[s]tudents viewed Facebook, not only as a social tool for staying connected with friends and family, but as an essential tool for communicating and collaborating with peers in their courses" (p. 10). Few of the participants had even joined the university' group on Facebook. For example, the participant Martin, stated he had joined the Facebook group so he could read other students' posts in his program to keep informed. Martin spoke of seeing "a lot of the people on there (Facebook) . . . as far as the names of people . . . I didn't recognize any people that I've had classes with."

Participant Cara described how she collaborated frequently with friends (fellow students) who resided in the states of Minnesota, Michigan and Dallas. She shared how they would constantly "email, send them a message via messenger or send them a text message to say," *Hey, in this part of the process, what did you do here*? Cara believed, this was how they assisted one another.

Ethan also spoke of working with another student recently when doing a joint project for a course. Ethan explained that this collaboration consisted of:

> talking on the phone from here to this person who lives in Washington . . . and we would also send messages back and forth. And we would do editing on our project and I'd send it to her, and she'd check it . . . and make changes, where she saw fit and then, I would do the same thing. We were able to collaborate to get the project completed.

It was apparent from the participants' responses that communication or collaboration with peers had occurred more frequently earlier in the participants' education programs. The participants spoke of interacting with other students when in a cohort through the discussion boards and other social media platforms for group projects. Many of the participants are now enrolled in graduate programs at the university in which the participants were communicating more with the faculty, rather than other cohort members. However, even though the participants' mobile devices were the means of connectivity, not having a personal connection with students and faculty was concerning to many of them.

Loss of personal connection. One prominent theme that emerged in the study was the participants' concern that the increased use of mobile technology, had resulted in less interaction between their peers and faculty members. Participant Amy voiced her concern on how social skills have suffered, stating "I feel like the increased use of technology has ruined what it means

to be social." She believed that "the students can't have normal conversations anymore because they're so used to communicating via email or texting." Aaron also mentioned he missed having personal conversation in his courses. He stated:

> I really appreciate seeing people's faces and having a conversation. . . . I don't like the fact that it's harder to have a conversation, even in Blackboard and discussion area. . . . You still miss the emotion and the personal aspect of the education process.

Ethan's focus was rather on the lack of student-professor relationships in mobile learning. He explained that:

> There's a certain amount of disconnect between having the professor and not being able to have that opportunity to interact on a personal level. There's a lot about it that's wonderful. I'll be the first one to say it, but there's also the amount of creativity that you can feed off of. And it spawns more creative thought when you're talking to somebody and you can actually interact with other people.

Cara, agreeing with the other participants, commented that she missed interacting with people. Referring to the Webex™ focus group she was currently in, Cara shared with the group:

> What I don't like about mobile learning the most . . . is that I miss this (video chatting). I miss the interaction with people. I missed the conversation. I missed the classmates that get together after class and drink coffee and things. 'saying that lecture sucked. I don't understand what that lecture was talking about. I need help here.' I missed that. It's like you're on your own. You're in a vacuum and you've got to do your own thing. And you've got to be self-motivated, and you've got to be self-directed. Sometimes you're not always that way because your life gets in the way. It would help if we had a group

that could get together like this and visit and discuss and work through things. We just don't always have that.

The lack of collaboration opportunities and the difficulty of developing relationships seemed to be a problem for many students only enrolled in online programs. The conveniences, accessibility, and the adaptability of mobile technology had made online the preferable mode of education for the participants. Yet, many of the participants during the (Webex)™ focus groups commented on how much they liked being able to visualize one other "to connect a name to a face."

Chapter 4 Summary

The findings of this qualitative case study aligned with the literature as well with this current study. First, vivo-coding and pattern coding later was used to categorized responses into pertinent themes that addressed how mobile technology use influenced tertiary students in their learning endeavors. The findings presented in this chapter and in Chapter 5 as well were supported through the triangulation of data sources used in the study.

As a result of the analysis of the data obtained from demographic questionnaires, the interviews, and focus groups, nine specific themes emerged that had addressed the research questions of this study. The Koole's FRAME model provided the conceptual framework for the study. As further detailed in Chapter 5, the data demonstrated the various ways the students in this study perceived the use of mobile technology and how its use influenced their collegiate experiences in relation to the Koole's model of mobile learning (the mobile device, the learner, & social ramifications; Koole et al., 2010). Also discussed in the next chapter are the conclusions and limitations of the study, as well as the recommendations for further research regarding this topic.

Chapter 5: Discussion and Conclusion

Introduction

The purpose of this chapter is to present a summation of the findings of the study and a discussion of how these findings relate to the literature in Chapter 2. The limitations of the study are also discussed in this chapter, as well as the implications in findings applicable for future practice, policy, and theory. Recommendations for further research are included in this chapter also. In addition, the researcher shared her own insight, her evaluations, and interpretation of the findings in the descriptive case study; and determined what the results mean to the education community. How the study informed the literature, and how the results confirmed or added new knowledge to the learning community are also included in this chapter.

Chapter 5 describes how the study's results aligned around the conceptual framework this research used to answer the research questions of the study. The brief discussion of the study's research design in this chapter clarifies both the purpose of the study and the researchers' plan for answering the study's research questions. Primarily, the aim of this study was to provide further insight in the field of education, gained from prior studies on mobile technology's impact on students in tertiary education, however from the learner's perspective only.

Summary of the Results

Koole's FRAME model (Koole et al. (2010), was the conceptual framework that guided this descriptive case study. The Koole's model was initially used to study the distant learner by addressing the interrelation of three components that occurs during the process of mobile learning. Koole et al. (2010) asserted that mobile learning involved the influences from the interactions of the device, learner, and the social components during the learning process. The research questions were based on the three components, as well were the thematic categories the

researcher used for the coding and analysis processes. Around these thematic categories, nine distinct and re-occurring themes surfaced during the analysis of the data which provided valuable insight into both the interrelations and the influences that the use of mobile technology had on the 13 university student participants in the study (see Figure 5). The research questions of this study, based on Koole's model (Koole et al., 2010) were:

RQ1: How do college students believe the device aspect of mobile learning influences their collegiate education experiences?

RQ2: How do college students believe the learner aspect of mobile learning influences their collegiate education experiences?

RQ3: How do college students believe the social aspect of mobile learning influences their collegiate education experiences?

