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# Mobile device acceptance in nursing education

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# Mobile Device Acceptance in Nursing Education

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## Dedication

I dedicate this paper to my wonderful husband, Jeremy, who has truly supported my educational journey. Without you, I would have not gone this far. We are truly stronger together. "A cord of *three strands* is not quickly *broken*." Ecclesiastes 4:11b. From our meager newlywed budget justifying our first cell phone to save on long distance bills to buying my first smartphone a few years ago, who would have guessed technology would have consumed my life? However, your wisdom, prayers, and encouragement made me get through. May many others be supported by your steadfastness and support! Kids…listen to your dad and follow in his footsteps.

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## Abstract

Mobile devices such as smartphones and tablets are being used in healthcare settings for better patient outcomes. By laying the foundation for mobile device use in the educational setting, students can be better prepared for nursing practice in this technology-rich environment (National League for Nursing [NLN], 2008). The purpose of this cross-sectional study was to investigate the mobile device acceptance (MDA) model that guides nursing students' decision to use mobile devices as educational tools. The MDA model also guides the measurement development and psychometrics testing for the MDA constructs in order to understand mobile device use and to examine correlates in the nursing student population. The study included variables that measure diversity including students who are first generation college students (FGCS), English as a second language (ESL), Pell grant eligible, recipient of welfare/public housing, and ethnic minority. The study also tested moderating effects between demographic variables and MDA constructs.

The study sample included 327 nursing students from two BSN programs who completed the study instrument. The results showed that the MDA instrument had strong reliability and promising construct validity. Diverse students (i.e., FGCS, ESL, Pell grant eligible, recipient of welfare, ethnic minority) had significantly higher MDA scores than non-diverse students. Age was considered a main variable in the MDA model. The preferred size and function of device had significant MDA results. Based on the regression analysis, three predictor variables (i.e., diversity, social persuasion, and affective state) explained a small percentage of variance in the standardized test scores (i.e., ATI).

Nursing educators can support diverse nursing students through the continued use of mobile devices in the nursing curriculum. Further examination is needed to see if diverse

students are affected more than non-diverse students by not gaining admission into nursing programs. As mobile devices continue to be embedded into health care, nurse educators and students can use them in educational settings.

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# Chapter 1: Introduction

## Technology in Healthcare and Nursing Education

Technology is embedded into health care, making this environment more complex. The Institute of Medicine (IOM) defined core competencies that every healthcare worker can possess to work in an information-rich, healthcare environment (Greiner & Knebel, 2003). The National League for Nursing (NLN; 2008) stated that graduate nursing students need to be prepared to practice in technology-rich environments of the twenty-first century, which included using electronic devices for safe and quality patient care. Mobile devices are part of the current technology embedded into this healthcare environment. Mobile devices are highly portable and multifunctional handheld electronic computers that have touch screens and can access the Internet. Mobile devices include both smartphones and tablets. According to Ozdalga, Ozdalga, and Ahuja (2012), "The smartphone may one day be recognized as a diagnostic and therapeutic tool that is as irreplaceable as the stethoscope has been in the practice of medicine" (para. 46).

To explain the importance of mobile devices in the current medical landscape, this section will examine how nursing has historically responded to technology and, more specifically, to mobile devices. Also, this section will provide an overview of how mobile device use impacts core competencies established by the Quality and Safety Education for Nurses (QSEN) to prepare students for nursing practice. This section will discuss problems associated with mobile device use: first, the need for more diversity within the nursing profession; second, how diversity may impact mobile device use; third, the need to support diverse students with their educational outcomes and program completion; and finally, the use of a conceptual framework and instrument that focuses on the decision to use mobile devices as an educational tool that may also support diverse nursing students and create an inclusive environment. Mobile

device use is important in preparing nursing students for practice and in supporting them in their educational journey.

**Background.** Historically, nursing educators have researched how electronic technology has impacted the academic performance of nursing students. Educators have championed the use of computers since the 1980s (Arnold, 1992; Ronald & Skiba, 1987). The use of computers increased cognitive mastery (Hodson, Worrell, & Alonzi, 1985), and computers were used for instruction and evaluation to aid in the learning process (Lassan, 1989). Then educators researched how the personal digital assistants (PDAs) in the early 2000s impacted academic performance with increased test scores (Beard, Greenfield, Morote, & Walter, 2011; Cibulka & Crane-Wider, 2011; Farrell & Rose, 2008; Greenfield, 2007; Koeniger-Donohue, 2008; Williams & Dittmer, 2009). Currently, nursing educators are using mobile devices for higher-order learning activities to increase academic performance. Nursing students who used mobile devices as sensors in skills training increased exam scores in their physical assessment course more than students who did not use mobile devices (Wu, Hwang, Su, & Huang, 2012). In addition, nursing students who used a decision-tree-making and content-learning software on mobile devices had higher respiratory test scores than students who did not use mobile devices (Wu, Hwang, Tsai, Chen, & Huang, 2011). Nursing students who used mobile devices as a collaboration tool to study public health concepts had higher final test scores in their course/clinical grades than students who did not (Wu, 2014; Wu & Sung, 2014). The increased quality of mobile device use led to better educational outcomes among students who used them than students who did not. Quality use of technology impacts learning and academic performance (Wu et al., 2012; Wu, Hwang, Tsai, Chen, & Huang, 2011; Wu, 2014; Wu & Sung, 2014).

According to QSEN, nursing students need to possess six core competencies to prepare them for nursing practice: patient-centered care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics (Cronenwett et al., 2007). Nursing education researchers have been studying how mobile device use impacts the QSEN core competencies for nursing students. Studies showed that nursing students who use mobile devices perceived that the devices increase nursing knowledge to better care for patients (Dearnley, Haigh, & Fairhall, 2008; Galvão & Püschel, 2012; Jenkins, Hewitt, & Bakken, 2006; Kneebone, Nestel, Ratnasothy, Kidd, & Darzi, 2003; Koeniger-Donohue, 2008; Martyn, Larkin, Sander, Yuginovich, & Jamieson-Proctor, 2014; Schlairet, 2012; Secco, Doiron-Maillet, Amirault, & Furlong, 2013; Smith & Pattillo, 2006; Stroud, Erkel, & Smith, 2005; Wu et al., 2011; Wu, 2014), and increased collaboration with peers and/or faculty (Kenny et al., 2012; Lai & Wu, 2006; MacKay & Harding, 2009; Wu & Lai, 2009; Wu, 2014; Wyatt et al., 2010). In addition, nursing students reported that mobile devices enabled them to provide quality patient care through applying the most current, accurate information in clinical settings (Garrett & Jackson, 2006; Koeniger-Donohue, 2008; Lai & Wu, 2012; Williams & Dittmer, 2009; Wittmann-Price, Kennedy, & Godwin, 2012) and helped them to perform higher levels of safe patient care (Bauldoff, Kirkpatrick, Sheets, Mays, & Curran, 2008; Johansson et al., 2013; Johansson et al., 2014; Schlairet, 2012; Secco et al., 2013; Swan et al., 2013). Students exhibited positive attitudes when using mobile devices for nursing education (Elliott et al., 2012; Kenny et al., 2012; Ortega et al., 2011; Schlairet, 2012; Scollin, Healey-Walsh, Kafel, Mehta, & Callahan, 2007; Swan et al., 2013; Wu, 2014; Wu & Sung, 2014; Wyatt et al., 2010). Appropriate mobile device use by nursing students impacts QSEN core competencies of patient-centered care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics. However,

studies still showed that nursing students are not adequately prepared to use mobile devices for learning or patient care (Beard et al., 2011; Cibulka & Crane-Wider, 2011; Kowalski & Smith, 2012; Lai & Wu, 2012; Swan et al., 2013; Wink, 2011).

**Statement of the problem.** As nursing researchers study how mobile device use impacts core competencies and academic performance, research needs to continue to investigate how students' diverse backgrounds may affect the use of mobile devices. The accessibility and knowledge of appropriate mobile device use may be an additional barrier that affects diverse students (Goodman, 2013; Gorski, 2003; Hilbert, 2012; Richtel, 2012; Yu, 2011). Therefore, this section will discuss why the diversity of students is needed in the nursing profession, how this diversity may impact mobile device use, and how the need for a conceptual framework and instrument on mobile device use can support diverse nursing students. Nurse educators need to support diverse nursing students for an inclusive environment where all students continue in the nursing program with higher completion rates and higher educational outcomes than they do currently. After reading this section, one can see the significance of the problem and the justification for more research.

***Promoting diversity in the nursing profession.*** Eighty-three percent of registered nurses (RNs) are white/Caucasian; in contrast, 65.6% of the U.S. total population is white/Caucasian (U.S. Department of Health & Human Services, 2010). According to the U.S. Census Bureau (2012), the latest projections expect that there will be no majority group, such as white/Caucasians are presently, in the next half of the century. While nursing education has made strides in creating a supportive, caring environment for diverse students, a lack of diversity in the current registered nurse population continues (Jeffreys, 2012; Xue & Brewer, 2014). The American Psychological Association (APA, 2015) and the NLN (2009) stated that to create an

inclusive environment, the diversity of students needs to be taken into consideration in all empirical research. Examining the phenomenon of mobile device use in diverse student nurse populations facilitates inclusiveness.

Furthermore, nursing students from diverse backgrounds have higher attrition rates than students from non-diverse backgrounds (Condon et al., 2013; Jeffreys, 2012). Diverse nursing students need to complete the nursing programs to increase the diversity of the RN population. To provide better care for patients of all ethnic backgrounds, nurses need to reflect the current demographics of the U.S. because patients prefer the same ethnic background as themselves when choosing healthcare providers (Traylor, Schmittdiel, Uratsu, Mangione, & Subramanian, 2010). Patients' preferences with regard to ethnic diversity could also be applied to socioeconomic diversity. Hence, nursing students need to come from all socioeconomic backgrounds to better relate to patients of all socioeconomic backgrounds. Nurse educators need to support diverse student retention in nursing programs to have diversity in the nursing profession (Jeffreys, 2012).

According to the NLN (2009), nurse educators need to be committed to diversity in nursing education by examining and assessing practices, such as mobile device use, that may favor some and exclude others. While nursing educators are preparing nursing students to work in the technology-rich healthcare field by using mobile devices, larger social problems, such as the digital divide, affect technology use. The digital divide is the disparity between access, use, and knowledge of technology based on certain demographic characteristics. Diverse students who come from low socioeconomic backgrounds are the most vulnerable to the digital divide (Richtel, 2012). The practice of incorporating mobile devices into the nursing curriculum may be

a barrier to diverse student populations and may be another factor that leads to the higher attrition rate of diverse students.

***Research on mobile devices with diverse students.*** As stated earlier, nursing research has shown that using mobile devices in nursing education has increased the QSEN core competencies. Also, articles in nursing, medicine, and education have explored positive and negative aspects relating to informatics with the knowledge, skills, and attitudes toward using mobile devices as learning tools. For example, positive aspects of learning informatics when using mobile devices include higher test scores (Lin, 2013; Wu & Sung, 2014) and enhanced learning experiences (Dahlstrom, 2013; Martyn et al., 2014; Pearson Foundation, 2012; Robinson et al., 2013). Some of the negative aspects of knowledge when using mobile devices are distraction from learning (Airth-Kindree & Vandenbark, 2014; Dahlstrom, 2013; Robinson et al., 2013; Swan et al., 2013) and technical issues that impede learning (Finkelstein et al., 2013; Martyn et al., 2014). Within the category of skills of informatics, positive aspects include increased collaboration (Finkelstein, Winer, Buddle, & Ernst, 2013; Lin, 2013; Rung, Warnke, & Mattheos, 2014), better decision-making (Johansson et al., 2013; Schlairet, 2012; Tran et al., 2014) and perceived higher quality of patient care (Johansson et al., 2013; Johansson et al., 2014; Swan et al., 2013). Negative aspects of skills regarding informatics include the lack of technical skills to use mobile devices (Finkelstein et al., 2013; Lin, 2013; Sakraida & Person, 2014) and distraction from patient care (Payne, Wharrad, & Watts, 2012; Tran et al., 2014). Within the category of attitudes regarding informatics, a positive aspect is that students enjoy using technology for learning (Montenery et al., 2013; Secco et al., 2013; Swan et al., 2013; Wu, 2014; Wu & Sung, 2014). The negative aspect is that students become frustrated when technical issues arise (Finkelstein et al., 2013; Martyn et al., 2014; Swan et al., 2013). These articles highlight the

positive findings while discussing the negative aspects to help increase the use of mobile devices for informatics purposes. The current literature shows that mobile devices impact knowledge, skills, and attitudes with more positive informatics aspects relating to the devices than negative aspects, and the basis of using mobile devices in education may translate into a stronger basis for informatics. Nevertheless, the negative aspects of using mobile devices as learning tools may be attributed to the diverse background characteristics of nursing students, yet diversity is not the focus on these studies.

Diverse nursing students have backgrounds where technology may be lacking either in access or proper use as a learning tool (Goodman, 2013; Gorski, 2003; Hilbert, 2012; Richtel, 2012; Yu, 2011). Demographic variables relating to diversity are being a FGCS, grant eligible, an ESL learner, a prior/present recipient of public housing or welfare, and/or an ethnic minority student. For example, FGCS may not have the social support to use mobile devices as a learning tool because of the lack of parental education. Those students who are Pell grant eligible and/or recipients of welfare may lack the financial resources to afford a mobile device or costly learning apps. The main characteristics that affect all ESL students are their multilingual identities and linguistic struggles (Almon, 2014; Freeman, 2004; Kim & Duff, 2012; Tshabangu-Soko & Caron, 2011), which could impact how ESL students use mobile devices as learning tools. The location of public housing is not equal in resources to those who reside in private residences (Fryer & Katz, 2013; Sparks, 2014); therefore, students who reside in public housing may be limited as to technology resources. Because of the digital divide in the U.S., nursing education needs research in this area. As stated above, most research about mobile device use has focused on QSEN competencies and informatics, not on possible differences of access and use among diverse nursing students.

***Need for a conceptual framework.*** In order to explain the quality of mobile device use and how background characteristics of diverse students may affect educational outcomes and possibly higher attrition rates, a conceptual framework needs to be used to describe how nursing students decide to use mobile devices to enhance nursing education. The NLN (2015) stated, "In order to improve health care outcomes, the NLN's new vision statement calls for nursing programs to teach with and about technology to better prepare the nursing workforce" (para. 1). The NLN (2015) stated that the lack of technology integration into the curriculum was a clear deficiency in nursing education. A conceptual framework aids educators in the investigation of mobile device use to prepare nursing students for practice.

Four nursing studies used a conceptual framework that focused on mobile device use (Kenny et al., 2012; Martyn et al., 2014; Sakraida & Person, 2014; Wang, Wiesemes, & Gibbons, 2012). Wang et al. (2012) used grounded theory to interpret the data that described nursing students' experiences of using mobile devices to enhance nursing content. Martyn et al. (2014) and Sakraida and Person (2014) used activity theory to guide the intervention of the course design that implemented mobile devices into learning. Kenny et al. (2012) used Koole's Model of Mobile Learning, with the construct of mobile learning self-efficacy, to determine whether nursing students and faculty were prepared for mobile learning in the educational setting. Few researchers used a conceptual framework, and no conceptual framework adequately addressed the decision to use mobile devices with nursing education and evaluate differences in incorporation by background characteristics in non-mandated settings.

***Need for a sound instrument.*** Just as no conceptual frameworks address mobile device use, likewise few instruments exist with mobile device use. An instrument can measure and provide evidence that examines the decision to use mobile devices as learning tools to prepare

nursing students for practice. The instruments used to study mobile device use measured knowledge of material, attitudes, and/or critical thinking to test mobile devices and the impact on informatics or QSEN core competencies (Lin, 2013; Montenery et al., 2013; Schlairet, 2012; Secco et al., 2013; Wu et al., 2012; Wu & Sung, 2014). Other instruments measured different factors. For example, Kenny et al. (2012) modified a mobile learning self-efficacy scale to measure nursing students' perceptions and readiness for mobile learning for nursing education. Mather et al. (2014) and Johansson et al. (2014) used a modified instrument on the use of mobile devices during clinical rotations with nursing students. While all these instruments are needed, none of the above studies used an instrument that measured nursing students' decisions to use mobile devices as learning tools to enhance nursing education. Therefore, an instrument needs to be developed or modified to adequately measure nursing students' decisions to use mobile devices as learning tools to enhance nursing education in the classroom, lab, and clinical rotations. Then, this instrument can be applied to diverse nursing students to examine the impact of the digital divide to better prepare graduates for nursing practice by supporting diverse nursing students and advocating for their successful completion of the nursing program.