As stated, the aim of this qualitative case study was to explore students' perceptions of the influences, if any, from using mobile technology in academia. Literature has shown that mobile technology continued to have an impact on learning in higher education worldwide. According to Al-Emran et al. (2016), mobile learning had become an instrumental component of higher education in recent years, making it possible for learning, collaborating, and the sharing views with the assistance of technology. Davison and Lazaros (2015) also pointed to studies in which students concurred that "mLearning (mobile learning) [was] an important aspect of their coursework" (p. 30).

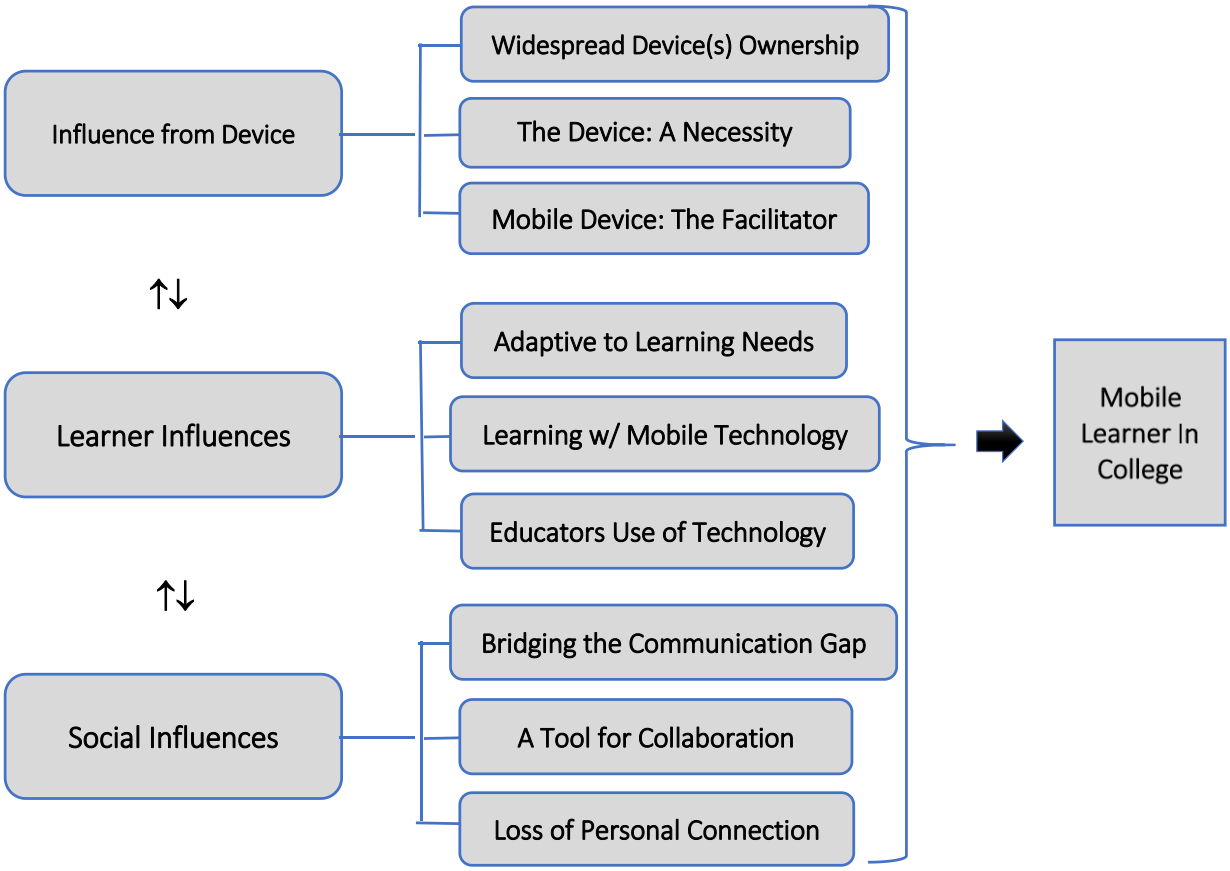

Figure 5. Participants' influences from the use of mobile technology.

Additionally, the rapid advances in mobile technologies has resulted in that most university students possessing and using more than one mobile device (Bikumalla et al., 2017; Vázquez-Cano, 2014). Seminal literature has also confirmed greater mobile technology use by students as well its perceived importance in their education. Crompton & Burke (2018) wrote that mobile devices usage had spread "at [such]an unprecedented rate in the past decade . . . 95% of the global population live in an area covered by a mobile-cellular network" (p. 53). Most mobile device users are between the ages of 18–29 years old, which is the same age most students are enrolled in college (Crompton & Burke, 2018).

The research data, as attested by Davison and Lazaros (2015), indicated that students were using many different mobile technologies; that "over 70% of the students utilized more

than one mLearning device, with many students possessing and utilizing three or more mLearning technologies" (p. 33). However, the laptop was found to be the students' preferred technology (Davison & Lazaros, 2015). The researcher also discovered that the students preferred the laptop for communicating with other students instead of mobile phone texting. Yet, for texting and calling friends or family, the students had chosen their mobile phones over all other technologies (Davison & Lazaros, 2015).

It was due to the ubiquitous use of mobile devices students, the researcher felt further research on mobile technology's influence on college learners was necessary. A qualitative research design was used to collect information wirelessly on the Internet (via email, text, & Webex™) from 13 university students enrolled in one university but live all over the United States. The analysis of the data from the questionnaires, interviews, and focus groups yielded the following nine themes derived from how the device, learner, and social aspects of mobile technology use had influenced these college students in their education.

Device aspect. The first perception of the participants was related to the ways the mobile device or apps affected their learning at the university. For most of the participants, mobile technology was not a luxury item but a necessity for them for school and work. Apparently, for the participants, they saw their mobile devices as simply "tools" in their work and academic lives.

Widespread mobile device(s) ownership. All of study participants owned and were using at least a smartphone and a laptop regularly. The specific apps the participants chose to install on their mobile devices had made the device efficient and user-friendly for each one personally . Subsequently, mobile devices were customized to fit each individual's social or learning need by each participant's choice of features or software for the device. Though not every feature and

application could be included in tables, the types of features and/or apps listed seem to indicate that the participants' choices were primarily user specific.

The necessity of device(s). Having quick access to their mobile device(s) had become almost "second nature" to the participants. Mobile device(s) were used frequently to do "everything" in several of the participants' personal, occupational, and academic lives. *The mobile device or apps as the facilitator* for some of the participants, by teaching them, reading to them, and being their "go to" for obtaining resources and at times for guidance. In addition, mobile technology had affected how some of the learners actually learned.

Learner aspect. *Mobile technology was adaptive to learning needs*: Students apparently are often using mobile technology to support their learning at universities; thus, it seems probable college students will use more mobile technology in the future. *Learning with mobile technology:* The study participants shared with the researcher a wide range of different learning practices with mobile technology which were dependent on such things as particular courses or learning styles.

Several of participants had also voiced concerns and even their frustrations about prior instructors or professor lacking adequate technology skills. Thus, the *educators use of technology* also affected student learning for some of the participants. However, the majority had no concerns or were indifferent regarding technology in courses. Lastly, several of the participants' perceptions of less than positive social outcomes resulting mobile technology use described in following paragraph.

Social aspect. Though many of the participants believed that *mobile technology could be used as a tool for collaboration*, the instances of collaboration the participants had with peers or faculty were minimal and had occurred only sporadically in their programs. In addition, the

consensus was that collaboration had occurred more often earlier in the participants' program of study. Only a few of the participants still communicated with past course mates.

Bridging the communication gap. All the social platforms available on mobile devices had opened new and efficient ways of communication for participants, however most were for personal or work related. The participants used social networking on their mobile devices the most for communication other than texting and phone calls. *Loss of personal connection:* The difficulties of connecting with peers or faculty were a significant concern for several of the participants.

Discussion of the Results

The conceptual framework generated by Koole's FRAME model held true for this study as well. The study participants in sharing their education experiences demonstrated that their learning or education had been influenced in various ways that were related to the device, learner, and social components of mobile learning. These findings in the descriptive case study that addressed those aspects included:

1. The ownership and use of mobile technology were directly linked to attending this university for most of the participants *(device influence)*.
2. Mobile technology afforded the participants greater means for communication, however, having more methods for communication did not manifest in their college experience for most of the students *(social influence).*
3. Many of the participants expressed a sense of loss, perceived less opportunities to form friendships or mentoring relationships with peers and faculty in their online programs *(social influence).*

4. Additionally, it was found that the students strongly believed their mobile device(s) easily and quickly facilitated learning regardless of their location *(learner influence).*
5. Several participants' perception was that a number of their past instructors or professors had lacked adequate **t**echnological knowledge or skills in their courses *(learner influence).*
6. The pros and cons of mobile technology use**:** Lastly, after considering both the advantages and disadvantages of mobile technology usage for coursework, the majority expressed the desire for greater uses of mobile technology in the collegiate experience.

The results of the study with its implications are each discussed in the following paragraphs. One significant finding of the study was the participants' increased dependence on mobile technology and how it related to the participants' current programs of study.

No mobile device(s), no college. It was obvious, the mobile devices' influences on the study participants' education were paramount. It was found that their mobile devices were not only indispensable for their work and their personal lives, but for the participants' academic lives also. All the study participants confirmed owning and using a laptop and smartphone for educational purposes frequently. A majority (62%) also possessed other mobile devices like a tablet; two participants had owned, smart watches. As supported in the literature, the laptop was the primary mobile device used for course work. More importantly, as online students at the university, the mobile device had become. . . their college! For most of the participants, mobile technology is what made attending the university possible.

College in any location. The researcher realized from the information shared during the interviews or focus group sessions that every study participant, except for one (Aaron), were

residents in states other than the state the university was located. Yet, even Aaron was an online student. He mentioned during his interview that he lived quite near the university, and that he visited the university's library on occasions. Interestingly, however, Aaron also did not feel that same towards his mobile device(s) as most of the participants. His thoughts were that the mobile device did not actually help him learn. Aaron explained that as "a doctoral candidate in education. I don't think that the device itself helps me learn. I think the device helps me get to information that develops knowledge." The researcher did not discuss with Aaron the reasons why he chose to enroll in the university's online program rather than the campus-based program since the university's doctoral program included both options for doctoral students.

However, it seemed apparent that for most of the participants, the use of mobile technology was their only means in furthering their education. The participant, Jeffery, emphatically stated that he only did "online" college and that his mobile devices were "basically [his] college." Leah mentioned that she lived close to a university as well where she had used its library resources at times. But Leah felt as an online student, her only option was to use her mobile devices for her education. Leah had stated, "[i]f I didn't have a computer or mobile device of some sort, I would not be able to do anything at all."

Primary tool for education. Most of the other study participants shared similar views regarding the importance of their mobile devices in their pursuit of advanced college degrees. Alexi stated she that used a laptop **"**since [her] sophomore year of college," and did not know if she would be able "to learn as efficiently without it (mobile technology)" Amy also commented about her inability of functioning if she "didn't use my phone for my program."

Cara suggested that if she had no mobile device, she would not be doing what she was doing currently—college in a "completely different state, [at] a completely different university."

While the researcher did not discuss with the participants their reasons for choosing the online format, it was obvious that having that option of online programs via mobile devices was essential in obtaining an education. Yet there were other significant findings in study which were centered around the social and the learners' aspects of mobile technology.

Interestingly, it was found that the participants had customized their mobile devices consistent with their particular tastes, interests, and learning styles. The participants had chosen specific features and applications on their devices, which made the devices more useful not only in their academic lives but for work and home also. For example, applications like *BeeLine Reader,* made reading off a screen easier for some. For instance, a participant with a reading difficulty had the *NaturalReader* application downloaded so he could have his textbooks read aloud to him. Features such as Internet and Wi-Fi capabilities were very important for majority of the participants. In addition, both the texting and emailing functions on their devices were highly important for the participants in this study.

Greater communication, except in college. Seemingly, mobile technology had profoundly influenced the participants' ability to communicate both effectively and quickly— at home, work, and school. The wide variety of social platforms that are now available enable the participants in the sharing of ideas and information with anyone, any place, and at any time. Texting, email, phone, and social media apps on their mobile devices had made communication so accessible to the participants, generally, no further than an arm's length away.

Connecting: Work, family, and friends. It was also found that every participant except one of them had the Facebook app installed on their mobile device(s). Most of them were frequently using more than one social platform. Though not every social app the participants used was listed, the most commonly used social apps are described in Figure 5. However, for

much of the time, it was found that the participants had used their social apps (Facebook, Twitter, and Instagram), mostly for connecting and communicating with family, friends, or co-workers.