***Need for educational outcomes with mobile device use in non-mandated settings.*** There has been a debate about how the use of mobile devices impact educational outcomes. Dahlstrom and Bichsel (2014) found that faculty in all disciplines, not just nursing, believe that mobile device use creates a distraction from learning. Despite this common perception among faculty, nursing researchers have found that using mobile devices as an intervention to enhance nursing education positively increased learning outcomes (Wu et al., 2012; Wu et al, 2011; Wu, 2014; Wu & Sung, 2014). These studies had an intervention to purposefully incorporate mobile devices as academic tools. Without formal integration into the curriculum, non-mandated settings, the

educational impact of mobile devices is unknown. The question that needs to be investigated is whether students who use mobile devices for learning purposes have a greater educational advantage over those who do not own or use mobile devices for learning purposes. Lack of access to and educational use of mobile devices are barriers in low socioeconomic populations (Richtel, 2012). Due to the vast diversity of mobile device use in the student population, are there differences in use patterns based on students' background characteristics that impact educational outcomes?

To summarize this section, the APA (2015) and the NLN (2009) stated that the diversity of students needs to be taken into consideration in all empirical research in order to create an inclusive environment. Because of the digital divide in the U.S., research regarding mobile device use in nursing education is needed (Goodman, 2013; Gorski, 2003; Hilbert, 2012; Richtel, 2012; Yu, 2011), especially with demographic variables relating to diversity (FGCS, Pell grant eligibility, ESL, prior/present use of public housing, prior/present use of welfare, and/or ethnicity). Therefore, nurse educators need not inadvertently promote educational practices that may exclude or be a barrier to nursing students who come from diverse backgrounds (NLN, 2009). In order to examine diversity, a conceptual framework and instrument need to be developed to explain the nursing students' decisions to use mobile devices as learning tools and to investigate the impact of the digital divide. Also, researchers need to continue to investigate the impact of mobile device use in regard to educational outcomes through grade point average (GPA) or standardized test scores (e.g. Assessment Technologies Institute [ATI] testing). Nursing educators need to champion diversity and support diverse students to help them reach their educational goals of completing nursing school and practicing as nurses.

## Conceptual Framework

A conceptual framework provides the theoretical basis to guide research. This section provides the background of the conceptual framework used in current study. Also, this section describes the MDA model in terms of the relationships between study variables and outcomes.

The conceptual framework for this study is based on the technology acceptance model (TAM) and self-efficacy. The TAM is an information technology model that predicts people's decision to use technology. There are six constructs in the model (Davis, 1989). External variables influence perceived usefulness of technology and perceived ease of use of technology. Both of the perception constructs affect attitude toward using technology. Attitudes toward both using and perceived usefulness impact behavioral intention to use, which then influences actual system use. The TAM is based on a diverse range of end-users accepting and using various computer systems (Davis, 1989). This model has been tested in a variety of disciplines and technology devices, including web software (Morris & Dillon, 1997), education with integrating technology into the classroom (Wong, Osman, Goh, & Rahmat, 2013), and in company management with employee technology use (Mariani, Curcuruto, & Gaetani, 2013).

Bandura's self-efficacy theory also provides additional direction for current study to guide the work. According to Bandura (1986), self-efficacy is a person's beliefs in his/her capabilities to perform or act in a way to produce a desirable response even in the midst of adversity. Self-efficacy can impact future behaviors such as performing clinical care of patients, teaching others about health practice, learning nursing content, providing dementia care, and demonstrating cultural competence (Allen, Brown, Duff, Nesbitt, & Hepner, 2013; Chesser-Smyth & Long, 2013; Karabacak, Serbest, Kan Öntürk, Eti Aslan, & Olgun, 2013; Jordan & Church, 2013; McMullan, Jones, & Lea, 2011; Mager & Campbell, 2013) and has been studied

in nursing education. Previous studies also showed that past accomplishments increased self-efficacy when nursing students performed safe patient care in clinical rotations (Chesser-Smyth & Long, 2013) and simulation (Mager & Campbell, 2013). Other studies also found that vicarious experiences increased self-efficacy by seeing others model how to teach with sex education materials (Karabacak, Serbest, Kan Öntürk, Eti Aslan, & Olgun, 2013), eLearning medications (McMullan, Jones, & Lea, 2011), providing dementia care (Jordan & Church, 2013), and demonstrating cultural competence (Allen, Brown, Duff, Nesbitt, & Hepner, 2013). Additional nursing education articles found that social persuasion affects self-efficacy through faculty instruction (Raman, 2013) and peer-to-peer interaction (Brannagan et al., 2013). The physiological/emotional states of attitude toward computers affected computer self-efficacy of nursing students (Chow et al., 2013). While self-efficacy has been studied in nursing education with other topics, it was less studied with mobile device use.

The self-efficacy model can be added to the TAM to help strengthen constructs predicting behavior. More recently, the TAM and self-efficacy model have been tested in nursing education. Chow et al. (2013) tested TAM and self-efficacy with students' intentions to use electronic imagery software during clinicals. The authors found that the software exhibited high degrees of perceived usefulness and perceived ease of use and also that the students enjoyed using the software to predict intention to use the software. Another group of researchers—Kowitlawakul, Chan, Pulcini, and Wang (2014)—tested the TAM and self-efficacy with students using an electronic health record with simulation patients. The results showed that students' use of the electronic health record was influenced by their attitude and perceived usefulness. Both of the studies showed that TAM and self-efficacy explained technology acceptance in nursing education (Chow et al., 2013; Kowitlawakul et al., 2014).

**MDA model.** Davis's (1989) TAM and Bandura's (1977) self-efficacy model were used to examine nursing students' decisions to use mobile devices as learning tools to enhance nursing education. The TAM evolved from the theory of reasoned action (TRA)'s decision-making model. The TAM posits that perceptions, attitudes, and external variables influence intentions and use of technology. Davis's TAM (1989) includes three types of influences that affect the intention to use technology: external variables (e.g., job relevance, demographics, organization support); perceptions (e.g. usefulness of technology, ease of use); and attitudes (e.g., excitement to use technology). Intention to use predicts actual use. Actual use of the technology is the desired behavioral outcome. Bandura's (1977) self-efficacy model is based on social-cognitive theory. Bandura's (1986) self-efficacy model posits that experience, attitudes, persuasions, and cognitions influence behavior. The model includes four sources of self-efficacy: past accomplishment, vicarious experiences, social persuasion, and affective state. These sources of self-efficacy influence overall self-efficacy, which then impacts behavior. Behavior is the end outcome. Both the TAM and self-efficacy model have behavior as the outcome. The adaptation of the TAM and self-efficacy model depicted the influences on the decision to use mobile devices among nursing students. In the MDA model, the proposed relationships are between eight key constructs: perceived usefulness, perceived ease of use, behavior intention, mobile device self-efficacy, past accomplishment, vicarious experiences, affective state, and social persuasion, to predict the actual use of mobile devices as an educational tool.

## Purpose of the Study

The purpose of the study is to examine and apply the MDA model. Specific aims of this proposed study include the following:

a. to examine the validity and reliability measures of the MDA instrument;

b. to examine the digital divide regarding the differences of key study variables in the MDA model;
c. to identify moderator variables (age, gender, prior experience, and ethnicity) that may impact behavioral intention in the educational setting;
d. to examine whether the preferred brand, size, and features/apps explain differences of key study constructs in the MDA model, in order to provide information and recommendations for integrating mobile technology into the nursing curriculum;
e. to examine the relationship between the constructs of the MDA model with diversity and educational outcomes.

**Research Questions**

The following are the research questions of the study:

1. Is the MDA instrument a valid and reliable instrument?

2. Is there a difference in the constructs of the MDA model (perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state) between nursing students with different background experiences (e.g. FGCS, Pell grant eligibility, ESL, prior/present use of public housing, prior/present use of welfare, and ethnicity)?

3. Are there moderator variables (age, gender, prior experience, and ethnicity) that could be included in the MDA model that affects behavioral intention?

4a. Is there a difference in the constructs of the MDA model between the preferred operating systems (Apple IOS, Google Android Platform, and Windows)?

4b. Is there a difference in the constructs of the MDA model between the preferred size of mobile devices (small handheld, such as smartphone size; midsize, such as iPad mini; or larger handheld, such as tablet)?

4c. Is there a difference in the constructs of the MDA model between the preferred feature/apps used (communication/interaction, organization, reference material, or study aid apps)?

5a. Is there a relationship between the constructs of the MDA model with diversity and ATI test scores?

5b. Is there a relationship between the constructs of the MDA model with diversity and GPA?

## Chapter 2: Review of the Literature

This chapter addresses the literature that frames the current study. Information technology is embedded into nursing today. To prepare nursing students to practice successfully in the twenty-first century, nursing education needs to include informatics in the nursing curriculum. Mobile devices are part of information technology that prepares nursing students to practice in an informatics environment. However, factors that may impact mobile device use are age, gender, ethnicity, and prior experience. Also, other factors, more specific to the device itself, are the size of device, preferred operating system, and different functions used. In addition, the digital divide may be another factor that may impact how some nursing students use mobile devices. Specific demographic characteristics, such as FGCS, Pell grant eligibility, ESL students, recipients of welfare, residence in public housing, and ethnicity/minority students will be discussed, as these characteristics may be variables in the digital divide regarding mobile device use.

Diverse nursing students need to be supported throughout the nursing curriculum because the diversity of patients, RNs, and nursing students impacts patient-centered care. There is a need for more research that focuses on the educational outcomes of mobile device use and diversity in non-mandated settings located in the U.S. with nursing education. More research is needed regarding a conceptual framework and an instrument that focuses on mobile device use. Also, the MDA model and instrument will be discussed. Mobile device use, as part of information technology and informatics, can be the foundation to prepare nursing students to practice in the current health care environment.

## Information Technology and Informatics in Nursing Today

The current health care environment is embedded with information technology centered on informatics. Nurses need to possess the ability to practice nursing using a variety of information technology including healthcare portals, electronic medical records (EMR), digital resources, telehealth, and devices with technology. As technology increases patients' healthcare outcomes, nurses who interact with patients the most need to be comfortable in this technology embedded environment.

**Healthcare portals.** Nurses are expected to use healthcare portals (NLN, 2015). A healthcare portal is an electronic means for patients and the medical team to communicate and share personal health information safely and securely. The study showed that patients who used the healthcare portal in conjunction with the medical team had stronger medication adherence and management than patients who did not use the portal (Osborn, Mayberry, Wallston, Johnson, & Elasy, 2013). With the U.S. government providing incentives for further electronic meaningful use, healthcare portals will continue to evolve (HealthIT.gov, 2013), and nurses who use the portals with patients will provide strong patient-centered care (Fant & Theiss, 2015).

**Electronic medical record.** Nurses are expected to use the EMR (NLN, 2015). The EMR is an electronic charting system that all members of the health care team contribute to for the benefit of the patient. The use of the EMR increased patient and provider satisfaction with medication management (Duffy, Yiu, Molokhia, Walker, & Perkins, 2010). When the medical staff used the EMR on mobile devices, there were higher rates of completion of documentation, higher levels of efficiency, and lower levels of errors than with the use of EMR on computers (Mickan, Atherton, Roberts, Heneghan, & Tilson, 2014). Nurses are expected to fully use the EMR for quality patient care.

**Digital resources.** Nurses are expected to use digital resources (NLN, 2015). Digital resources are electronic sources that support health and wellness of patients. A variety of digital resources exists for the current healthcare environment: eBooks, healthcare apps for providers, forum posts, and electronic evidence-based practice guidelines for patient care (American Medical Association [AMA], 2016; Beers & Berry, 2015; Secco et al., 2013). Digital resources allowed for quicker and more efficient ways to support patient care than traditional paper resources (Beers & Berry, 2015).

**Telehealth.** Nurses are expected to use telehealth (NLN, 2015). Telehealth is the use of technology to support long-distance health (AMA, 2016). Telehealth is now also being described as mobile health because of mobile devices' ability to monitor and care for patients in real time (AMA, 2016). This new way of healthcare was associated with lower emergency admission rates and lower mortality (Steventon et al., 2012). Telehealth also tracked health in chronic disease patients and reduced hospital admission rates because of the ability to monitor patients' health/compliance and to increase communication to address post-discharge complications (Ozdalga et al., 2012). Nurses are part of the health care team that used telehealth, and this means of healthcare will continue to grow exponentially (AMA, 2016; NLN, 2015).

**Devices with technology.** Nurses are expected to use technology devices for health care (NLN, 2015). Mobile devices are being tested to function as heart-rate monitors (Gregoski et al., 2012), high-fall-risk monitors (Nishiguchi et al., 2012), dopplers (Huang, Lee, Chen, & Liu, 2012), and ECG monitors (Baig, Gholamhosseini, & Connolly, 2013). According to Ozdalga, Ozdalga, and Ahuja (2012), "The smartphone may one day be recognized as a diagnostic and therapeutic tool that is as irreplaceable as the stethoscope has been in the practice of medicine" (para. 46). Mobile devices have been used to track dementia patients' wanderings and reorient

patients for safety (Sposaro, Danielson, & Tyson, 2010). For bipolar patients, smartphones could detect early signs and symptoms of manic or depressive episodes (Puiatti, Mudda, Giordano, & Mayora, 2011).

## Preparation for Nursing Practice

Because of this information technology environment, nurse educators need to prepare nursing students for practice using mobile devices. “The implications for nursing education are clear: nursing curricula and teaching strategies need to teach with and about technology to better inform health care interventions that improve health care outcomes and prepare the nursing workforce” (NLN, 2014, par.13). Cronenwett et al. (2007) argued that the most important core competency was informatics. Nursing education needs to focus on curriculum integration and to prepare faculty to increase students’ knowledge, skills, and attitudes of informatics.

**Curriculum integration.** Curriculum integration needs to focus on informatics, as nurses can be the bridge from patients to technology (NLN, 2015). Major curriculum informatics initiatives were proposed by the NLN and Technology Informatics Guiding Education Reform (TIGER; Lindsay & Earl, 2014; NLN, 2008b, 2014; TIGER, 2007). The NLN has produced their vision series in which technology is a major focus, urging curricular changes to reflect the current healthcare environment (NLN, 2008b, 2014). The TIGER initiative is a group of 40 nursing organizations dedicated to promoting the advancement of technology in nursing. The TIGER outlined specific steps to increase technology literacy for curriculum integration (TIGER, 2007). Both nursing organizations, along with the IOM, champion technology literacy and strong informatics curriculum among nursing programs.

**Prepare faculty to teach informatics**. To help students, faculty needs to be prepared to teach with technology for informatics. First, faculty needs to understand how to integrate

informatics in the curriculum, which requires training. The NLN (2015) called for nursing faculty to use technology for patient-centered care, use simulation and clinical rotations to maximize informatics, and develop telehealth experiences for community health. Second, technology devices served as a tool for informatics, but the tools need to be used to increase safe patient care and collaboration while decreasing error. Although students are exposed to technology in nursing, it is not enough; technology needs to be used for informatics purposes (NLN, 2015). Faculty needs to lead the way for a solid foundation of informatics in nursing education.

**Mobile devices prepare nursing students for practice.** The NLN (2014) stated that informatics needs to be improved for nursing students to be prepared for practice. Improvements with informatics included increasing the use of technology for stronger decision-making support while minimizing errors, greater collaboration in all healthcare members, and better use of quality resources for patient care. Students need to exhibit strong informatics principles. Mobile device use can be part of the information technology environment. Nursing students who used mobile devices during their education may be better prepared for nursing practice. The NLN (2008) stated that graduating nursing students need to be prepared to practice in technology-rich environments of the twenty-first century, which includes using "various electronic communication devices" for safe and quality patient care (p. 1). The use of mobile devices impacts QSEN six core competencies that every nursing student needs to possess to prepare them for nursing practice: increased patient-centered care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics.

***Patient-centered care.*** For patient-centered care, students perceived that the benefit of mobile devices was to increase nursing knowledge to care better for patients (Dearnley, Haigh, &

Fairhall, 2008; Galvão & Püschel, 2012; Jenkins, Hewitt, & Bakken, 2006; Kneebone, Nestel, Ratnasothy, Kidd, & Darzi, 2003; Koeniger-Donohue, 2008; Martyn et al., 2014; Schlairet, 2012; Secco et al., 2013; Smith & Pattillo, 2006; Stroud, Erkel, & Smith, 2005; Wu et al., 2011; Wu, 2014). For example, Martyn et al. found that when content resources were downloaded onto an iPod, students felt that they could care for patients because of the resources on hand. Wu (2014) found that students who used Google plus on mobile devices had greater communication and higher test scores for community health clinical rotation than students who did not use Google plus on mobile devices. Also, the use of mobile devices helped integrate theory into practice (Johansson, Petersson, & Nilsson, 2013; Johansson, Petersson, Saveman, & Nilsson, 2014; Secco et al., 2013; Stroud et al., 2005; Wu et al., 2012; Wu, 2014). For example, Secco et al. (2013) found that using an app called "Nursing Central" helped apply classroom content to clinical situations. Wu et al. (2012) found that students using mobile devices as sensory devices in health assessment labs had more time to practice procedures than those using traditional methods.