Collaboration issues. However, I gathered from the discussions regarding communication or collaboration with students or faculty, it was apparent that those types of interactions did not occur frequently at the university. While few of the participants had acknowledged the university's group page on Facebook and had joined the group, only one of the participants actually interacted with their fellow students or faculty on the social site. Participant Martin spoke of seeing many university students on that Facebook forum, yet all were unrecognizable to him. Jeffrey had also joined the university's Facebook group. He also stated that the group was comprised of "hundreds of people." Jeffery, in contrast had posted on group page and had "maybe 10 friends" in the group.

Connecting in the past. Some of the participants mentioned that earlier in their educational programs, there had been times when they connected with other cohort members such as when they posted on discussion boards or worked together on group projects. Cara said she currently collaborated with friends or fellow students who lived in three different states. Ethan also commented on working on a group project recently with another student, with who he said communicated with often by email. Though most of the participants had shared such communication experiences on the discussion boards and other media for the purpose of group work, there was not much talk of the formation of relationships with peers or faculty members.

Connecting less. Apparently, the times of collaboration and communication the participants mentioned had occurred more often earlier in their education programs. While most participants, 12 of the 13, in the study were doctoral students, the researcher did not have any

knowledge of their progress or lack of progress in their programs. Although the details of each education program differed, many of the participants did confirmed they communicated often with dissertation chairs and committee members as deemed necessary by the student-faculty member via calls, emails, and text.

Sense of loss of connectedness. Although the focus groups had nearly the same questioning on the topic of mobile technology use in higher education, occasionally the participants' responses would lead the group discussion off to a different but relevant direction. For instance, the participants in one focus group, had shared with one another how much they missed the social component in their current education programs. Only one participant in that group, the only masters' student also, stated that he still posted frequently on the discussion boards via the university's LMS (Learning Management System). Most of the other participants had voiced in the interview and the focus group sessions they had minimal or no interaction with other university students in this current time in their programs.

Socialization lacking. One of the other participants, Amy, felt that the "increased use of technology" had a negative effect on the development of the students' social skills. She said, that the use of "email or texting" resulted in the students' inability to converse normally. Several participants also commented on how they missed seeing people's faces and talking with them one-on one. In Aaron's opinion, even in the discussion forum of the LMS, the education process lacked "the emotion[al] and personal aspect[s]" of learning.

Lack of comradery. For participant Cara, it was more the social gatherings, like going out for coffee after class, was what she missed the most. She said, during that time, they would discuss the aspects of lecture and share concerns about the course, instead of feeling as if "[y]ou're in a vacuum and you've got to do your own thing." Ethan on the other hand, perceived

in his mobile learning, more of a "certain amount of disconnect" in the student-professor relationship. He thought there was more "creative thought" exchanged when students and professors talked and interacted with one another.

Social networking in college. Additionally, only a few participants (Martin & Jeffrey) utilized the social networks other than for their personal use. Both had joined the university's group page on Facebook, yet only one communicated with others in the group. The other, used the site just to obtain school information that he thought was relevant to his program.

Student learning enhanced. It was found that several of the student participants had used their mobile devices to "teach" at certain times also. For example, Leah had often used Google on her device to look up items, for clarification, probably even before she had asked her instructors. Martin, as well, believed that "[p]robably well over 90% of my knowledge and information come from . . . media sources." Jeffrey, being an online student only, saw his mobile device and his college experience, as being inseparable. Both, Ethan and Elise mentioned having apps like *Audible* and *NaturalReader* on their devices that read the text aloud to them as they read along. Several participants also mentioned web sites like *YouTube* which provided instruction or information on most subject matter quickly.

Apparently, the mobile device did not only take on the role as facilitator, but the device became the primary resource center for many of the participants as well. Many participants had downloaded specific resource apps on their devices such as *Dictionary* and *Bookshelf*. The Bookshelf app was an e-reader where the required textbooks (e-books) for courses were also stored. The participants spoke often of the ease and convenience of researching on their devices. There were possibly many more participants like Sarah, who said, "I'm able to access things immediately . . . anytime I want, anytime of the day, no matter where I am." Equally important,

since all the participants were graduate students, they thought that having online access to the university's massive library was invaluable in researching.

Mobile technology did not only provide many learning opportunities in the classroom for the participants, but in every facet of their lives. For instance, Yvonne continued to learn even in church, "googling" on her phone an unfamiliar word she heard in her pastor's sermon. Likewise, Elise received her daily morning news via email on her smartphone. Cara spoke of utilizing the university's library when she needed to obtain information for her schoolwork and her teaching job as well. Yet, although most of the participants believed they were proficient with technology in their courses, some participants shared their frustrations from some of their professors being inadequately prepared—technologically.

Concerns of unprepared educators. There were several discussions in the interviews and focus groups regarding some instructors or professors use of technology or lack of, in some of their courses at the university. As explained by Al-Emran et al. (2016), there had to be acceptance not only by learners but educators also "in the employments of M-(mobile) learning systems" (p. 93). Several participants did feel in some courses the instructors or professors seemed to lack **t**echnological knowledge or skills. While most of the participants were neutral or were unaware of such instructors, but for the participants who had these experiences, it was highly problematic to them to have less technologically skilled professors facilitating their courses.

Leah's thinking was that some of the instructors just did not "know how to use some applications or they don't really know how to use their technology." Also, Alexi seemed to experience more with "faculty members that struggle with technology use" which really frustrated her. According to Alexi, it was not that the faculty did not want to use the technology

but rather they were less proficient that was due to lack of training. It was apparent in the study the participants thought educators needed to be competent in using mobile technology to teach effectively, not just navigating around in the LMS, but email communication, and other technological activities also.

The pros outweighing the cons. The participants' viewpoints how mobile technology use had influenced learning revealed both negative and positive effects in the study. Whether for financial reasons, a particular degree, or only for the sake of convenience, each participant ultimately made a choice to enroll in an online program. Despite the fact having access to the mobile technologies had made education possible for most of the participants, unfortunately for some, it had also resulted in lesser occurrences of interaction, socialization and collaboration with university students and faculty. Vázquez-Cano (2014) wrote that, "the benefits of mobile learning stem from the portability, flexibility, and context of mobile technologies, which facilitate learning, promote collaboration, and encourage both independent and cooperative learning for life" (p. 1506). Obviously, after weighing the advantages and the disadvantages the participants perceived in mobile learning, every participant had decided to enroll and remain in a mobile learning online program.