In addition to the increased patient care knowledge, nursing students who used mobile devices impacted patients' sense of control and partnership, based on the respect of patients' values and needs (Cronenwett et al., 2007). Since more patients preferred getting their health information online via mobile devices (Bristol, 2014; Katz, 2007; Ozdalga et al., 2012), nursing students needed to respect that choice. Using mobile devices with patients may help increase true partnerships for patients, with everyone participating fully in the patients' care. Multiple studies showed that mobile device use helped nursing students interact with patients for teaching and strong patient-centered care (Jenkins et al., 2006; Swan et al., 2013).

***Teamwork and collaboration.*** For teamwork and collaboration, students perceived that mobile device use increased collaboration with peers and/or faculty (Kenny et al., 2012; Lai & Wu, 2006; MacKay & Harding, 2009; Wu & Lai, 2009; Wu, 2014; Wyatt et al., 2010). Using technology facilitated greater communication between the student and instructor in the clinical setting, where students often need more support for patient care (Lai & Wu, 2012). When students used mobile devices, they felt less isolated during clinical rotations (Garrett & Jackson, 2006; Young et al., 2010). Mobile device use helped students be flexible when working through problems with peers (MacKay & Harding, 2009).

***Evidence-based practice.*** Mobile device use impacts evidence-based practice in a variety of ways. Since new research and practices are being developed daily, students perceived that when they used mobile devices, they received the most current data (Brubaker, Ruthman, & Walloch, 2009; Sakraida & Person, 2014; Secco et al., 2013). Applying the most current, accurate information in clinical settings enabled students to give quality patient care (Garrett & Jackson, 2006; Koeniger-Donohue, 2008; Lai & Wu, 2012; Williams & Dittmer, 2009; Wittmann-Price, Kennedy, & Godwin, 2012). For example, students personalized and did not disrupt the flow of patient care during clinical rotations because of the resources readily available on mobile devices (Koeniger-Donohue, 2008). Another way mobile device use impacted evidence-based practice was when students used an evidence-based practice and technology literacy framework to critique apps that patients used. This critique increased the importance of educating patients on the quality content in apps (Airth-Kindree & Vandenbark, 2014). The use of mobile devices was helpful for increasing evidence-based practice.

***Quality improvement.*** Mobile device use impacted quality improvement with different purposes. To monitor outcomes of care processes, Lee et al. (2009) found that when nursing

students used mobile devices to screen for a health condition during clinical rotations there was greater compliance with the guidelines. To use improvement methods in the education setting, Trangenstein, Weiner, Gordon, and McNew (2007) found that nursing students could input clinical experiences into a clinical log on mobile devices to examine any trends in care and clinical skills. As evidenced by the full completion of screening data and the use of logs, mobile device use may be a basis on which to impact students' competency of quality improvement.

***Safety.*** For safety, students perceived that they performed higher levels of safe patient care when using mobile devices (Bauldoff, Kirkpatrick, Sheets, Mays, & Curran, 2008; Johansson et al., 2013; Johansson et al., 2014; Schlairet, 2012; Secco et al., 2013; Swan et al., 2013). Students received the most support for safety through medication administration resources such as medication calculators and reference tools located on the mobile device (Clark & Gorski, 2002; Garrett & Jackson, 2006; George, Davidson, Serapiglia, Barla, & Thotakura, 2010; Greenfield, 2007; Hudson & Buell, 2011; Secco et al., 2013; Wittmann-Price et al., 2012). Greenfield (2007) found that when students had the correct information at the point of care through mobile devices, they reduced possible medication errors and increased clinical decision-making, which relates both to safety and informatics.

***Informatics.*** Informatics is the "use of information and technology to communicate, manage knowledge, mitigate error, and support decision-making" (Cronenwett et al., 2007, p. 129). Decision-making is the conscious process to decide what sources to use to apply to specific patients (Muir, 2004). The NLN (2014) stated that informatics needs to be improved for nursing students to be prepared for practice, and mobile devices when used for learning purposes can help strengthen informatics principles. For example, students stated that mobile devices brought increased collaboration (Lin, 2013), better decision-making (Johansson et al., 2013; Schlairet,

2012), and perceived higher quality of patient care (Johansson et al., 2013; Johansson et al., 2014; Swan et al., 2013). Students also perceived that they were making better point-of-care decisions, being more time-efficient with care, committing fewer errors, and increasing communication when using mobile devices (Johansson et al., 2013; Schlairet, 2012). Additionally, students had higher test scores when using mobile devices (Lin, 2013; Wu & Sung, 2014) and enhanced learning experiences (Martyn et al., 2014). Last, students were better equipped to navigate technology and information management (Airth-Kindree & Vandenbark, 2014; Swan et al., 2013), and they enjoyed using technology for learning (Montenery et al., 2013; Secco et al., 2013; Swan et al., 2013; Wu, 2014; Wu & Sung, 2014).

Despite the benefits from using mobile devices for informatics purposes, problems still arose with this use. Students felt distracted from learning (Airth-Kindree & Vandenbark, 2014; Swan et al., 2013) and had technical issues that impeded learning when using mobile devices (Martyn et al., 2014). Students felt that they lacked the technical skills to use mobile devices (Lin, 2013), and some students did not understand the importance of avoiding distractions when using mobile devices or of adhering to patient confidentiality policies (Robb & Shellenbarger, 2012). Additionally, students were frustrated when technical issues arose (Martyn et al., 2014; Swan et al., 2013). Regarding these concerns, faculty needs to understand the best practices of using mobile devices to impact and not distract from learning outcomes. When students knew the time, effort, and skill it took to learn material with mobile devices (Johansson et al., 2014), they might use these same principles and apply the principles to better translate the time, effort, and skill for safe, quality patient care (Cronenwett et al., 2007). Students need to be educated on the appropriate professional use of mobile devices to impact safe, quality, and effective patient care when practicing nursing.

## Factors That May Impact Mobile Device Use

Despite these advances in QSEN competencies using mobile devices in nursing, there are factors that may affect mobile device use as an educational and informatics tool. Not only do mobile devices come in various sizes and operating systems with multiple functions, there may be other factors that influence the use for specific purposes: age, gender, ethnicity, socioeconomic status (SES), and prior experience.

**Various sizes, operating systems, and multiple functions and mobile device use.** Mobile devices come in various sizes and operating systems with multiple purposes that affect technology use. In 2015, the sizes of mobile devices were traditional smartphones categorized as small, larger smartphones or mini-tablets categorized as medium, or tablets categorized as large. With each size of mobile devices come competing issues. For example, with the small size, some studies found that students enjoy the ease of portability with learning (Kenny, Neste-Kenny, Park, Burton, & Meiers, 2009; Swan et al., 2013). However, other studies found that students did not like to learn, and information was hard to navigate on such a small screen size for a long period of time (Farrell & Rose, 2008; Martyn et al., 2014; Swan et al., 2013). According to Chen and Denoyelles (2013), college students who used small devices for learning had significantly lower GPAs than college students who used large devices for learning. Hence, the preferred size of the device may impact mobile device use and educational outcomes.

Not only do mobile devices come in various sizes, but they also come in a variety of operating systems. The different operating systems are Apple IOS, Google Android, and Microsoft Windows. Users usually prefer one operating system over another for a variety of reasons (Chien, Lin, & Yu, 2014). Although Google Android has the greatest market share,

followed by Apple IOS and then Microsoft Windows, many app developers are trying to create apps and resources that can be used on multiple operating systems (Puder & Antebi, 2013).

In addition to various sizes and operating systems, mobile devices also have multiple purposes. For nursing education, those multiple purposes have been broken down into four categories: communication/interaction (such as text, email) with classmates and faculty; organization (such as calendar, to do lists); reference materials (such as Googling terms or eBooks); and study aid apps (such as Quizlet or Study Blue). Students learn through communication, which the mobile device aids (Lai & Wu, 2012). However, using mobile devices as a communication tool was harder to accomplish than using mobile devices as a reference tool (Kenny et al., 2009). Mobile devices that had trouble connecting to the Internet for communication and reference material purposes frustrated students (Kenny et al., 2009; Martyn et al., 2014).

No nursing research has focused on the organizational aspect of mobile devices: dates of assignments, exams reminders, and to-do lists. The most researched reference material was Nursing Central, an app that contains reference books such as a drug book, lab book, and nursing care book that can be searched simultaneously for convenient and easy access. Secco et al. (2013) and Swan et al. (2013) found that students enjoyed using Nursing Central for student learning. Wolters Kluwer Health (2012) found that 85% of nurses and students had a drug book app on their smartphone. In higher education, Pearson Foundation (2012) found that 70% of students prefer eBooks over hard copy. For study aid apps, Swan et al. (2013) and Bristol (2014) found insufficient apps for learning nursing content. In higher education, Chen and Denoyelles (2013) found that among college students, the most popular apps were social networking, music,

and games, while education-type apps were ranked in ninth place. Such statistics indicated that mobile devices could function as an educational tool, depending on the user.

**Age and mobile device use.** Age is a variable that affects technology use. The terms *digital natives* and *digital immigrants* depict how age can affect the use of technology (Prensky, 2001). Historically, according to Prensky (2001), those who are younger grew up with technology all around them and then used it more to their advantage, hence the term *digital natives*. Those who did not grow up with technology and had to purposefully learn how to incorporate technology into their lives are termed *digital immigrants*. However, VanSlyke (2003) asserted that both digital natives and digital immigrants need information and communication technology skills to think critically and research the vast amount of resources available. Also, both populations need to be flexible in order to balance the old ways of practice with the new ways of accessing and using technology (VanSlyke, 2003).

**Gender and mobile device use.** From a feministic perspective, most of the technology inventions and advances have been interpreted as masculine in nature. For example, "Technology is identified as masculine, and masculinity is defined in terms of technical competence" (Wajcman, 2000, p. 447). Historically, females are characterized as passive in acceptance of technology (Morris, Venkatesh, & Ackerman, 2005), while men are characterized as the creators of technology (Brake, 2014). For mobile devices, there was not a large disparity among gender. The most recent Pew Internet Project (2014) stated that 61% of males own a smartphone, and 57% of females do. Although the education purposes were not measured, males used mobile devices for videos, news, and GPS systems, whereas females used mobile devices for games, sharing, and camera (Nielsen, 2014). There was not a large disparity with access to mobile devices as it relates to gender; however, the educational purposes are unknown.

**Ethnicity and mobile device use.** There are deep rooted patterns of racism in the U.S. that explain the disparities of technology access along racial lines (Shapiro, Meschede, & Osoro, 2013). The technology divide in history included all technology inventions, such as the telephone, radio, and television (Norris, 2001). However, with the invention of the smartphone, 64% of African-American adults own a smartphone, whereas 60% of Hispanics and 53% of Caucasians do (Smith, 2013). African Americans and Hispanics benefitted by accessing the Internet from their smartphones. Nonetheless, there are still digital divides with Internet: only 71% of Spanish-speaking people in the U.S. use the Internet, compared to 86% of English-speaking people who do (Rainie, 2013).

Research has indicated that in regard to using technology, minorities use their mobile devices for more functions than Caucasians do (Smith & Zickuhr, 2012). African Americans use mobile devices across all digital platforms for news and media, and they are avid users of social media, blogging, and watching videos on mobile devices (Nielsen, 2015). Another study found that African Americans and Hispanics use the following functions of a smartphone significantly more than Caucasians: accessing the Internet, playing games, listening to music, participating in social networking, downloading apps, viewing and recording videos, using online banking, checking email, and participating in video call or chat (Smith & Zickuhr, 2012). The current technology environment appears to be supportive of minorities using mobile devices. More research is needed for the quality of use and frequency of use by minorities for educational purposes.

**SES and mobile device use.** SES is the combination of income, educational attainment, and occupation (APA, 2015) that may impact mobile device use. With lower household income and educational levels, there is lower ownership of cell phones, smartphones, and tablets, and

lower use of the internet (Smith & Zickuhr, 2012). When this population accesses the Internet, the quality of use has been questioned because of a lack in training on how to use the Internet effectively (Richtel, 2012; Van Deursen & Van Dijk, 2014; Zach, Dalrymple, Rogers, & Williver-Farr, 2012). Lower SES families use mobile devices for playing games, watching TV, and connecting to social media rather than for advancement out of poverty (Richtel, 2012). Vicky Rideout, author of the Kaiser study, said, "Instead of closing the achievement gap, [Internet devices are] widening the time-wasting gap" (as cited in Richtel, 2012, para. 18). Lower SES students may experience more challenges using mobile devices for learning.

**Prior experience and mobile device use.** Prior experience may impact mobile device use. Of those who are new to accessing the Internet, 63% believed that they would need someone to help them learn how to use it (Rainie, 2013). In education, those students who rated themselves high in technology inclination were more actively involved in courses that use technology and felt more adequately prepared for college (Dahlstrom & Bichsel, 2014). However, all college students should be guided to use technology as an educational tool in engaging and meaningful ways (Dahlstrom & Bichsel, 2014, p. 5).

## The Digital Divide, Diversity, and Mobile Device Use

Larger social issues affect mobile device use and information technology. The underlying structure of technology may negatively affect diverse students who are lacking in physical, digital, and/or social resources (Warschauer, 2003), whereas these resources or lack of resources contribute to the digital divide.

**Physical resources and the digital divide.** Physical resources consist of two components: the access to mobile devices and the access to the Internet (Warschauer, 2003). In 1999, the National Telecommunications and Information Administration (NTIA) found that the

access and use of technology and the Internet was sharply determined by race and income level, from which the term *digital divide* was coined. Caucasians and those with higher income levels had significantly greater access to technology and the Internet than the rest of the U.S. population (NTIA, 1999). Historically, regarding any technology, those with higher income levels gained access to technology first (Clark & Gorski, 2002; Norris, 2001; Warschauer, 2003). In 2015, the digital divide continued with mobile devices (Goodman, 2013; Gorski, 2003; Hilbert, 2012; Richtel, 2012; Yu, 2011). According to Chen and Denoyelles (2013), 9% of college students at one university did not have access to mobile devices. Despite this statistic, ownership is expected to be saturated with mobile devices (Dahlstrom & Bichsel, 2014), similar to the saturation of other technology such as the television in all populations in the US (Norris, 2001; Warschauer, 2003). However, the disparity will continue to exist regarding the use of mobile devices. Students who do not know how to access physical resources may miss out on the portability, convenience, accessibility, functionality, and almost invisibility that mobile devices bring to education (Norris & Soloway, 2012).

**Digital resources and the digital divide.** Digital resources consisted of the apps, or downloaded software, on the mobile device. There are many categories of apps, from business to lifestyle to utilities to weather. According to Chen and Denoyelles (2013), college students who have access to mobile devices ranked the most popular categories of apps as follows: social networking (75%), music (71%), games (53%), navigation (48%), entertainment (47%), photography (38%), news (31%), college/university specific apps (24%), education (20%), books (19%), reference (17%), and productivity (16%). Apps enabled mobile devices to be multifunctioning tools; sadly, the apps associated with learning appeared to have lower popularity with college students.

**Social resources and the digital divide.** Social resources that impacted the digital divide were inadequate schools to prepare for technology, inadequate stores that support technology, less cultural capital associated with technology, and fewer technology resources at public places (Clark & Gorski, 2002). While many want to make technology accessible to all, one needs to remember the reason why accessibility was an issue in the first place (Clark & Gorski, 2002). Because of unequal funding, a disproportionate lack of resources existed between low SES geographical areas to high SES geographical areas. Therefore, low SES students were lacking in social resources and experiencing inadequate housing, higher crime rate, and less access to parks and fresh foods, things that others may take for granted, which impacted technology and learning outcomes (Kassam, Iding, & Hogenbirk, 2012).

## Characteristics of Diverse Populations

Students who do not have the underlying structures of informational technology relating to mobile devices may be at an educational disadvantage, which may lead to different educational outcomes. In this study, the multidimensional variables of diverse students was defined by the following characteristics: FGCS, Pell grant eligibility, ESL student, prior or present recipient of welfare, past or present residence in public housing, and minority/ethnicity status.

**First generation college students**. FGCS have barriers for success in the university setting. Some of these students may have attended inadequate high schools that poorly prepared them for college (Contreras, 2012). They need to take remedial courses during college; they work more hours to pay for college, attend college part-time, and/or commute to college (Contreras, 2012; Dumais, Rizzuto, Cleary, & Dowden, 2013; Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012; Wilson & Kittleson, 2013). For example, non-FGCS are twice as

likely to complete calculus or precalculus in high school than FGCS, which is a major factor on test scores for college (Contreras, 2012). FGCS may have a harder time adjusting to college (Hertel, 2010). Because FGCS are the first to obtain a degree in their family, they also may lack the social support systems at home that encourage, promote, and support attending college and finishing a degree (Contreras, 2012; Wang, 2012; Wilson & Kittleson, 2013). FGCS tend to be African American or Hispanic and come from low socioeconomic backgrounds (Contreras, 2012; Hertel, 2010). However, FGCS are also optimistic about the future, with hope of climbing the social ladder and persisting in overcoming obstacles in their education (Contreras, 2012; Dumais et al., 2013; Wang, 2012; Wilson & Kittleson, 2013). Despite this optimism, Vuong, Brown-Welty, and Tracz (2010) found that FGCS have lower college self-efficacy, affecting academic success, and less persistence than non-FGCS.

**Pell grant eligibility.** Students who are eligible for the Pell grant may be at a disadvantage when attending college. First, most financial aid does not cover all college expenses; students often need to work to support their families (Goldrick-Rab, 2013; Long, 2012). Goldrick-Rab (2013) stated that Pell grant students max out at $5,645 per year, which barely covers college tuition. If students need child care, health insurance, and books, they may not have the money to pay for these extra expenses. Students who attend college through self-paced learning, distance learning, hybrid courses, and weekend courses may not receive the maximum funds that they could be eligible for due to the stipulations in the federal guidelines (Williams, 2004). Second, once these students receive financial aid, they may require extra resources to help them continue their college studies (Long, 2012; Supiano, 2013). The extra resources include childcare provision, remedial courses not considered part of the degree, work-study programs, mentoring programs, and academic/life skills training. However, eligibility for

financial aid does not equate with college readiness; therefore, students may have the financial backing but lack the ability to complete the degree (Sparks, 2014). Degree completion needs to be the goal, not continued financial aid.

**English as a second language.** ESL students may be educationally disadvantaged. The main characteristics that affect all ESL students are their multilingual identities and linguistic struggles (Almon, 2014; Freeman, 2004; Kim & Duff, 2012; Tshabangu-Soko & Caron, 2011). However, ESL students not only face academic rigor, such as learning a language based on a specific discipline in a university setting, but also the university environment may not be conducive to their type of learning. In the US, universities are built on independent culture, not collective partnership, and put too much strain on individuals who are family focused, while not respecting the mastery of their first language (Kanno & Varghese, 2010). The three main reasons why ESL students drop out of college are family obligations, lack of finances, and demands of full-time employment (Almon, 2014). In a longitudinal study following eighth-grade ESL students for 12 years, only one in eight ESL students earned a bachelor's degree compared to one in four minority non-ESL students (Kanno & Cromley, 2013). Universities, parents of ESL children, and ESL students focus primarily on English acquisition, instead of placing emphasis on the importance and elevation of knowing two or more languages to live in a multicultural world (Kim & Duff, 2012). Hence, there is an urgent call in higher education to change ESL educational practices that disrespect others' cultures that place emphasis on communal dependence and multilingual abilities (Kibler, Bunch, & Endris, 2011). Higher education needs to focus on positive lived experiences of ESL students to aid in degree completion (Kibler et al., 2011).

**Prior/present recipient of welfare.** Students who are past or present recipients of welfare may be educationally disadvantaged. A college degree is one of the best ways to get out of poverty (Duquaine-Watson, 2007; Karier, 2000; Porche, 2004). The current welfare system, Temporary Assistance to Needy Families (TANF), is under debate as to the best way to help support those who need financial support. TANF created disincentives for attending college and focuses on employment instead (Karier, 2000). Students receiving assistance under the TANF understand the following: the temporary nature of the program, the abrupt end of aid for any missing documentation, the lengthy paperwork and appointments involved in receiving aid, and the time needed to understand and fulfill the requirements for aid (Porche, 2004). Students understand that the assistance granted leaves little room for extra costs, such as Internet, as well as extra time needed for study. Students who qualified for TANF may choose not to seek it because of the lengthy process and requirements (Porche, 2004). Students who received aid knew that the aid was only for a limited amount of time. Those who need to put time and effort into qualifying for welfare are at a disadvantage educationally because of emphasis on employment, coupled with family commitments and survival (Duquaine-Watson, 2007).

**Past or present residence in public housing.** Students who reside or have resided in public housing may be at a disadvantage educationally. Due to its location, public housing is not equal in resources to private residences because of the lack of recreational spaces, grocery stores, and high achieving schools (Fryer & Katz, 2013; Sparks, 2014). The high levels of crime, violence, and drug use, prevalent in public housing, can disrupt the educational process and may lead youth into participating in, and ultimately being incarcerated for, those crimes (Sciandra et al., 2013). In spite of all of this, the school system bears the brunt of performing well, while the

other social, public systems in the areas of public housing fail to support students' success (Fryer & Katz, 2013).

**Ethnicity/minority.** Students who are ethnically diverse may be at a disadvantage educationally. As stated earlier, the US has institutionalized patterns of racism that suppress populations who are ethnically diverse (Delgado & Stefancic, 2012; Shapiro et al., 2013). According to Freire (2000), traditional educational systems perpetuated the domination of ruling class and did not allow for education as a means for freedom. According to the APA (2012), ethnically diverse students had lower high school graduation rates, consistently lower academic performance, and lower admission rates to post-secondary institutions than Caucasians and Asian Americans. For example, 55.7% of Blacks and 63.9% of Latino high school graduates attended higher education, compared to 71.7% of Caucasians. Also, these lower patterns of graduation rates, poor academic performance, and lower admission rates to postsecondary institutions in ethnic minority populations have remained steady from 1992–2011.

**Diversity of Current Patients, RNs, and Nursing Students**

The diversity of nursing students not only impacts their education but also their care of patients. In the midst of examining factors that may impact mobile device use, diversity in nursing education is important because the current ethnic background of most RNs does not reflect the ethnic background of the current U.S. population (U.S. Census Bureau, 2012; Xue & Brewer, 2014). Bavier stated, "It is imperative that educational institutions produce health professionals that mirror our nation and have the capacity to meet the health care needs of all ages, cultures, ethnicities, gender identity, race, and socioeconomic status" (as cited in NLN, 2016, par #2). Diversity of patients, RNs, and nursing students will be discussed in this section.

**Diversity of patients.** The patient population in the US is becoming more diverse. According to the U.S. Census Bureau (2012), the latest projections expected that there will be no majority group, such as Caucasians are presently, in the next half of the century. Patients generally prefer a person with the same ethnic background as themselves when choosing health care providers (Traylor et al., 2010).

**Diversity of RNs.** A lack of ethnic diversity in the current RN population continues (Jeffreys, 2012; Xue & Brewer, 2014). In contrast to the 65.6% of the U.S. total population that is Caucasian, 83% of RNs are Caucasian (U.S. Department of Health & Human Services, 2010). Despite the statistics, a lack of literature exists about the ethnic, racial, and gender diversity of RNs (NLN, 2016). Compounding this problem is the lack of ethnic diversity of nursing faculty. Nursing faculty, along with nurse executives, have the least amount of diversity among other segments of RNs (Budden, Zhong, Moulton, & Cimiotti, 2013).

**Diversity of nursing students.** A lack of ethnically diverse nursing students exists. The majority of nursing students are Caucasian female (Jeffreys, 2012). According to the NLN's (2014) biannual report, the percentage of minority nursing students has remained fixed, around 28%, since 2003 until 2014, despite the efforts to increase diversity. A lack of research exists regarding other diverse demographic characteristics, such as socioeconomic and cultural factors. Research showed that ethnic minority students needed additional support to successfully complete nursing programs, including psychosocial and academic support and mentorship (Brooks-Carthon, Nguyen, Chittams, Park, & Guevara, 2014).

## Gaps in Current Literature in Nursing Education

Researchers have been studying how to implement mobile device use into nursing education. However, there are gaps in the current literature about mobile devices that need to be addressed regarding the digital divide and the impact on nursing students.

A literature search was conducted from 2012 to 2015, through CINHAL, Google Scholar, and PubMed, that examined whether and how students are currently using mobile devices as learning tools in nursing education. Specific items, such as settings, investigation of diversity factors, and the conceptual framework and instrument used were examined to see whether the research supported the diversity of students and to show the need for the current research study. Eighteen nursing education articles were examined. The following were identified as gaps in the literature: more educational outcomes with mobile device use, more research in non-mandated settings and mobile device use, more research in the US, more research based on the diversity of the U.S. population and mobile device use, and a model and instrument based on the use of mobile devices as learning tools.

**The need for more educational outcomes with mobile device use.** There has been a debate as to how the use of mobile devices impact educational outcomes. Faculty believed that mobile device use created a distraction to learning and negatively impacted educational outcomes (Dahlstrom & Bichsel, 2014). Studies that used mobile devices as an intervention to enhance nursing education, however, found that mobile devices positively increased learning outcomes (Wu et al., 2012; Wu, Hwang, Tsai, Chen, & Huang, 2011; Wu, 2014; Wu & Sung, 2014). No study has yet investigated the educational impact of mobile devices without formal integration into the curriculum or without a purposeful intervention study.

**The need for research in non-mandated settings and use of mobile devices.** There is a gap in research on mobile device use in non-mandated settings. Again, non-mandated settings are programs in which the students are not required to use mobile devices for nursing education and there is not a formal, supportive integration of mobile devices into the nursing curriculum. Most research articles focused on mandated use of mobile devices (Airth-Kindree & Vandenbark, 2014; Elliott et al., 2012; Lin, 2013; Martyn et al., 2014; Montenery et al., 2013; Sakraida & Person, 2014; Schlairet, 2012; Secco et al., 2013; Swan et al., 2013; Wu et al., 2012; Wu, 2014; Wu & Sung, 2014). In non-mandated settings, Mather, Cummings, and Allen (2014) found that 56% of the sample had access to a mobile device in a nursing clinical setting in Australia. In a similar study in Sweden, 73% of nursing students and nurses own a mobile device, and 23% use a mobile device in practice (Johansson et al., 2014). There has not been a study in the U.S. in nursing education investigating mobile device use in non-mandated settings.

**The need for research in the US.** Of the five articles that addressed differences among demographics regarding mobile device use in nursing education, only one study was conducted in the US. (Wang et al., 2012), which highlighted the need for a study conducted in the US to address the digital divide. It is a great concern that diverse students, who increasingly represent more of the U.S. population, are not addressed in most studies.

**The need for research with diversity factors in nursing education and mobile device use.** The APA (2015) and the NLN (2009) implored that demographic variables need to be presented in research to create inclusive educational environments. In nursing education, out of the 18 articles examined, only seven articles presented demographic variables of the sample (Johansson et al., 2013; Johansson et al., 2014; Kenny et al., 2012; Mather et al., 2014; Schlairet, 2012; Secco et al., 2013; Wang et al., 2012). For representative sample purposes, three articles

described the sample in terms of age, gender, ethnicity, past experience, and/or tech skills (Johansson et al., 2013; Schlairet, 2012; Secco et al., 2013). Four articles examined differences regarding mobile devices. Of these four articles, three were quantitative, cross-sectional survey design studies. The demographic variables examined were the following: RNs vs nursing students (Johansson et al., 2014), BSN vs. LPN students (Kenny et al., 2012), and age and gender (Wang et al., 2012). In regard to differences with access (not use) to mobile devices, gender and ethnicity were examined (Mather et al., 2014). Barriers with educationally disadvantaged nursing students' demographics have been examined even less than other demographics. If researchers start examining educationally disadvantaged students and technology, there may be more disparities.

**The need for a conceptual framework and instrument regarding mobile device use.** In order to study the decision to use mobile devices as educational tools, specifically in nursing education, a conceptual framework and instrument need to be used. No instrument adequately addresses the decision to incorporate mobile devices into nursing education as learning tools. Again, 13 of the 18 recent articles used a variety of quantitative instruments. However, the instruments did not examine the decision to use mobile devices as learning tools. First, five of those 13 articles did not fully describe the instrument in terms of instrument development, constructs of the instrument, or psychometric properties (Elliott et al., 2012; Johansson et al., 2013; Martyn et al., 2014; Sakraida & Person, 2014; Wu, 2014). Second, five of the studies used instruments to measure knowledge, attitudes, and/or critical thinking, not the decision to use mobile devices (Lin, 2013; Montenery et al., 2013; Schlairet, 2012; Secco et al., 2013; Wu et al., 2012; Wu & Sung, 2014). Three studies used instruments to describe the sample and not to test an intervention (Johansson et al., 2014; Kenny et al., 2012; Mather et al., 2014), but no

instruments measured the decision to use mobile devices. Kenny et al. (2012) modified a mobile learning self-efficacy scale to measure nursing students' perceptions and readiness for mobile learning for nursing education. Mather et al. (2014) and Johansson et al. (2014) used a modified instrument on the use of mobile devices during clinical rotations with nursing students. These studies focused on mobile learning and clinical learning for practice, not, more specifically, the decision to use mobile devices as learning tools, hence the need to develop or modify a model and instrument.

## Conceptual Framework

According to NLN (2015), nurse faculty should increase knowledge and technological skills to prepare nursing students to practice in a technology-embedded environment. However, few studies have used a conceptual framework to study mobile device use in nursing education, with no conceptual framework that adequately described nursing students' decisions to use mobile devices as learning tools. In today's educational environment, with many technology devices embedded into society (Castells, 1993; Dahlstrom & Bichsel, 2014), there is a need for a conceptual framework that can better explain how nursing students decide to use mobile devices as learning tools. This section will describe the purposes of the MDA model and instrument and provide an explanation for the justification of the MDA model.

**Background of MDA model.** The MDA model identifies the constructs that were used to explain the impact of the digital divide in nursing education, which, in turn, could help support and advocate for diverse nursing students. The MDA model is based on the TAM (Davis, 1989) and self-efficacy theory (Bandura, 1977). The TAM was created based on a diverse range of end users accepting and using various computer systems (Davis, 1989). Based on the TRA (Fishbein

& Ajzen, 1975) model, Davis (1989) focused specifically on the constructs of perceived usefulness, perceived ease of use, and attitude toward using to influence behavioral intention.

Other technology models have been developed, such as the technology acceptance model two (TAM2; Venkatesh & Davis, 2000) and the unified theory of acceptance and use of technology (UTAUT; Venkatesh, Morris, Davis, & Davis, 2003). All of these theories have the end outcome of actual behavior to use technology. The TAM2 addressed the weakness in the original TAM by strengthening the construct of perceived usefulness with different dimensions, such as subjective norm, image, job relevance, output quality, and result demonstrability (Venkatesh & Davis, 2000). Venkatesh, Morris, Davis, and Davis (2003) created the UTAUT that combines the competing technology models for a uniform and consistent model to advance technology acceptance. This new model takes into consideration the users' unique characteristics, such as the moderating roles of gender, age, experience, and voluntariness, while emphasizing social systems, such as social influence and facilitating conditions (Venkatesh et al. 2003). Each theory has been tested and well published in many meta-analyses and literature reviews in many different settings and kinds of technology with positive results (Attuquayefio & Addo, 2014; Bagozzi, 2007; Curtis et al., 2010; King & He, 2006; Legris, Ingham, & Collerette, 2003; Turner, Kitchenham, Brereton, Charters, & Budgen, 2010; Venkatesh, Sykes, & Zhang, 2011; Williams, Rana, Dwivedi, & Lal, 2011). Most researchers use a combination of TAM/TAM2/UTAUT constructs, with perceived usefulness, perceived ease of use, and behavior intentions as the foundation (King & He, 2006; Legris et al., 2003; Turner et al., 2010). Therefore, the MDA model has included the TAM constructs of perceived usefulness, perceived ease of use, behavior intentions, and actual use as the foundation.

The MDA model also includes Bandura's self-efficacy theory (Bandura, 1977). According to Bandura (1986), self-efficacy is "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391). There are four sources of self-efficacy: past accomplishments, vicarious experiences, social persuasion, and affective state (Bandura, 1986). Self-efficacy has been tested in a variety of disciplines and settings (Ashford, Edmunds, & French, 2010; Bandura, 2012; Karsten, Mitra, & Schmidt, 2012; Multon, Brown, & Lent, 1991; Stajkovic & Luthans, 1998). In nursing education, researchers have used self-efficacy with the TAM as their model to guide research (Chow et al., 2013; Kowitlawakul et al., 2014). Therefore, the MDA model contains self-efficacy and the four sources of self-efficacy.