Discussion of the Results in Relation to the Literature

A mobile learning trend. Tertiary students enrolled in online programs, hybrid programs, and campus-based institutions are using mobile technology more and more in both their personal lives and academic lives as well (Vázquez-Cano, 2014). Though much of the literature like this current study have yielded findings that are both positive and negative on the use of mobile technology in higher education, to facilitate student learning, all aspects of mobile learning should be addressed. According to Al-Emran et al. (2016) "[m]obile learning . . . has

become an important educational technology component in higher education, mak[ing] it possible for students to learn, collaborate, and share ideas among each other with the aid of internet and technology development" (p. 93).

Subsequently, the growing trend of the ubiquitous use of mobile technology necessitates tertiary education institutions to give greater consideration and attention to the development of mobile learning programs today and in the future. The advances in mobile technology will continue, along with the increase of mobile device users indicate the need for educators and institutional leaders to create more mobile learning environments and interventions so to facilitate effective learning for the upcoming multitude of mobile learners. The literature was clear, mobile technology use did facilitate and promote learning in different disciplines in a number of colleges and universities (George & DeCristofaro, 2016; Kim et al., 2014; Rodis et al., 2016).

Helpful/unhelpful for learning. Selwyn (2016) believed that most of the prior research's foci had been on just the beneficial aspects of the use "digital" technology in education, even though not all their all findings were positive. Much of the literature had also reflected the opposite effects of mobile technology use (Henderson et al., 2017; Selwyn, 2016). Selwyn (2016) saw the use of this technology in education being more "unhelpful." Selwyn explained the literature that addressed the differences in mobile learning such as the student's subject matter, age, race, and so forth, demonstrated these factors did influence student engagement in the learning process.

The results of study aligned with those other studies, in that the researcher noted both positive and negative outcomes. For example, the participants saw greater convenience and portability using their devices, but they also saw less collaboration and difficulties in forming

relationships in their education programs. Likewise, Henderson et al. (2017) found "usefulness" of mobile technology in student learning also. The study participants pointed out several benefits, some significant, in their use their mobile device(s) for educational purposes. For example, Participant Yvonne said that "(mobile technology) was beneficial in (her) learning. Jeffrey holding a similar view stated, "[t]hat's the only way I got through." Jeffrey was not only referring to his current program, but his prior degree programs as well.

Koole's model. The literature also specified that the Koole's FRAME model not only showed the interrelationship of the device, learner, social components of mobile learning but also the equal importance of all the components in the learning process (Koole, Buck, Anderson, & Laj, 2018). According to Koole et al. (2018), the three large circles in the FRAME model that represented the three aspects of mobile learning are same size in the Venn diagram; "symbolizing that they are equally important" in the mobile learning process (p. 3).

Though it seemed that many of the participants understood the connection of their mobile devices or apps and their education, this study also reflected that the influences from the device or app component were no more important than the influences that stemmed from learner or the social components in the learning process. In explaining the Venn diagram in the FRAME model, Koole et al. (2018), wrote that "[t]he reason the Venn diagram was used was to depict the pieces that come together co-construct the phenomenon of mobile learning . . . [therefore] it is not possible to suggest that the FRAME model is device-centric, technologically determinist, or socially determinist" (p. 3).

The interlocking pieces. The findings of the case study also indicated there was interaction and the overlapping of the three aspects of mobile learning in the academic lives of the participants. It seemed, for effective learning to occur for the student, all three parts needed

to fit together and work together in the learning process. For instance, the influences of device and the learner aspect may have resulted in positive outcomes for the mobile learner, but if the social portion was lacking or ineffective, the entire learning experience would be affected negatively as well.

As stated by Koole et al. (2018), effective mobile learning was like "a jigsaw puzzle," where all the pieces had to be present and by interlocking them together, it resulted in one whole picture. While all the pieces needed to be present to complete the picture, it was also imperative that each piece be undamaged or shaped correctly so to fit together properly with the rest of the pieces. For a certainty, this analogy of Koole et al. (2018) was so applicable to this case study.

The device pieces. It was also clear that the participants' use of mobile devices and apps facilitated learning in any setting. This not only included laptops, tablets, and smartphones but for a few, wearable technology such as smart watches also served those functions. The literature showed that students will usually choose mobile devices that best suited their learning style, using like a "trial and error" system, in deciding what works and what does not (Davison & Lazaros, 2015). All the participants in this study had personalize their devices with specific features and applications to assist them in their course work.

Course specific apps could be useful for students also. McQuiggan et al. (2015) suggested that developers of applications for education should consider which specific features or formats to incorporate in their new instructional programs. As explained by McQuiggan et al. (2015), the factors like the device's hardware options, operating systems, and other features" added with "sound app development and thoughtful pedagogy, [could] maximize the learning experience" for students (p. 143).

The learner pieces. The findings revealed learner influences from mobile technology use also. Farley et al. (2015) stated that many colleges and universities have not considered that most students are actively using mobile devices or apps "to support their learning" (p. 4). Tertiary education institutions could use the results of the study in the development of learning strategies such as how to "incorporate smartphones and apps as a learning and communication tool" (Vázquez-Cano, 2014, p. 1507). In addition, adequately trained educators in the use of mobile technologies in curricula is imperative.

The social pieces. It was apparent in the study some participants were concern about certain social ramifications of mobile technology use. Despite partaking in group projects and the discussion boards in past coursed, these participants still perceived fewer socialization or bonding opportunities with students and faculty members. According to the research conducted by Salisbury et al. (2015), the students had used social networking apps more often than and other apps on their mobile devices, including apps for entertainment and education. The participants in this study used the social platforms on their devices frequently, but not for communicating with fellow students or faculty. Although the study provided valuable information on the different attitudes and viewpoints of mobile learners in a university setting, this study still was limited in several areas.

Limitations

While this case study provided insight into tertiary students' perceptions on the use of mobile technology for educational purposes, the study was limited to only students who attended a single university in one region of the United States. Nevertheless, the university where the case study was conducted, could be representative of many of the colleges and universities across the nation. For instance, the university is a diverse liberal-arts institution which offered

its students a variety of undergraduate and graduate degree programs (20) in addition to choices of learning modes (traditional, hybrid & online). The researcher encountered other limitations during the sampling and data collection phases of the research.

Sampling limitations. This study was limited by the small size of the sample as well, with only 13 students volunteering for study. The sample was only diverse as to gender, age, race, and level of study, but only the age and class rank were relevant for this study. While the study' recruitment email was sent to all the students enrolled at the university, the participants that signed consents begun the first phase of study shared more similarities than the researcher had initially anticipated.