To sum up, the MDA model combines the best research of the TAM's constructs in the discipline of technology, incorporating self-efficacy's constructs in the disciplines of education, psychology, and nursing to describe nursing students' decision to use mobile devices as learning tools. Empirical research supports the constructs and relationships with this model. The MDA instrument is based on the MDA model.

***Constructs and relationships of the MDA model.*** The MDA model contains nine constructs (Figure 1). The end construct, which is considered the end outcome variable, is actual use, while behavioral intention is proxy to the behavioral outcome (i.e., actual use). According to the MDA model, mobile device self-efficacy, perceived usefulness, and perceived ease of use have a direct path with behavior intention. Mobile device self-efficacy has an indirect relationship to behavior intention through perceived usefulness and perceived ease of use. Behavioral intention has a direct impact on actual use. In terms of the sources for mobile device self-efficacy, past accomplishments, vicarious experiences, social persuasion, and affective state

have a direct path to self-efficacy. These then have an indirect relationship to behavior intention through mobile device self-efficacy. The empirical support from several professional fields and disciplines provided both empirical and theoretical base for hypothesized relationship among MDA constructs.

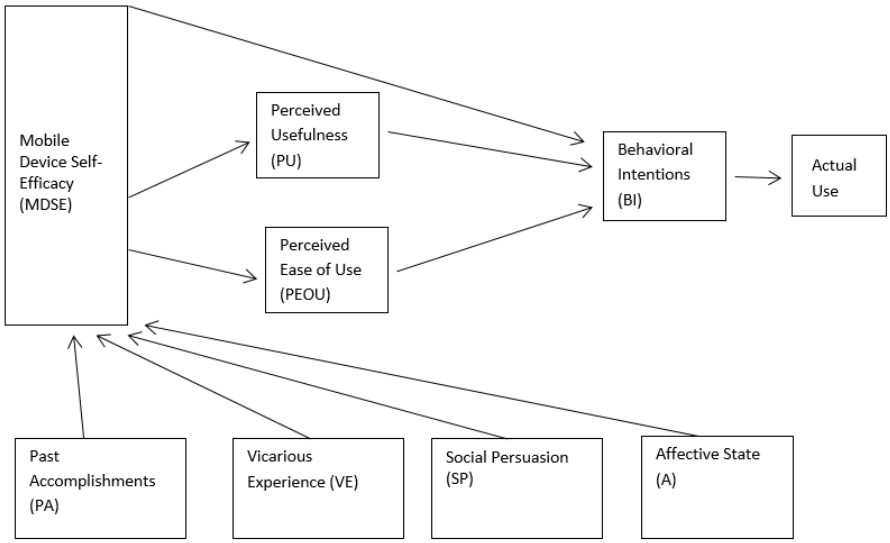


*Figure 1.* Mobile device acceptance model.

Meta-analyses and literature reviews have been conducted to examine the TAM and self-efficacy. Sumak, Hericko, and Pusnik (2011) performed a meta-analysis that investigated the relationships of the TAM and self-efficacy in regard to eLearning. The study sample contained 42 empirical articles on eLearning acceptance with the number of participants ranging from 30–1,107 in the chosen studies. Participants were predominantly students, but professors and employees were also examined in some of the studies. The results found that perceived usefulness impacted behavioral intention in 28 out of 28 studies, and perceived ease of use influenced behavioral intention in 10 out of 14 studies. Behavioral intention significantly impacted actual use. Also, five out of the six articles showed the impact of self-efficacy on behavioral intention.

For the application of the TAM to health care information technology, Holden and Karsh (2010) examined the TAM relationships in the healthcare environment. The types of technology in health care included the EMR, computerized care plans, telemedicine, and PDAs. The study sample included 20 articles with participant numbers ranging from 10–1,605 in the chosen studies. The participants were predominantly nurses and doctors, along with other health team members. The results found that the TAM could be adapted to the healthcare setting to increase technology use. Perceived usefulness predicted behavioral intention in 16 out of 16 studies, and perceived ease of use influenced behavioral intention in 7 out of 13 studies. The results also showed that behavioral intention significantly impacted actual use.

Legris, Ingham, and Collerette (2003) investigated the application of the TAM and TAM2. Empirical articles were examined regarding information system management with various software (i.e., text-editor, debugging tool, telemedicine, and computing center). The study sample was 22 empirical articles with participant numbers ranging from 25–2,500 in the chosen studies. The participants were predominantly students, but employees also participated in some of the articles. The TAM was a predictive model. Perceived usefulness predicted behavioral intention in 16 out of 19 studies, and perceived ease of use influenced behavioral intention in 10 out of 13 studies. The results also showed that behavioral intention significantly impacted actual use.

Turner et al. (2010) investigated behavioral intention and actual use in the TAM. There were 73 empirical articles examined that focused on various technology applications (i.e., software project management, E-collaboration, instant messaging, bank networking, and distant learning). The participants, students, employees, or consumers in the chosen studies ranged from 25–1,370. Behavioral intention impacted actual use by correlating well together ($r = 0.90$).

King and He (2006) examined the application of the TAM in various contexts. There were 88 empirical articles in a variety of disciplines and subjects (i.e., office software, telecommunications, internet, and banking) with the total sample size in all the articles being 12,582. Participants were separated into three groups: students, professionals, and general users. The results found that the TAM can be applied to various contexts, especially with students as the participants. King and He (2006) found significant correlations with perceived usefulness impacting behavioral intention and perceived ease of use impacting behavioral intention.

Schepers and Wetzels (2007) examined variables of participants (i.e., students, professionals, or general users), types of technology (i.e., electronic supermarket, eLearning, groupware, or banking) and country of origin to investigate the impact on the TAM relationships. There were 63 studies focusing on a variety of technology/disciplines (i.e., distant learning, telemedicine, home shopping service, online gaming, restaurant touch screen ordering, and banking). The number of participants in the chosen studies, including students, professionals, or general users, ranged from 35–845. This study confirmed that the TAM was a useful model. The use of students as participants increased the relationships of the TAM compared to professionals and general users. Perceived usefulness predicted behavioral intention in 38 out of 38 studies, and perceived ease of use influenced behavioral intention in 40 out of 40 studies. The results also showed that behavioral intention significantly impacted actual use.

Usher and Pajares (2008) described and reviewed articles that investigated self-efficacy and the sources of self-efficacy. There were 21 education empirical studies that examined self-efficacy and the sources self-efficacy. Self-efficacy was focused on various types of specific self-efficacy (i.e., self-efficacy in math, science, career choice, or self-regulation). This study accounted for both quantitative and qualitative studies, with participant numbers ranging from

10–1,256. The participants were primary, secondary, or postsecondary students. The four sources of self-efficacy proved predictive; however, past experience was the most impactful source.

Stajkovic and Luthans (1998) investigated the relationship between self-efficacy and behavior. There were 114 studies on self-efficacy and work-related performance, with 21,616 combined participants from all of the studies. Specific self-efficacy was examined (i.e., sales self-efficacy, academic self-efficacy, job seeking self-efficacy, and decision-making self-efficacy). The participants were professionals, employees, and students. The results found self-efficacy positively and strongly predicted behavior.

***The conceptual and operational definitions of MDA.*** The conceptual and operational definitions will be given for each of the MDA model's constructs: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishments, vicarious experience, social persuasion, and affective state. The original theorist construct definitions will be included. One can examine how the conceptual definitions of the MDA model align with the original theorists' definitions and understand how the items are operationalized from the conceptual definitions.

*Perceived usefulness.* Perceived usefulness, in the MDA model, is the students' belief that mobile devices are useful as learning tools to enhance nursing education. According to Davis (1989), perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). For perceived usefulness, the following items were constructed for the MDA instrument.

1. A mobile device can improve my learning efficiency for nursing school.
2. A mobile device can enhance my knowledge for nursing school.
3. A mobile device increases my learning output for nursing school.

4. I find a mobile device useful for my learning in nursing school.
5. I find it hard to concentrate on learning nursing content when using a mobile device. (reverse order)
6. Using a mobile device can help me learn with others in the nursing program.
7. A mobile device is very convenient to use for nursing content.
8. I can use a mobile device anytime/anywhere to learn nursing content.
9. It is easier to carry an electronic device than to carry the hard copy books with me wherever I go to study nursing material.

*Perceived ease of use.* Perceived ease of use, in the MDA model, is the effortless incorporation of mobile devices as learning tools to enhance nursing education. According to Davis (1989), perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (p. 320). For perceived ease of use, the following items were constructed for the MDA instrument.

1. It will be easy to operate a mobile device for getting information I need for lab, clinicals, and lectures in nursing school.
2. I find that a mobile device could be easy to use for lab, clinicals, and lectures in nursing school.
3. It will be hard to navigate nursing content on a mobile device. (reverse order)
4. I will not find what I am looking for when using a mobile device for learning in nursing school. (reverse order)
5. It is not difficult to use a mobile device during clinicals with my patient assignment.

6. I could easily gain access to the Internet on a mobile device for learning at most places I go.
7. Campus Tech Support will help if problems arise using a mobile device.
8. It is easier to use an electronic version of study material than a hard copy version of the same material because of the convenience of having the material on hand.

*Behavioral intention.* Behavioral intention, in the MDA model, is the desire to use mobile devices as learning tools, currently to enhance nursing education and for future nursing endeavors. According to Davis, Bagozzi, and Warshaw (1989), behavioral intention is "the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior" (p. 985). For behavioral intention, the following items were constructed for the MDA instrument.

1. Given that I have access to a mobile device at clinicals, I predict that I would use it.
2. I intend to use a mobile device as often as needed for my nursing education.
3. A mobile device costs too much for me to use for nursing education. (reverse order)
4. A mobile device is worth the cost of the device so that I could use it for nursing education.
5. I predict that I will not use a mobile device in the future for learning nursing content. (reverse order)
6. I would become too dependent on a mobile device if I used it with the nursing curriculum. (reverse order)

7. I predict that a mobile device will be mandatory as part of a job requirement when I become a nurse.

*Actual use.* Actual use, in the MDA Model, is the definite use of mobile devices as learning tools to enhance nursing education. According to Davis (1993), actual use is the current use of the system. Davis also states that self-reported measures of actual use, while not as precise as objective measures such as number of times of login into a system by the computer, can produce adequate results. Since there is no objective measure for the number of minutes used on a mobile device for a nursing learning tool, the number of minutes used for nursing education weekly, as reported by the students, was adequate for this study.

*Mobile device self-efficacy.* Mobile device self-efficacy, in the MDA model, is the students' belief in their capabilities of using mobile devices as learning tools to enhance nursing education. According to Bandura (1986), self-efficacy is "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391). For mobile device self-efficacy, the following items were constructed for the MDA instrument.

1. I expect to become proficient in using a mobile device for nursing curriculum.
2. I would feel confident that I could use a mobile device for nursing school.
3. I am confident that I could use a mobile device to learn nursing material.
4. Mobile devices can empower me to learn nursing content.

*Past accomplishments.* Past accomplishments, in the MDA model, is the successful use in prior experiences of mobile devices as learning tools to enhance nursing education. According to Bandura (1986), past accomplishment is the enactive attainment "based on mastery experiences" (p. 399). For past accomplishments, the following items were used for the MDA instrument.

1. In the past, I have used a mobile device for learning nursing content.
2. I have never used a mobile device for nursing school. (reverse order)
3. I consider myself to be very proficient at using a mobile device for nursing education because of my past experience.
4. I have past experience using a mobile device only for other uses and not for nursing school. (reverse order)
5. My past attempts at incorporating mobile devices for nursing school have been unsuccessful. (reverse order)

*Vicarious experience.* Vicarious experience, in the MDA model, is when others, whether peers or professionals, model the use of a mobile device as a learning tool to enhance nursing education. According to Bandura (1986), vicarious experience is "seeing or visualizing other similar people perform successfully" (p. 399). For vicarious experiences, the following items were used.

1. My close nursing student friends use a mobile device for learning nursing content.
2. Many of my classmates use a mobile device for enhancing nursing content.
3. Many of my clinical instructors use a mobile device for nursing practice.
4. Many of my nursing lecturers use a mobile device during class for nursing content.
5. Many of the nurses on the clinical floor use a mobile device for nursing practice.

*Social persuasion.* Social persuasion, in the MDA model, is the process of encouragement of various support systems, university system support or medical data security support, that influence students to use mobile devices as learning tools to enhance nursing education. According to Bandura (1986), social persuasion is the process of talking "people into

believing they possess capabilities that will enable them to achieve what they seek" (p. 400). The following items were constructed for social persuasion.

1. The university encourages mobile device use for learning.
2. Campus Tech Support assists with the use of mobile devices.
3. I know there are university systems in place that make sure that data are secure when using a mobile device.
4. My clinical placements encourage the use of mobile devices for nursing practice.
5. My nursing professors encourage me to use a mobile device for learning.
6. My classmates encourage me to use a mobile device for enhancing nursing education.
7. I know the medical systems in place make sure that data are secure when using a mobile device for patient information.
8. I know how to use a mobile device for patient data to NOT violate HIPPA.
9. There are systems in place that ensure that patient data remain private and secure.

*Affective state.* Affective state, in the MDA model, refers to students' feelings about using a mobile device as a learning tool to enhance nursing education. According to Bandura (1986), affective state is the "physiological state in judging [one's] capabilities" (p. 401). The affective state in the MDA instrument consisted of the following items:

1. Using a mobile device is a good idea for nursing students.
2. I like the idea of using a mobile device for nursing school.
3. I would feel overwhelmed if I used a mobile device for learning. (reverse order)
4. Using a mobile device for nursing education would be frustrating. (reverse order)
5. Using a mobile device will distract me from nursing content. (reverse order)

# Chapter 3: Methodology

This chapter addresses how the research study was conducted. The research design, sample, data collection procedures, human subject protection, measures, and data analysis will be discussed. These sections combined will frame the methodology used for this study.

## Research Design

The study incorporated a cross-sectional design survey method. This study described the population and examined the key constructs in the MDA Model (perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishments, social persuasion, vicarious experiences, and affective state) and educational outcomes. The cross-sectional design study was chosen to describe different diverse demographic variables among the pre-licensure nursing student population in order to identify their decision to use mobile devices as learning tools to enhance nursing education. The purpose of this chosen design was to provide descriptive statistics to describe data in order to identify beliefs and perceptions about a given phenomenon at one point in time (Fraenkel & Wallen, 2003). The data were collected through nursing students' self-report.

Strengths and weaknesses exist when using a cross-sectional survey. The strength of this design is that the population can be described with meaningful data associated with the outcome variables (Fraenkel & Wallen, 2003). The data can be useful for examining the decision to use mobile devices as learning tools within a given point of time. The weakness of this design is that no causality can be inferred, and more research needs to be conducted through different designs to infer causality (Fraenkel & Wallen, 2003). Also, because the cross-sectional design is given at only one point of time the longitudinal effect is missing, and that effect would determine whether the decision to use mobile devices changes with time.

**Sample**

The population was pre-licensure nursing students attending a bachelor's of science degree nursing (BSN) program. This study used a convenience sample to describe and investigate factors that impact pre-licensure BSN nursing students' mobile device use in non-mandated settings. According to Fraenkel and Wallen (2003), a convenience sample allows for a suitable opportunity to gain easy access to a population. However, a threat to external validity is caused by using a convenience sample to make generalizations to the population. The sample was made available to the researcher through personal associations within the nursing programs. Inclusion criteria were all BSN pre-licensure nursing students enrolled in the programs. Exclusion criteria were RN students gaining their bachelor's degree in nursing.

The following factors were taken into consideration to determine the power analysis: types of statistical analysis, sample size, significance level, effect size, and reliability coefficient. The researcher evaluated the power by first determining the type of statistical analysis corresponding to the research questions. To test for psychometric properties of the MDA instrument with a factor analysis, 250 subjects is the minimum needed for a reliability coefficient of 0.80 with a confidence interval of +/- 0.05 (Streiner & Geoffey, 1995).

A priori power analysis was conducted for the research question focusing on the four moderating variables (age, gender, prior experience, and ethnicity) impacting the relationship between two constructs of the MDA model: perceived usefulness and behavioral intention, perceived ease of use and behavioral intention, and mobile device self-efficacy and behavioral intention that requires multiple regression. With a medium effect size of ($d$ = 0.15), alpha at 0.05 and beta at 0.80, the minimum number of subjects is 74. The medium effect size, along with the alpha and beta levels, was based on convention in the social sciences (Munro, 2005).