Although all the study participants were both graduate and online students at the university, neither was the selection was intentionally nor was it part of the initial research design. Additionally, all except one of the participants were doctoral students at the university. It would have been much more beneficial and a way to ensure a more diverse sample, if I included questions regarding rank and mode of education in the initial recruitment questionnaire rather than the demographic questionnaire the participants completed post selection, as they did in this study.

The student enrollment at the research university was comprised of traditional, hybrid, and online students, as well as both undergraduate and graduate students. The masters' and the doctoral program made up graduate program. The sample probably would have had greater diversity if the respondents had been given their demographic information in the recruitment questionnaire. The researcher would then have selected study participants that were more representative of the actual make-up of the university.

The scheduling challenges with time zones. Though the study participants attended the same university, which was the location of the study, nearly all resided in other states. The researcher had conducted each phase of the case study via the Internet with participants that lived in U. S. time zones from Hawaii to Eastern Standard Time. So, with time differences as much as six hours, there were instances of confusion with interviews and focus groups for both researcher and participants. The researcher successfully scheduled and conducted the 13 interviews on Webex™ with the participants without major problems.

However, the different time zones proved to be more problematic in the last phase (focus groups). Communicating, scheduling and web conferencing at the same time with a greater number of people was a little more difficult. The researcher attempted to accommodate each participant's time constraints via email and text, however, there were a few re-scheduled times for participants whose personal, work, or travel obligations had changed. Although, the researcher needed to resolve several scheduling conflicts, most of the participants were very accommodating, with some of them volunteering to do their interviews or focus groups at very early hours in the morning or quite late in the evening and night.

Implications of the Results

The use of mobile technology by students in higher education continues to steadily increase at home, work, and school. The participants' perceptions in this study as well as the literature reviewed, aligned with the premise that mobile technology use in academia had mostly a positive effect on student learning**.** Crompton and Burke (2018) wrote that "[r]ecent empirical evidence has found that mobile learning can be used to support students' learning in higher education settings" (p. 53). The Koole's FRAME model that guided this study supported the study's findings that revealed specific areas that were influenced by the participants use of

mobile technology. While the implications in this study are not generalizable to all online college students or every mobile learner, several findings proved to be quite informative regarding many of the college students' use of mobile technologies for educational purposes.

The theoretical implications. Research on how students in higher education perceive the use of mobile technologies in their studies are important in not just understanding the learners of today, but the future learners of tomorrow also. Just as the interrelationship of the three learning components seen in the Koole's model, the findings in this study demonstrated as well, that for effective student learning to place, all of the components in mobile learning needed to be involved and interacting appropriately during the learning process (Koole et al., 2018). An issue with one, two, or all the components, the device, learner, or social, will undoubtedly have a less than positive affect on student learning. For example, for some of the participants, their perception of lack in social areas was concerning to them. From the aspect of the learner, factors such as the learner's prior knowledge, his or her environment as well as how the content is presented will influence student learning (Ally & Prieto-Blázquez, 2014).

Future implications. Farley et al. (2015) pointed out that "[g]iven that students are already using mobile devices to support their study it seems the most efficient and easy entry into mobile learning for educators, lies in supporting what students already do" (p. 8). This study confirmed that observation also; all the participants in this study had used their mobile devices for all of their courses. Since so many college students are using their mobiles devices for educational purposes, it is indicative that further exploration of the attitudes of the students and the educators towards mobile learning in tertiary education (Al-Emran et al., 2016).

Integrating mobile technologies. Seemingly, one practical implication for the future will be the need for educators in colleges and universities to evaluate further how to integrate mobile

technologies into their college curricula as they make better use of the technology students are presently using. According to McQuiggan et al. (2015), discussions focused at developers are necessary to look at "the key features of mobile learning—that is, how to tap into mobile devices' educational potential by making the best use of it's hardware, software, and accessories" (p. 143). However, just as important are the social implications that the researcher observed from the study's findings.

The social implications. It was apparent that the participants' current asynchronous learning method (not online at the same time), had allowed the participants the freedom of learning any time of the day or night on schedules that were convenient to them. But learning asynchronously prevented the participants in having "real time" discussions and interactions with classmates or instructors on the LMS. Even though the participants had taken online courses previously that entailed posting in the discussion forums and working on group projects, they still felt unconnected to fellow students and professors.

Many of the participants in this study had voiced desires of opportunities to learn synchronously while online with their cohort and instructors. They wanted to meet together throughout their courses at a fixed scheduled time regularly via a live medium such as teleconferencing. Those participants had expressed a desire to physically *see* and *talk* with other students or faculty members. It seemed as if these participants believed that losing the social component of the college experience was the cost that had to paid when obtaining an online degree.

In the opinion of Heflin et al. (2017), "literature has also shown mobile learning to be beneficial in increasing student independence, engagement, and communication" (p. 93). All the participants in this study had enrolled in online courses only for reasons unbeknownst to the

researcher. However, regarding this study and the participants' responses, the researcher suggests that colleges and universities may want to offer either more synchronous online courses or combine the aspects of both synchronous and asynchronous learning in their online courses. Thus, the social and collaborative needs of the mobile learner would be met.

Recommendations for Further Research

This study could be replicated to gain greater understanding of tertiary students' use of mobile technology for educational purposes. The limitations and delimitations of this study could be mitigated in several ways. For instance, the recruitment email should be re-worded to include questions on the respondents' demography so to ensure a more diverse student sample for the study. Students of every level of education are using their mobile devices, so research in such areas would be very informative. According to Chen and deNoyelles (2013), "more research is needed to investigate mobile teaching and learning strategies and how these strategies are being implemented to engage students in the learning process" (p. 1506).

In addition, further research to study specifically the effects of mobile technologies in education on students' social development would also provide beneficial insight into the mobile learner. To ensure mobile learning is implemented into higher education degree programs appropriately, additional research from both the pedagogical and technological perspectives of mobile learning would benefit the education community as well. Thus, each aspect of mobile learning in this study, social, learner, and device, which was based on Koole's FRAME model (Koole et al., 2018) would be further researched.

Obviously, the participants in this study had to choose which education format that best suited their personal, financial, or employment circumstances. All the participants at least utilized a laptop and smartphone to complete their online studies. However, due to the rapid

advancement of features, the greater portability, and the immediate accessibility of handheld devices (smartphones), students are now choosing to use their smartphones for so many other functions besides communication and entertainment (Heflin et al., 2017).

The use of smartphones has been found to enhance student learning, however how these devices can be used to teach effectively in higher education institutions still needs be further researched (Vasquez-Cano, 2014). For instance, the content in smartphones that could be used for learning is changing, therefore additional research is needed to explore what content would be appropriate for smartphones that will improve students' learning (Vasquez-Cano, 2014). Additionally, due to "the onset of ubiquitous handheld technology," by college students, the impact that smartphones are having on collaborative learning is another area that I believe warrants more research (Heflin et al., 2017, p. 91).

Conclusion

The purpose of this study was to explore college students' perceptions regarding mobile technology use and how the influences from the mobile device, the learner, and the social ramifications aspects affected their education experience. In order to gain greater insight into the students' perception of how their use of mobile devices to enhanced learning or not, this study asked the research questions— how did college students believe the (a) device, (b) learner, and (c) social aspects of mobile learning influenced their collegiate education experiences? Obtaining such insights could prove to be quite beneficial in the integration or implementation of mobile technologies in academia.

All the students that participated in the study were enrolled in both the online and graduate education programs at the university. Several of students also had previous traditional

college experiences in their undergraduate or masters' programs. A few other students in the study, by contrast, only had attended college online for past degrees.

This descriptive case study used several data collection methods to gather information on the participants' perceptions. The data was sorted and categorized using ATLAS.ti software, and from those emerging patterns, researcher was able to determine specific influences from the participants' use of mobile technology educational purposes. Though the participants had reported mostly positive experiences using their mobile devices from the influences of the aspects of mobile learning, there were also reports of feeling of a lack of socialization or collaboration and technologically unprepared instructors.

Al-Emran et al. (2016) believed that the nature of higher education has been changing drastically "due to the rapid development of mobile computing devices and internet capabilities" (p. 94). The use of mobile devices, especially smart phones are becoming increasingly popular in academia. Understanding not just the educators' attitudes towards mobile learning, but the learners' as well, will be key in the development and implementation of mobile technological based learning systems (Al-Emran et al., 2016). The information on the influences of students' use of mobile technologies can assist in filling the gap in the literature regarding mobile learning with students in higher education.

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Appendix A: Demographic Questionnaire (Qualtrics)

1. What is your gender? Male_____ Female_____
2. What is your class ranking at [redacted] University?

   Freshman___ Sophomore___ Junior___ Senior___ Graduate____
3. Are you currently a traditional____ or online student?_____
4. What age range below do you fit in?

   18-25 years old____ 26-35 years____ 36-49 years____ 50 years and above___
5. How many times would you say you have used educational apps?

   Never____ Rarely (0-2)____ Several times (3-4)_____ Quite a few times (>5)___

Appendix B: Mobile Learning Interview Questions: Kooles' FRAME Model

Device Aspect **(DA)** Learner Aspect **(LA)** Social Aspect **(SA)**

1. How have you used your mobile device(s), if any, during class time? **LA**
2. What mobile device(s) do you now own and use regularly (daily)? **DA**
3. Other than talking and texting, what other ways of communication do you use your mobile(s) device for? **SA**
4. How often do you use your mobile device(s) to contact another student for something related to coursework? **LA**
5. What are the most important features on your device(s)? **DA**
6. Why are those features so important to you? **DA**
7. What social media do you use on your device(s)? **SA**
8. How many people from school (student/ faculty) are on your social media? **SA**
9. What kinds of apps, if any, do you use for educational purposes? **DA**
10. In what ways, if any, would you like mobile devices/apps incorporated in courses? **LA**
11. In what ways, if any, are mobile devices like a smart phone less useful in college? **LA**
12. In what ways do you think your instructors embraced/resisted the use of mobile technology? **LA**
13. In what ways, if any, do you use the university's app on your device(s)? **DA**
14. Other than your friends and family, who else contacts you on your mobile device(s)? **SA**
15. How much do you think your mobile device(s) helps/help you learn? **LA**

Appendix C: Questions for Focus Groups

1. What has been your experience with technology while in college?
2. What are some ways you access information today different than say 5 years ago?
3. How do you feel about your smartphone?
4. What do you like about integrating mobile learning in academia?
5. What don't you like about mobile learning in academia?

Possible Follow-up Questioning for Focus Groups

1. Can you tell me more about that?
2. Can you give some examples?
3. Can you tell why you feel that way?
4. Ask others in group their view about a response or opinion.
5. Attempt to obtain input from all participants in focus group.

Appendix D: Consent Form for Participants

Concordia University – Portland Institutional Review Board
Approved: November 5, 2018; will Expire: November 5, 2019

CONSENT FORM

Research Study Title: The Effect of Mobile Technologies on Students in Higher Education: A Case Study
Principal Investigator: Donna Avery
Research Institution: Concordia University-Portland
Faculty Advisor: Dr. Donna Graham

Purpose and what you will be doing:

The purpose of this research study is to learn how students think regarding the use of mobile technology for educational purposes. To take part in the study you must be currently enrolled at Concordia either as an on-campus or online student and use mobile technology (tablet/smartphone/apps) regularly (several times weekly) for educational purposes. We expect to recruit approximately 10 volunteers. Each participant will be given a $15 electronic gift card from Amazon to be in the study.

What the study entails after you fill out a short questionnaire, we will conduct an interview with you via Web-Ex, as well, you will take part in a focus group with other Concordia students via Web-Ex. The interviews/focus groups will include questions about the device(s) and apps you use, for what areas of study you generally use the device(s)/app(s) for, and in what ways the devices/apps have or have not help your learning. The interview and focus group will take about 30-45 minutes to complete each. With your permission, we would also like to record your responses during the interview and focus group.

Risks:

There are no risks to participating in this study other than providing your information. However, we will protect your information. I will record interviews and focus groups. The recordings will be transcribed by me, the principal investigator, and the recordings will be deleted when the transcription is completed. Any data you provide will be coded so people who are not the investigator cannot link your information to you. Any name or identifying information you give will be kept securely via electronic encryption on my password protected computer locked inside the cabinet in my office. The recordings will be deleted as soon as possible; all other

study documents will kept secure for 3 years and then be destroyed. We will not identify you in any publication or report.

Benefits:

Information you provide will help us learn more about how students' perception on mobile learning while earning their degrees. Concordia University-Portland offers both traditional and distant learning to students. You could possibly benefit in the improvement of education programs in the future by providing insight on the integration of mobile technology in academia. In addition, each participant will receive a $15 electronic gift card from Amazon at the end of the study.

Confidentiality:

This information will not be distributed to any other agency and will be kept private and confidential. The only exception to this is if you tell us abuse or neglect that makes us seriously concerned for your immediate health and safety.