Another a priori power analysis was conducted for the ANOVA statistical test with three grouping variables of preferred operating system: Apple IOS, Google Android Platform, and Microsoft Windows; preferred size of device: small, medium, large; top features/apps used: communication/interaction, organization, reference material, or study aid apps. The dependent variable included each of the following key constructs separately: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state. The minimum sample size required is 252 (Office of Research and Development, 2015). Again, the medium effect size, along with the alpha and beta levels, was based on convention in the social sciences (Cohen, 1992). Therefore, given the various statistical tests needed for the study, with the effect size and alpha/beta levels based on convention, the minimum number of participants needed for this study is 252.

**Data Collection Procedures**

For data collection, the following procedures were used. Given the 252 participants needed for this study to decrease the probability of a Type II error, the researcher contacted two nursing program directors in two pre-licensure BSN programs. Because of the personal association, the researcher spoke or emailed the directors in multiple conversations about the purpose of the study, human subject approval process, informed consent, electronic or paper survey, and means to contact the nursing students (Appendix A). Both directors responded to the spoken or written communication to allow access to their students after specific Institutional Review Board (IRB) approval was granted depending on the institutional policy.

The surveys were distributed electronically to 883 pre-licensure nursing students at two different nursing programs. A total of 161 subjects completed the electronic survey, for a

response rate of 18%. To increase the response rate, the researcher, with additional human subject approval, went in person with a paper/pencil survey to both universities. After obtaining additional responses (166) using the in-person paper/pencil method, the total sample size was 327, with a response rate of 37%.

The following procedures were used for student contact. First, the students had their initial contact through an introductory email (Appendix B) that quickly described the study. Second, the students received a follow-up email that detailed the study, informed consent, and a link to the survey (Appendix C). The students verified that they understood the informed consent before taking the 20-minute survey, which contained 65 items consisting of multiple demographic questions about the students' background and mobile device preferences (Appendix C). The electronic survey was submitted through Google Forms.

The students had two weeks to complete the online survey. After the two weeks, one instructor, who volunteered, offered the electronic survey again to students in his class before class started. As mentioned before, to increase the response rate, the researcher, with additional IRB approval, went in person with a paper/pencil survey to both universities. One university allowed the researcher to talk to the students at the end of class. This brought about 130 additional responses. The other university allowed the researcher to approach students in a common area of campus, with 36 additional subjects responding to the survey. Students who had already filled out the electronic survey were not allowed to fill out the paper survey. The paper survey contained the same information and questions as the electronic survey. The researcher was available in the room to answer any questions. Students filled out the paper survey and returned the survey to the researcher. The paper survey data were inputted into Excel by a trained research assistant and added to the results from the electronic means from Google Forms.

## Human Subject Protection

IRB approval was granted before the start of the study through Eastern Michigan University (Appendix D). Participation in this study was voluntary. The informed consent was located at the beginning of the survey. If students did not consent to take the survey, they could exit out of the computer screen or not fill out the survey. The survey contained no personal data such as name, date of birth, or student number. All records and data remained confidential. The researcher was not the current instructor for any of these classes. The paper surveys (Appendix E) were then stored in a locked cabinet in a locked office. The data from the surveys were coded into an Excel spreadsheet and uploaded to SPSS onto a password-protected computer used only by the researcher.

No foreseen potential risks were involved in the project, and minimal risk was expected. In spite of precautions to protect confidentiality, there was a risk of losing anonymity because participants' email addresses were recorded if they wanted to enter the drawing on a separate mini-survey. However, survey responses were not associated with email addresses, since the two surveys were separate. If the subjects decided to put an identifying email on the separate mini-survey, the email addresses were confidential and deleted as soon as a winner was chosen in the drawing. The compensation was the following for the electronic survey: One student per each university who completed the electronic survey was randomly chosen for a $25 gift card or iPad mini. All emails were deleted after the winners were chosen. There was no compensation for the paper survey.

## Study Measurement

In the current study, the study measurement was developed based on the MDA model. The MDA instrument consists of 52 items, mostly based on a five-point Likert scale, which

measures the students' decision to use mobile devices as learning tools to enhance nursing education within the nine subscales (perceived usefulness, perceived ease of use, behavior intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state). The five-point Likert scale used a rating range of 1–5, one being *strongly disagree*, two being *disagree*, three being *undecided*, four being *agree*, and five being *strongly agree*. The subscale, actual use, was not a Likert scale but instead was measured by self-report of the number of minutes per week spent on the device for nursing content.

The MDA instrument was expanded from an existing 12-item computer self-efficacy scale (CSES) by Chow et al. (2013). Chow et al. used the CSES to measure nursing students' decision to use the technology of mobile imagery for clinical rotations. The CSES was previously adopted from the self-efficacy instrument by Compeau and Higgins (1995). Compeau and Higgins's instrument was used to study professionals' computer self-efficacy impact in computer use. Chow granted permission to modify the CSES (Appendix F) for use with mobile devices. Items in the current study were modified from Chow's original wording because Chow's items focused on the technology of clinical imagery instead of the technology of mobile devices. Also, the sources of self-efficacy were added as additional constructs. To ensure the most accurate content within the items, three subject-matter experts evaluated the MDA instrument to establish content validity. The MDA instrument was pilot-tested on 37 nursing students. Table 1 provides the internal consistencies of both the CSES and the pilot MDA instrument.

Table 1

*Internal Consistencies of the Constructs with the CSES and MDAS*

| Construct | CSES Alpha | MDAS Alpha |
|---|---|---|
| Perceived Usefulness | 0.92 | 0.92 |
| Perceived Ease of Use | 0.84 | 0.84 |
| Behavioral Intention to Use | 0.85 | 0.75 |
| Self-Efficacy | 0.79 | 0.85 |
| Attitude/Affective State | 0.82 | 0.75 |
| Social Persuasion | NA | 0.76 |
| Past Accomplishments | NA | 0.76 |
| Vicarious Experience | NA | 0.71 |

**Demographic and mobile device data.** Demographic data were collected to put students into groups based on certain characteristics. Participants filled in the blanks regarding their age and college credits completed. Participants had options to choose their gender: male or female; year in nursing school: sophomore, junior, or senior; and ethnicity: African American/Black, Caucasian, Hispanic, Asian, Middle Eastern, or Native American. In addition to ethnicity, the subjects could choose *yes* or *no* to the following diverse characteristics: a parent with a baccalaureate degree, Pell grant eligibility, English as a second language, recipient of welfare, and residence in public housing. Using a variety of diversity characteristics, one may see the impact of these variables on MDA.

More specific questions regarding mobile device use were asked. Participants filled in the blanks regarding the number of years of experience with mobile devices and the number of

mobile devices owned. They chose their preferred operating system from the following—Apple IOS, Google Android, or Windows—and their preferred size of device—small (regular smartphone), medium (iPad mini), or large (regular tablet). They selected how often they used mobile devices for nursing and non-nursing purposes from the following choices: never, seldom/once per month, once per week, once per day, 2–5 times per day, and 6+ times per day. They selected the feature of the device that was most helpful for both nursing and non-nursing purposes: communication, organization, reference, entertainment, study aid, or other. They filled in the blanks regarding how many minutes they spent per week on their device total, then Monday–Friday, then Saturday–Sunday, and, on each of the above functions, for nursing and non-nursing purposes. These specific questions relating to mobile device use may help describe the impact that this use has with other data collected.

**Educational outcomes.** The survey responses contained measures to determine the educational outcomes of using mobile devices as learning tools. The educational outcome measures are the most current Assessment Technology Institute (ATI) score and GPA, again by the nursing students' self-report. ATI testing is a series of standardized tests that most nursing schools use to measure various nursing classes taken by students to ensure adequate preparation for the National Council Licensure Examination (NCLEX). Subject areas include fundamentals, med-surg, obstetrics, pediatrics, mental health, community, leadership, and RN comprehensive predictor. The higher the ATI score, the greater mastery of the material. The GPA is a standardized instrument for the weighing of marks earned in a given amount of time, usually based on a 4.0 instrument. The higher the GPA, the higher the grades earned, which translates into higher educational outcomes achieved. For this study, the last proctored ATI percentage score and the cumulative college GPA were used.

**Data Analysis**

The data analysis entailed using SPSS versions 23 and 24 IBM software for most of the research questions and AMOS version 16 for the structural equation modeling. The level of significance for all of the data analysis was predetermined to be $p \leq 0.05$. Also, the a priori power analyses were already calculated before collecting the subjects. The sample was described using descriptive statistics. Each research question had statistical analyses appropriate for the type of research question.

The following data analysis was performed depending on the type of research question. For the research question "Is the MDA instrument a reliable and valid instrument?" the researcher performed psychometric testing (Cronbach's alpha, factor analysis) on the MDA instrument. First, for reliability, the Cronbach's alpha was calculated to measure the internal consistency of each subscale: perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state. The mean, standard deviation, mean inter-item correlations, and item-to-total correlations were calculated and examined to evaluate individual item characteristics. According to Munro (2005), items need to have inter-item correlation values of 0.15 to 0.50 that are closely around the mean inter-item correlation value to support unidimensionality of the scale. Also, a level of $0.30 < r < 0.70$ needs to be exhibited among items. Items under 0.30 do not belong in the scale; items above 0.70 are too redundant and not needed. For items to be retained for the MDA instrument, each item should exhibit at least a corrected item-total correlation of at least a 0.30 and mean inter-item correlation between 0.15 and 0.50, and the Cronbach alpha should have no increase if the item was not retained. The Cronbach's alpha for the entire subscale needs to be at least 0.70 or higher for a developing scale (Fraenkel & Wallen, 2003).

For validity, factor analyses were conducted. It is important to investigate whether all items defined by a construct are tested with multiple statistical methods to establish validity (Pett et al., 2013). Conducting not only a principal component analysis (PCA) but also a confirmatory factor analysis (CFA) allows for further statistical support to see how well the chosen theoretical model described by the PCA fits within the CFA structure for validity. Validity is important to establish with a newly modified instrument. First, PCA tested the MDA instrument with a varimax orthogonal rotation. According to Munro (2005), 0.30 totaled factor loadings were used to retain an item for future analysis. Also, if an item loaded onto more than one factor, the decision to place the item onto a given factor depended mostly on the magnitude of leading with a difference greater than 0.10. Second, CFA was run to confirm the results of the PCA. This crucial step allows for further construct validity of the instrument and validation of theory. First, the factor loadings of >.50 were deemed acceptable to be retained in the model. Then, model fit was based on the chi-squared divided by its degrees of freedom with 2/1–3/1 in the acceptable range; comparative fit index (CFI) with acceptable values closer to one (0 = poor fit; > .95 good fit); the Tucker-Lewis Index (TFI) with acceptable values closer to one (> .95 good fit) although highly correlated with the CFI; and the root mean square error of approximation (RMSEA) with acceptable values closer to zero (< 0.05 is close fit; > 0.08 is mediocre fit; > 0.10 is poor fit; University of Colorado at Denver and Health Science Center [UCDHSC] for Nursing Research, 2006). Again, these combined tests allowed the researcher to determine the validity of the newly modified MDA instrument.

For the research question, “Is there a difference in the constructs of the MDA model between diverse and non-diverse nursing students?” the researcher performed a t-test comparing diverse and non-diverse nursing students on the nine constructs of the MDA model. The

independent variables were diverse and non-diverse nursing students. The dependent variable was each of the following key constructs separately: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state.

For the research question, “Are there moderator variables (age, gender, prior experience, and ethnicity) that could be included in the MDA model?” the researcher performed a multiple linear regression analysis. The researcher determined whether age, gender, prior experience, and ethnicity, and their interaction terms have a moderating effect on the relationship of perceived usefulness and behavioral intention, perceived ease of use and behavioral intention, and mobile device self-efficacy and behavioral intention. The researcher performed a multiple regression analysis in each of the relationships with the proposed moderator variables. To measure the significance of the model and predictors with the outcome variable of behavioral intention, age, gender, prior experience, and ethnicity, along with their interaction terms, were the moderating variables along with predictor variables of perceived usefulness, perceived ease of use, and mobile device self-efficacy.

For the research question, “Is there a difference in the constructs of the MDA model between the preferred operating systems (Apple IOS, Google Android Platform, and Windows)?” the researcher performed an ANOVA. The independent variable was the preferred operating system (Apple IOS, Google Android, and Microsoft Windows), and the dependent variable was each of the following key constructs separately: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state.

For the research question, “Is there a difference in the constructs of the MDA model between the size of mobile devices?” the researcher performed ANOVA with the preferred size of mobile devices. The independent variables were small (such as basic smartphone size), midsize (such as an iPad mini), or large (tablet), and the dependent variable was each of the following key constructs separately: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state. The researcher performed ANOVA with the most helpful category of function/apps used. The independent variables were communication/interaction, organization, reference material, or study aid apps, and the dependent variable was each of the following key constructs separately: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state.

For the research question, “Is there a relationship between the constructs of the MDA model with diversity and ATI test scores?” the researcher performed a multiple linear regression analysis. Perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state were the predictor variables, along with diversity/ethnicity, and the outcome variable was the ATI test score. Each of the diversity variables—FGCS, Pell grant eligibility, ESL student, recipient of welfare, and residence in public housing—was considered one point. The higher the diversity score, the greater the diversity the student exhibited. Also, ethnicity, either Caucasian or non-Caucasian, was separated from the other diversity variables due to the profound effect that ethnicity has in society (Freire, 2000).

For the research question, “Is there a relationship between the constructs of the MDA model with diversity and GPA?” the researcher performed a multiple linear regression analysis. Perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state, along with diversity/ethnicity, were predictor variables, and the outcome variable was the GPA. Each of the diversity variables—FGCS, Pell grant eligibility, ESL student, recipient of welfare, and residence in public housing—was worth one point. The higher the diversity score, the greater the diversity the student exhibited. Again, ethnicity, either Caucasian or non-Caucasian, was entered as a separate variable from the other diversity variables.

# Chapter 4: Results

This paper described the study sample and examined the key constructs in the MDA model (perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishments, social persuasion, vicarious experiences, and affective state) with other factors. Results of the study are presented as follows. First, the sample results are described. Second, the results of each research question are described.

## Results of the Sample

In the current study, 883 pre-licensure nursing students in two different programs in two different states in the Midwest were contacted to take the electronic survey. There were 161 participants who completed the survey. To increase the response rate, a paper/pencil survey was offered again to the participants at both universities who had not taken the electronic survey. This increased the sample size by 166 additional participants. In regard to the entire sample, one university provided 210 participants out of 336 contacts, for a response rate of 62%. This university is a public university located in a suburban setting with a large commuter population. The other university provided 117 participants out of 530 contacts, for a response rate of 21%. This university is private and located in a rural setting with a large dormitory population. Therefore, the total sample was 327 participants out of 883 contacts, for a response rate of 37%.

**Participant demographic characteristics.** First, general characteristics are shared. As shown in Table 2, the majority of the participants were female (82.6%), and seniors (49.8%). The average age was 24.8 with a range of 18–58 years old (Table 3). The average number of college credits completed was 101.1 (*SD* = 42.4) with a range of 13–232 (Table 3).

Table 2

*Participant Demographic Characteristics*

| Characteristic | *n*(%) |
|---|---|
| Gender | |
| Male | 55 (16.8%) |
| Female | 270 (82.6%) |
| Year in nursing school | |
| Sophomore | 62 (19%) |
| Junior | 99 (30.3%) |
| Senior | 163 (49.8%) |
| Ethnicity/Race | |
| Caucasian | 271 (82.9%) |
| African-American/Black | 17 (5.2%) |
| Hispanic | 8 (2.4%) |
| Asian | 22 (6.7%) |
| Middle Eastern | 5 (1.5%) |
| Native American | 3 (0.9%) |
| First Generation College Student | |
| Yes | 152 (46.5%) |
| No | 174 (53.2%) |
| Eligible for Pell grant | |
| Yes | 119 (36.4%) |
| No | 197 (60.2%) |
| English as second language | |
| Yes (survey is no) | 18 (5.5%) |
| No (survey is yes) | 307 (93.9%) |
| Recipient of welfare | |
| Yes | 40 (12.2%) |
| No | 284 (86.9%) |
| Lived in public housing | |
| Yes | 28 (8.6%) |
| No | 296 (90.5%) |
| Diverse students Summary | |
| Ethnicity Minority/Non-Caucasian | 55 (16.8%) |
| Caucasian | 271 (82.8%) |

Table 3

*Participant Demographic Characteristics with Distributions*

| Measure | M(SD) | Range |
|---|---|---|
| Age in years | 24.8(6.5) | 18-58 |
| College credits completed | 101.1 (42.4) | 13-232 |
| ATI test score | 74.0 (9.3) | 30-99 |
| GPA | 3.61 (0.32) | 1.78-4.0 |

Second, for the diversity student characteristics (Table 2), the majority were Caucasian (82.9%), followed by Asian (6.7%), African American/Black (5.2%), Hispanic (2.4%), Middle Eastern (1.5%), and Native American (0.9%). Non-Caucasians made up 16.7% of the participants. Slightly fewer than half of the participants (46.5%) considered themselves a FGCS, and 53.2% were non-FGCS. More than one third of the participants (36.4%) considered themselves eligible for the Pell grant compared to almost two thirds not eligible (60.2%). The other diversity statistics were considerably lower, with 5.5% considering themselves ESL, 12.2% who were or had been recipients of welfare, and 8.6% who lived or had lived in public housing.

**Mobile device characteristics.** The following are mobile device characteristics in Table 4. The majority of the participants were mobile device owners (98.4%). The average number of mobile devices owned was 2.1, with a range of 0–11 (Table 5). The average number of years of experience with mobile devices was 9.6, with a range of 0–25 (Table 5). In Table 4, the preferred use of the mobile device for nursing education was for communication, such as email/text (44%), followed by reference, such as eBooks/Google (20.5%); organization, such as calendar/to do lists (14.4%); then study aid, such as flashcards (13.1%). The preferred operating system was Apple IOS at 62.1%, Google Android Platform was chosen by 22.3% of participants, and Windows by 13.8%. Almost half of the participants stated that the preferred size of device was small (48%). Of the total, 29.1% preferred a large device and 21.4% preferred a midsize device, such as an

iPad Mini. The sample was using their mobile devices for more non-nursing education purposes than nursing education purposes. For non-nursing education purposes, over three fourths (76.1%) used their mobile device 6 or more times a day, followed by 16.5% who used their device 2–5 times per day. In contrast, for nursing education purposes, the majority, 41.9%, used their mobile device 2–5 times per day, followed by 19.6%, who used their device once per day. For nursing education, the participants chose the best feature of mobile devices as the following: 44% for communication, 20.5% for reference, 14.4% for organization, and 13.1% for study apps. The feature that was used the most in minutes per week was reference ($M$ = 82.05, $SD$ = 185.30), followed by communication ($M$ = 67.84, $SD$ = 123.77), other ($M$ = 58.31, $SD$ = 201.85), study aid apps ($M$ = 45.84, $SD$ = 89.81), and organization ($M$ = 22.10, $SD$ = 40.2).

Table 4

*Characteristics of Mobile Devices Among Study Participants*

| Characteristics | *n*(%) |
|---|---|
| Own a mobile device | |
| Yes | 319 (98.4%) |
| No | 5 (0.02%) |
| Preferred feature of mobile device for nursing education | |
| Communication | 114 (44%) |
| Organization | 47 (14.4%) |
| Reference | 67 (20.5%) |
| Study aid | 43 (13.1%) |
| Preferred operating system | |
| Apple IOS | 203 (62.1%) |
| Google Android Platform | 73 (22.3%) |
| Windows | 45 (13.8%) |
| Preferred size | |
| Small | 157 (48.0%) |
| Mid-size | 70 (21.4%) |
| Large | 95 (29.1%) |
| How often use mobile device-ONLY nursing | |
| Never | 6 (1.8%) |
| Seldom/Once per month | 22 (6.7%) |
| Once per week | 34 (10.4%) |
| Once per day | 64 (19.6%) |
| 2-5 times per day | 137 (41.9%) |
| 6+ times per day | 61 (18.7%) |
| How often use mobile device-NON-nursing | |
| Never | 1 (0.3%) |
| Seldom/Once per month | 4 (1.2%) |
| Once per week | 4 (1.2%) |
| Once per day | 12 (3.7%) |
| 2-5 times per day | 54 (16.5%) |
| 6+ times per day | 249 (76.1%) |

Table 5

*Characteristics of Mobile Devices Among Study Participants with Distributions*

| Characteristic | Total M(SD) | Range |
|---|---|---|
| Years of Experience with mobile devices | 9.6 (3.9) | 0-25 |
| Number of mobile devices owned | 2.1 (1.2) | 0-11 |
| Minutes per week on mobile device for nursing content | 218.0 (352.9) | 0-2400 |
| Mon--Fri | 170.7 (275.4) | 0-2000 |
| Sat--Sun | 78.5 (129.0) | 0-800 |
| Use of minutes for nursing content | | |
| Communication | 67.84 (123.77) | 0-1200 |
| Organization | 22.10 (40.2) | 0-420 |
| Reference | 82.05 (185.30) | 0-1800 |
| Study aid | 45.84 (89.81) | 0-720 |
| Other | 58.307 (201.85) | 0-1380 |

**Educational outcomes.** The educational outcomes of the participants are discussed (Table 2) in terms of ATI test scores (based on percentage, with 0% being the worst score and 100% being a perfect score) and cumulative GPA (based on a 0–4.0 scale, from 0 = failing to 4.0 = all A's; Table 3). The average, most recent ATI test score was 74.0 (*SD* = 9.3, range 30–99); GPA was 3.61 (*SD* = 0.32, range 1.78–4.00).

**Descriptive statistics of the study measures.** The subscales were examined for their appropriateness of use for the next statistical tests. The mean, range, skewness, and kurtosis are displayed in Table 6. The closer the skewness or kurtosis value is to zero, the more normally distributed the data are, with 1 to -1 being an acceptable range for normality (Fraenkel & Wallen,

2003). Perceived usefulness showed non-normal distribution with a skewness of -1.24, SE = 0.14 and Kurtosis 2.68, SE = 0.27. Actual use showed non-normal distribution with a skewness of 3.26, SE = 0.14 and kurtosis = 11.96, SE=0.28. However, with larger sample sizes, it is acceptable to accept normality of data if data outliers are removed (Fraenkel & Wallen, 2003; Johnson, 2004). Each construct was assessed for outliers by box-plot inspection with no significant outliers in each construct, except actual use. For actual use, an outlier was found. One participant had indicated a value of 2400 minutes of actual use per week, which was a significant outlier, causing that individual case to be removed. Once that participant's responses for actual use were removed, tests for normality were rerun, and the correct values for actual use improved with the skewness = 3.10, SE = 0.14 and kurtosis = 10.40, SE = 0.28. Because all these values of the subscales were close to or within the range and all study constructs had no outliers by visual inspection, subsequent testing was conducted because the assumption of normally distributed data had been met.

In addition, once the test for normality was conducted again after the outlier for actual use was removed, the values that measured actual use, total minutes per week, minutes Monday–Friday and Saturday–Sunday, and minutes per each mobile device function were compared to check for consistency among these values. The total minutes of actual use per week were compared to the total value the participants put for the minutes used per Monday–Friday and Saturday–Sunday and also to the total value for minutes used per each function of the device. Because there were only slight differences in the described values, the values were deemed consistent.

Table 6

*Constructs of MDA Scale with Means, Standard Deviations, and Range*

| Constructs | *M(SD)* | Range | Skewness (SE) | Kurtosis (SE) |
|---|---|---|---|---|
| Perceived Usefulness | 4.21 (0.70) | 1--5 | -1.24(0.14) | 2.68(0.27) |
| Perceived Ease of Use | 3.72 (0.74) | 1-- 5 | -0.43 (0.14) | 0.34 (0.27) |
| Behavioral Intention | 3.74 (0.73) | 1.40--5 | -0.68 (0.14) | 0.55 (0.27) |
| Mobile Device Self Efficacy | 3.99 (0.77) | 1--5 | -0.86(0.14) | 1.48 (0.27) |
| Vicarious Experiences | 3.5 (0.80) | 1.40--5 | -0.01 (0.14) | -0.28 (0.27) |
| Social Persuasion | 3.22 (0.68) | 1.44-5 | 0.29 (0.14) | 0.27 (0.27) |
| Past Accomplishments | 3.90 (0.79) | 1.5--5 | -0.57 (0.14)` | -0.11 (0.27) |
| Affective State | 3.79 (0.92) | 1--5 | -0.63 (0.13) | -0.19 (0.27) |
| Actual Use | 211.42 (331.21) | 0--2000 | 3.10 (0.14) | 10.40 (0.28) |

**Results by Each Research Question**

**Research Question 1.** Research Question 1 was "Is the MDA scale a reliable and valid instrument?" Psychometric testing (Cronbach's alpha, factor analyses) was performed on the MDA scale. First, Cronbach's alpha coefficients of the scale were conducted to measure the internal consistency of the subscales to ensure the items test the latent variable. Second, PCA was conducted to examine the internal structure of the subscales by accounting for the variance in the data. Next, based on the factor structures results from the PCA, CFA was conducted to test and verify the model fit of hypothesized models on perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishments, social persuasion, vicarious experiences, and affective state. By examining these measures, reliability and validity of the MDA instrument were tested.

In terms of content validity, three experts, one in nursing education and two in mobile device research, examined the items for content validity. With their feedback, some items were changed or added. For example, items relating to job relevance, cost, Internet access, and portability, that impacted students' use of mobile devices, were added. Words such as "very convenient" instead of "convenient" and "easily gain" instead of "gain" were added for further clarity. Then eight nursing students examined the items and circled unclear or confusing wording. The MDA items were modified based on the students' feedback. For example, the MDA instructions were refined to include the extra sentence "Laptop computers are not considered a mobile device." Wording such as "IT" was changed to "Campus Tech Support," and "instructors" was clarified to "lecturers" with the item that referred to classroom instruction. The final MDA instrument was sent again to the experts for their approval. The MDA instrument was pilot-tested on 37 BSN students with Cronbach's alpha of 0.71–0.92 for the subscales. A factor analysis was not performed due to the small sample size.

***Reliability.*** To test reliability for perceived usefulness, perceived ease of use, and behavioral intention, Cronbach's alphas and item analysis with the item-total correlations were calculated. The results are shown in Table 7. The results of this process found that the Cronbach's alphas on the study measures ranged from .73–.91.

Table 7

*Item Analysis and Internal Consistency of Perceived Usefulness, Perceived Ease of Use, and Behavioral Intention*

| Item | Mean | SD | Item-Total Correlation | If Item Deleted |
|---|---|---|---|---|
| **Perceived Usefulness (PU)** Alpha = 0.90; Alpha = 0.91 after item (5) deletion. | | | | |
| PU(1) A mobile device can improve my learning efficiency for nursing school. | 4.19 | 0.88 | 0.86 | 0.87 |
| PU(2) A mobile device can enhance my knowledge for nursing school. | 4.26 | 0.80 | 0.83 | 0.87 |
| PU(3) A mobile device increases my learning output for nursing school. | 4.06 | 0.97 | 0.85 | 0.86 |
| PU(4) I find a mobile device useful for my learning in nursing school. | 4.19 | 0.93 | 0.82 | 0.87 |
| PU(5) I find it hard to concentrate on learning nursing content when using a mobile device. | 3.24 | 1.17 | 0.38 | 0.91 |
| PU(6) Using a mobile device can help me learn with others in the nursing program. | 4.15 | 0.84 | 0.56 | 0.89 |
| PU(7) A mobile device is very convenient to use for nursing content. | 4.28 | 0.85 | 0.77 | 0.87 |
| PU(8) I can use a mobile device anytime/anywhere to learn nursing content. | 4.29 | 0.91 | 0.49 | 0.90 |
| PU(9) It is easier to carry an electronic device than to carry the hard copy books with me wherever I go to study nursing material. | 4.27 | 0.95 | 0.49 | 0.90 |
| **Perceived Ease of Use (PEOU)** Alpha = 0.71; Alpha = 0.73 after item (3),(4),(7) deletion | | | | |
| PEOU(1) It will be easy to operate a mobile device for getting information I need for lab, clinicals, and lectures in nursing school. | 4.11 | 0.92 | 0.62 | 0.64 |
| PEOU(2) I find that a mobile device could be easy to use for lab, clinicals, and lectures in nursing school. | 4.03 | 0.98 | 0.59 | 0.64 |
| PEOU(3) It will be hard to navigate nursing content on a mobile device. | 3.46 | 1.18 | 0.43 | 0.67 |
| PEOU(4) I will not find what I am looking for when using a mobile device for learning in nursing school. | 3.69 | 1.01 | 0.29 | 0.70 |
| PEOU(5) It is not difficult to use a mobile device during clinicals with my patient assignment. | 3.21 | 1.22 | 0.40 | 0.68 |
| PEOU(6) I could easily gain access to the internet on a mobile device for learning at most places I go. | 4.19 | 0.78 | 0.42 | 0.68 |
| PEOU(7) Campus Tech Support will help if problems arise using a mobile device. | 3.31 | 1.05 | 0.15 | 0.73 |
| PEOU(8) It is easier to use an electronic version of study material than a hard copy version of the same material because of the convenience of having the material on hand. | 3.10 | 1.30 | 0.41 | 0.68 |
| **Behavioral Intention (BI)** Alpha = 0.67; Alpha = 0.80 after item (3),(5),(6), (7) deletion. | | | | |
| BI(1) Given that I had access to a mobile device at clinicals, I predict that I would use it. | 3.86 | 1.05 | 0.52 | 0.59 |
| BI(2) I intend to use a mobile device as often as needed for my nursing education. | 4.04 | 0.92 | 0.63 | 0.57 |
| BI(3) A mobile device costs too much for me to use one for nursing education. | 3.65 | 1.16 | 0.29 | 0.65 |

| | | | | |
|---|---|---|---|---|
| BI(4) A mobile device is worth the cost of the device so that I could use it for nursing education. | 3.77 | 1.07 | 0.59 | 0.57 |
| BI(5) I predict that I will not use a mobile device in the future for learning nursing content. | 3.70 | 1.26 | 0.33 | 0.65 |
| BI(6) I would become too dependent (over reliant) on a mobile device if I used it with the nursing curriculum. | 3.10 | 1.25 | 0.16 | 0.70 |
| BI(7) I predict that a mobile device will be mandatory as part of a job requirement when I become a nurse. | 3.36 | 1.07 | 0.24 | 0.67 |

For perceived usefulness, one item (PU[5], "I find it hard to concentrate on learning nursing content when using a mobile device") had the corrected item total of 0.38, and, if deleted, would increase the Cronbach's alpha from 0.90 to 0.91. After careful consideration on the wording of that item, which was a reverse-order item and may have confused the students, the item was removed.

For perceived ease of use, three items were removed. Two items (PEOU[4], "I will not find what I am looking for when using a mobile device for learning in nursing school" and PEOU[7], "Campus Tech Support will help if problems arise using a mobile device") had low corrected item totals of 0.29 and 0.15, respectively. The first item was a reverse-order item and was removed because the wording may have confused the students. The second item had more to do with social persuasion and therefore was deleted. Another item, PEOU(3), "It will be hard to navigate nursing content on a mobile device," was a reverse-order item that was deleted, as students may have been confused about the wording of that question. The final Cronbach's alpha of the perceived ease of use subscale was 0.73.

For behavioral intention, the following three items had total item correlations less than 0.30: BI(3), "A mobile device costs too much for me to use one for nursing education" (0.29); BI(6), "I would become too dependent (over reliant) on a mobile device if I used it with the nursing curriculum" (0.16); and BI(7), "I predict that a mobile device will be mandatory as part of a job requirement when I become a nurse" (0.24). If deleted, the Cronbach's alpha would have

increased to 0.65, 0.70, and 0.67 respectively. However, more importantly, the wording on all items was examined more closely and compared to the conceptual definition. The following items were deleted due to the item not matching the definition, or the reverse order may have been confusing to the students: BI(3), BI(5), BI(6), BI(7). After removing the four items, the Cronbach's alpha was 0.80 instead of 0.67.

In order to examine the reliability for self-efficacy, Cronbach's alphas and item analysis with the item-total correlations were calculated among five subscales that included mobile device self-efficacy (MDSE) and four subscales that measured the sources for mobile device self-efficacy (i.e., past accomplishments, vicarious experiences, social persuasion, and affective state). Table 8 displays the results of the item analysis with the item-total correlations and Cronbach's alpha if the item was deleted. Cronbach's alphas on the self-efficacy study measures ranged from .74–.89. For the subscale of mobile device self-efficacy, all of the items had greater than 0.30 item total correlations, and the Cronbach's alpha was 0.88.