Right to Withdraw/Decline:

Your participation is greatly appreciated, but we acknowledge that the questions we are asking are personal in nature. You are free at any point to choose not to engage with or stop the study. You may skip any questions you do not wish to answer. This study is not required and there is no penalty for not participating. If at any time you experience a negative emotion from answering the questions, we will stop asking you questions.

In addition, you give your permission for the investigator to audio record the interview and focus group. However, you may decline from being recoded at any time. If you decline audio recording it will have no effect on the interview or focus group

Contact Information:

You will receive a copy of this consent form. If you have questions you can talk to or write the principal investigator, Donna Avery at [redacted] or email at [redacted]. If you want to talk with a participant advocate other than the investigator, you can write or call the director of our institutional review board, Dr. Ora Lee Branch (email [redacted] or call [redacted]).

Your Statement of Consent:

I have read the above information. I asked questions if I had them, and my questions were answered. I volunteer my consent for this study.

I give the Investigator permission to

_____	_____
Participant Name	Date
_____	_____
Participant Signature	Date
Donna Avery	_____
Investigator Name	Date
_____	_____
Investigator Signature	Date

Investigator: Donna Avery email: [redacted]
c/o: Professor Donna Graham PhD
Concordia University – Portland
2811 NE Holman Street
Portland, Oregon 97221

Appendix E: Concordia University Institutional Review Board Approval

CONCORDIA
UNIVERSITY
–PORTLAND, OREGON–

DATE:	November 7, 2018
TO:	Donna Avery
FROM:	Concordia University - Portland IRB (CU IRB)
PROJECT TITLE:	[1305554-1, -2, -3] The Influence of Mobile Technologies on Students in Higher Education: A Case Study
REFERENCE #:	EDD-20180919-Graham-Avery
SUBMISSION TYPE:	New Project wiht Response/Follow-Up Modification
ACTION:	APPROVED
APPROVAL DATE:	November 5, 2018
EXPIRATION DATE:	November 5, 2019
REVIEW TYPE:	Expedited Review

Thank you for your submission of New Project materials for this project. The Concordia University - Portland IRB (CU IRB) has APPROVED your submission. This approval is based on an appropriate risk/ benefit ratio. All research must be conducted in accordance with this approved submission.

This submission has received an Expedited Review based on the applicable federal regulations.

You are responsible for contacting and following the procedures and policies of Concordia University and any other institution where you conduct research.

Attached is a stamped copy of the approved consent form. You must use this stamped consent form. Note, the CU IRB made a slight change: correction in contact email on last page. Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. The form needed to request a revision is called a Modification Request Form, which is available at www.cu-portland.edu/IRB/Forms.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please email the CU IRB Director directly, at obranch@cu-portland.edu, if you have an unanticipated problem or other such urgent question or report.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of November 5, 2019.

You must submit a close-out report at the expiration of your project or upon completion of your project. The Close-out Report Form is available at www.cu-portland.edu/IRB/Forms.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Dr. OraLee Branch a[redacted] or [redacted].
Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Concordia University - Portland IRB (CU IRB)'s records. November 7, 2018

Appendix F: Recruitment Email via Qualtrics

Dear [Avery Collins University] Students,

We need your participation!

We are conducting a research study at [Avery Collins University] about students' perception on the use of mobile technology in a college setting. We are seeking student participants for the study. Please fill out this brief questionnaire about your mobile technology use. Those students who use mobile technology for educational purposes and are interested in participating in study will be recontacted from your contact information you provide at the end of questionnaire. Thank you, [University Name] Students, for your time!

Donna Avery: Principal Investigator

Link to Questionnaire: [URL Redacted]

Appendix G: Participants' Demographics

Table 5

Gender of Participants

M/F	%	Count
Male	31%	4
Female	69%	9
Total	100%	13

Table 6

Class Ranking of Participants

Ranking	%	Count
Freshman	0%	0
Sophomore	0%	0
Junior	0%	0
Senior	0%	0
Graduate	100%	13
Total	100%	13

Table 7

Participants' Educational Program

Program	%	Count
Traditional	0%	0
Online	100%	13
Hybrid	0%	0
Total	100%	13

Table 8

Age of Participants

Age	%	Count
18–25 years old	0%	0
26–35 years old	31%	4
36–49 years old	46%	6
50 years old & above	23%	3
Total	100%	13

Table 9

Participants' Use of Educational Apps

Times per week		%	Count
Rarely (2 times or less) per week		15.4%	2
Several times per week (3–4)		38.5%	5
Quite a few times (5 times or more per week)		46.1%	6
	Total	100%	13

Appendix H: Statement of Original Work

The Concordia University Doctorate of Education Program is a collaborative community of scholar-practitioners, who seek to transform society by pursuing ethically-informed, rigorously- researched, inquiry-based projects that benefit professional, institutional, and local educational contexts. Each member of the community affirms throughout their program of study, adherence to the principles and standards outlined in the Concordia University Academic Integrity Policy. This policy states the following:

Statement of academic integrity.

As a member of the Concordia University community, I will neither engage in fraudulent or unauthorized behaviors in the presentation and completion of my work, nor will I provide unauthorized assistance to others.

Explanations:

What does "fraudulent" mean?

"Fraudulent" work is any material submitted for evaluation that is falsely or improperly presented as one's own. This includes, but is not limited to texts, graphics and other multi-media files appropriated from any source, including another individual, that are intentionally presented as all or part of a candidate's final work without full and complete documentation.

What is "unauthorized" assistance?

"Unauthorized assistance" refers to any support candidates solicit in the completion of their work, that has not been either explicitly specified as appropriate by the instructor, or any assistance that is understood in the class context as inappropriate. This can include, but is not limited to:

- Use of unauthorized notes or another's work during an online test
- Use of unauthorized notes or personal assistance in an online exam setting
- Inappropriate collaboration in preparation and/or completion of a project
- Unauthorized solicitation of professional resources for the completion of the work.

Statement of Original Work (Continued)

I attest that:

1. I have read, understood, and complied with all aspects of the Concordia University–Portland Academic Integrity Policy during the development and writing of this dissertation.

2. Where information and/or materials from outside sources has been used in the production of this dissertation, all information and/or materials from outside sources has been properly referenced and all permissions required for use of the information and/or materials have been obtained, in accordance with research standards outlined in the *Publication Manual of The American Psychological Association*

Donna L. Avery

Digital Signature

Donna L. Avery

Name (Typed)

May 30, 2019

Date