For past accomplishments, all of the items had greater than 0.30 item total correlations, except for one item, PA(2), "I have never used a mobile device for nursing school," with the value being 0.11. Because of the low value and the reserve order, this item was removed, and the Cronbach's alpha was raised from 0.60 to 0.74. For vicarious experiences, all of the items had greater than 0.30 item total correlations, and the Cronbach's alpha was 0.80. For social persuasion, all of the items had greater than 0.30 item total correlations, and the Cronbach's alpha was 0.83. For affective state, all of the items had greater than 0.30 item total correlations, and the Cronbach's alpha was 0.89.

Table 8

*Item Analysis and Internal Consistency of Mobile Device Self-Efficacy and the Sources of Self-Efficacy*

| Item | Mean | SD | Item-Total Correlation | If Item Deleted |
|---|---|---|---|---|
| **Mobile Device Self Efficacy (MDSE)** Alpha= 0.88 | | | | |
| MDSE(1) I expect to become proficient in using a mobile device for nursing curriculum. | 3.75 | 1.00 | 0.69 | 0.88 |
| MDSE(2) I would feel confident that I can use a mobile device for nursing school. | 4.11 | 0.84 | 0.78 | 0.84 |
| MDSE(3) I am confident that I could use a mobile device to learn nursing material. | 4.12 | 0.82 | 0.80 | 0.83 |
| MDSE (4) Mobile devices can empower me to learn nursing content. | 3.97 | 0.89 | 0.74 | 0.85 |
| **Past Accomplishments (PA)** Alpha= 0.60; Alpha =0.74 after item (2) deletion. | | | | |
| Pa(1) In the past, I have used a mobile device for learning nursing content. | 4.15 | 0.92 | 0.54 | 0.47 |
| Pa(2) I have never used a mobile device for nursing school. | 3.18 | 1.70 | 0.11 | 0.74 |
| Pa(3) I consider myself to be very proficient at using a mobile device for nursing education because of my past experience. | 3.86 | 0.96 | 0.42 | 0.52 |
| Pa(4) I only have past experience using a mobile device for other uses and not for nursing school. | 3.74 | 1.24 | 0.48 | 0.47 |
| Pa(5) My past attempts of incorporating mobile devices for nursing school have been unsuccessful. | 3.84 | 1.08 | 0.44 | 0.50 |
| **Vicarious Experiences (VE)** Alpha= 0.80 | | | | |
| Ve(1) My close nursing student friends use a mobile device for learning nursing content. | 4.00 | 0.87 | 0.56 | 0.78 |
| Ve(2) Many of my classmates use a mobile device for enhancing nursing content. | 4.03 | 0.84 | 0.56 | 0.78 |
| Ve(3) Many of my clinical instructors use a mobile device for nursing practice. | 3.28 | 1.13 | 0.65 | 0.75 |
| Ve(4) Many of my nursing lecturers use a mobile device during class for nursing content. | 3.09 | 1.22 | 0.59 | 0.77 |
| Ve(5) Many of the nurses on the clinical floor use a mobile device for nursing practice. | 3.12 | 1.20 | 0.63 | 0.75 |
| **Social Persuasion (SP)** Alpha= 0.83 | | | | |
| Sp(1) The university encourages mobile device use for learning. | 2.96 | 1.06 | 0.58 | 0.81 |
| Sp(2) Campus Tech Support assists with the use mobile devices. | 3.16 | 1.04 | 0.46 | 0.82 |
| Sp(3) I know there are university systems in place that make sure that data is secure when using a mobile device. | 3.41 | 1.01 | 0.54 | 0.81 |
| Sp(4) My clinical placements encourage the use of mobile devices for nursing practice. | 2.26 | 1.12 | 0.55 | 0.81 |
| Sp(5) My nursing professors encourage me to use a mobile device for learning. | 2.78 | 1.16 | 0.62 | 0.80 |
| Sp(6) My classmates encourage me to use a mobile device for enhancing nursing education. | 3.51 | 1.07 | 0.50 | 0.81 |
| Sp(7) I know the medical systems in place make sure that data is secure when using a mobile device for patient information. | 3.42 | 0.97 | 0.58 | 0.81 |
| Sp(8) I know how to use a mobile device for patient data to NOT violate HIPPA. | 3.71 | 1.09 | 0.42 | 0.82 |
| Sp(9) There are systems in place that ensure that patient data remains private and secure. | 3.78 | 0.89 | 0.58 | 0.81 |
| **Affective State (AS)** Alpha= 0.89 | | | | |
| As(1) Using a mobile device is a good idea for nursing students. | 4.01 | 0.93 | 0.67 | 0.88 |
| As(2) I like the idea of using a mobile device for nursing school. | 3.96 | 1.02 | 0.74 | 0.86 |
| As(3) I would feel overwhelmed if I used a mobile device for learning. | 3.82 | 1.09 | 0.71 | 0.87 |
| As(4) Using a mobile device for nursing education would be frustrating. | 3.72 | 1.20 | 0.84 | 0.84 |
| As(5) Using a mobile device will distract me from nursing content. | 3.46 | 1.24 | 0.71 | 0.87 |

Compared to a previous instrument, CSES, from which the MDA instrument was modified, and also compared to the pilot study of the MDA instrument, the current study had

similar Cronbach's alpha values in all subscales, except the subscales of perceived ease of use, behavioral intention, and affective state (Table 9). The current study had lower but acceptable Cronbach's alpha coefficients than the CSES for perceived ease of use (0.73) and behavioral intention (0.80). These findings could be due to the additional items added to each construct based on theory and literature reviews. The goal was to have at least four items in each construct. This may have decreased the internal consistency because the added items may not have been related as proposed. However, the current study had higher Cronbach's alpha coefficients for affective state (0.89) and self-efficacy (0.88) than the CSES, which is a strength of the MDA instrument.

Table 9

*Cronbach's Alpha of the Constructs with the CSES and MDA Instrument*

| Scale Items | CSES Number of items, Cronbach's Alpha | MDA Pilot Study Number of items, Cronbach's Alpha | MDA Current Study Number of items, Cronbach's Alpha |
|---|---|---|---|
| Entire Instrument | 12 items, NA | 52 items, 0.96 | 43 items, 0.95 |
| Perceived Usefulness | 4 items, 0.92 | 9 items, 0.92 | 8 items, 0.91 |
| Perceived Ease of Use | 2 items, 0.84 | 8 items, 0.84 | 5 items, 0.73 |
| Behavioral Intention | 2 items, 0.85 | 7 items, 0.75 | 3 items, 0.80 |
| Self-Efficacy | 2 items, 0.79 | 4 items, 0.85 | 4 items, 0.88 |
| Past Accomplishment | NA | 5 items, 0.76 | 4 items, 0.74 |
| Social Persuasion | NA | 9 items, 0.76 | 9 items, 0.83 |
| Vicarious Experience | NA | 5 items, 0.71 | 5 items, 0.80 |
| Affective State | 2 items, 0.82 | 5 items, 0.75 | 5 items, 0.89 |

The next step to test the psychometric properties of the MDA instrument was to investigate validity. The following tests were performed. The PCA was conducted first, followed by the CFA.

***Principal component analysis.*** Using a varimax algorithm, a PCA was conducted on the 43 items of the MDA instrument to examine the factor structure and associations among items. To verify sampling adequacy, the Kaiser-Meyer-Olkin (KMO) was 0.932. Kaiser (1960) stated that anything above 0.8 has adequate sampling. According to the Barlett's test of sphericity, the data were $p < 0.05$, which indicated that the data were suitable for a PCA (Kaiser, 1974). For the factor analysis, assumptions of normality and linear relationships among variables were met, and a PCA was found to be an appropriate test.

In phase one, the results of the PCA on the 43 items MDA yielded ten factors with eigenvalues greater than one. However, the ten-factor solution did not produce interpretable factors. Even after examining the scree plot analysis for this solution, interpretable factors did not exist. Therefore, the researcher decided that the PCA was not feasible on the entire 43-item MDA instrument (Kaiser, 1974).

In the next phase, the PCA was conducted on the subscales, which yielded more interpretable results. Each study measure of the MDA instrument was loaded into the PCA to confirm that there was only one factor extracted using the varimax algorithm. If only one factor was extracted, then the results were positive in that the construct covered the content specific to one construct, as opposed to many constructs (Froman, 2001). Perceived usefulness (8 items), perceived ease of use (5 items), behavioral intention (3 items), mobile device self-efficacy (4 items), past accomplishments (4 items), and affective state (5 items) were loaded onto only one factor (Table 10). Because of one factor loading, each of the solutions could not be rotated, which confirmed that the content contained only one construct.

Table 10

*MDA Subscales with Principal Components Varimax Factor Loadings*

| | Item | Factor Loading |
|---|---|---|
| Perceived Usefulness = One factor | | |
| Eigenvalue = 5.1 | PU(1) A mobile device can improve my learning efficiency for nursing school. | .92 |
| % of variance explained=63.72 | PU(2) A mobile device can enhance my knowledge for nursing school. | .90 |
| | PU(3) A mobile device increases my learning output for nursing school. | .91 |
| | PU(4) I find a mobile device useful for my learning in nursing school. | .88 |
| | PU(6) Using a mobile device can help me learn with others in the nursing program. | .68 |
| | PU(7) A mobile device is very convenient to use for nursing content. | .85 |
| | PU(8) I can use a mobile device anytime/anywhere to learn nursing content. | .60 |
| | PU(9) It is easier to carry an electronic device than to carry the hard copy books with me wherever I go to study nursing material. | .57 |
| Perceived ease of Use = One factor | | |
| Eigenvalue = 2.53 | PEOU(1) It will be easy to operate a mobile device for getting information I need for lab, clinicals, and lectures in nursing school. | .85 |
| % of variance explained = 50.58 | PEOU(2) I find that a mobile device could be easy to use for lab, clinicals, and lectures in nursing school. | .84 |
| | PEOU(5) It is not difficult to use a mobile device during clinicals with my patient assignment. | .64 |
| | PEOU(6) I could easily gain access to the internet on a mobile device for learning at most places I go. | .57 |
| | PEOU(8) It is easier to use an electronic version of study material than a hard copy version of the same material because of the convenience of having the material on hand. | .61 |
| Behavioral Intention = One factor | | |
| Eigenvalue = 2.46 | BI(1) Given that I had access to a mobile device at clinicals, I predict that I would use it. | .80 |
| % of variance explained = 49.15 | BI(2) I intend to use a mobile device as often as needed for my nursing education. | .85 |
| | BI(4) A mobile device is worth the cost of the device so that I could use it for nursing education. | .81 |
| Mobile Device Self Efficacy = One factor | MDSE(1) I expect to become proficient in using a mobile device for nursing curriculum. | .82 |
| Eigenvalue = 3.01 | | |
| % of variance explained=75.20 | MDSE(2) I would feel confident that I can use a mobile device for nursing school. | .88 |
| | MDSE(3) I am confident that I could use a mobile device to learn nursing material. | .90 |
| | MDSE (4) Mobile devices can empower me to learn nursing content. | .86 |
| Past Accomplishments = One factor | | |
| Eigenvalue = 2.27 | Pa(1) In the past, I have used a mobile device for learning nursing content. | .79 |
| % of variance explained = 56.80 | Pa(3) I consider myself to be very proficient at using a mobile device for nursing education because of my past experience. | .76 |
| | Pa(4) I only have past experience using a mobile device for other uses and not for nursing school. | .72 |
| | Pa(5) My past attempts of incorporating mobile devices for nursing school have been unsuccessful. | .75 |
| Affective State = One factor | | |
| Eigenvalue = 3.48 | As(1) Using a mobile device is a good idea for nursing students. | .79 |
| | As(2) I like the idea of using a mobile device for nursing school. | .85 |
| % of variance explained = 69.55 | As(3) I would feel overwhelmed if I used a mobile device for learning. | .81 |
| | As(4) Using a mobile device for nursing education would be frustrating. | .90 |
| | As(5) Using a mobile device will distract me from nursing content. | .81 |

Two constructs, vicarious experience and social persuasion, were loaded onto two or more factors, which formed natural subsets of the constructs based on the content within the items in the subscale. Vicarious experience had two components extracted from the PCA: peer vicarious experience with two items (VE_1,2) and professional vicarious experience with three items (VE_3,4,5; Table 11). Factor one, peer vicarious experience, refers to when peers model the use of mobile devices as learning tools to enhance nursing education. Peer vicarious experience had a rotated eigenvalue of 2.86, which explained 57% of the variance. Factor two, professional vicarious experience, refers to when professionals model the use of mobile devices as learning tools to enhance nursing education. Professional vicarious experience had a rotated eigenvalue of 1.12, which explained 22% of the variance in vicarious experience.

Table 11

*Vicarious Experience Subscale with Principal Components Varimax Factor Loadings*

| | Item | Factor Loading |
|---|---|---|
| Factor One (Peer Vicarious Experience) | | |
| Eigenvalue = 2.86 | Ve(1) My close nursing student friends use a mobile device for learning nursing content. | .76 |
| % of variance explained=57.13 | Ve(2) Many of my classmates use a mobile device for enhancing nursing content. | .76 |
| Factor Two (Professional Vicarious Experience) | | |
| Eigenvalue = 1.12 | Ve(3) Many of my clinical instructors use a mobile device for nursing practice. | .34 |
| % of variance explained=22.36 | Ve(4) Many of my nursing lecturers use a mobile device during class for nursing content. | .37 |
| | Ve(5) Many of the nurses on the clinical floor use a mobile device for nursing practice. | .45 |

Social persuasion had three components from the PCA: encouragement by social system support with four items (SP_1,4,5,6), medical system security support with three items (SP_7,8,9), and university system support with two items (SP_2,3; Table 12). Factor one, encouragement by social system support, refers to when students' peers, professionals, and educational support persons influenced them to use mobile devices as learning tools to enhance nursing education. Encouragement by social system support had a rotated eigenvalue of 3.85,

which explained 43% of the variance in social persuasion. Factor two, medical system security support, was the influence to use mobile devices as learning tools to enhance nursing education by making patient data safe and secure. Medical system security support had a rotated eigenvalue of 1.29, which explained 14% of the variance in social persuasion. Factor three, university system support, was tech support and data security measures of the university that influence students to use mobile devices as learning tools to enhance nursing education. University system support had a rotated eigenvalue of 1.07, which explained 12% of the variance in social persuasion.

Table 12

*Social Persuasion Subscale with Principal Components Varimax Factor Loadings*

| | Item | Factor Loading |
|---|---|---|
| Factor One (Encouragement by Social System Support)<br>Eigenvalue = 3.85<br>% of variance explained=42.77 | Sp(1) The university encourages mobile device use for learning. | .69 |
| | Sp(4) My clinical placements encourage the use of mobile devices for nursing practice. | .67 |
| | Sp(5) My nursing professors encourage me to use a mobile device for learning. | .72 |
| | Sp(6) My classmates encourage me to use a mobile device for enhancing nursing education. | .61 |
| Factor Two (Medical System Security Support)<br>Eigenvalue = 1.29<br>% of variance explained=14.29 | Sp(7) I know the medical systems in place make sure that data is secure when using a mobile device for patient information. | .39 |
| | Sp(8) I know how to use a mobile device for patient data to NOT violate HIPPA. | .70 |
| | Sp(9) There are systems in place that ensure that patient data remains private and secure. | .58 |
| Factor Three (University System Security Support)<br>Eigenvalue = 1.07<br>% of variance explained=11.85 | Sp(2) Campus Tech Support assists with the use mobile devices. | .64 |
| | Sp(3) I know there are university systems in place that make sure that data is secure when using a mobile device. | .62 |

***Confirmatory factor analysis.*** CFA was conducted on perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishments, social persuasion, vicarious experiences, and affective state. Each of the subscales had latent variables to verify the factor structures of the PCA analyses. The following criteria were used: acceptable factor loadings were > .50 for the indicators for the measurement model. Then, the model fit was

based on acceptable values of the CFI and TFI closer to one (0 = poor fit; > .95 good fit), and RMSEA closer to zero (< 0.05 is close fit; > 0.08 is mediocre fit; > 0.10 is poor fit; UCDHSC for Nursing Research, 2006).

*CFA results for perceived usefulness.* Perceived usefulness was tested in CFA as a one-factor model (Figure 2) where all items were loaded onto a single factor with all items having independent errors. The CFA results revealed that the initial model displayed marginal acceptable fit results between the perceived usefulness model and the present data [$\chi^2$ = 101.73 (*df* = 20, *p* = .00); $\chi^2$ /*df* = 5.09; CFI = .96; TLI = .92; RMSEA = .11 (90% CI = .09 - .13)]. In addition, all the items loaded on this one factor had loadings greater than .50, except for one item, PU(9), which had .48: "It is easier to carry an electronic device than to carry the hard copy books with me wherever I go to study nursing material."

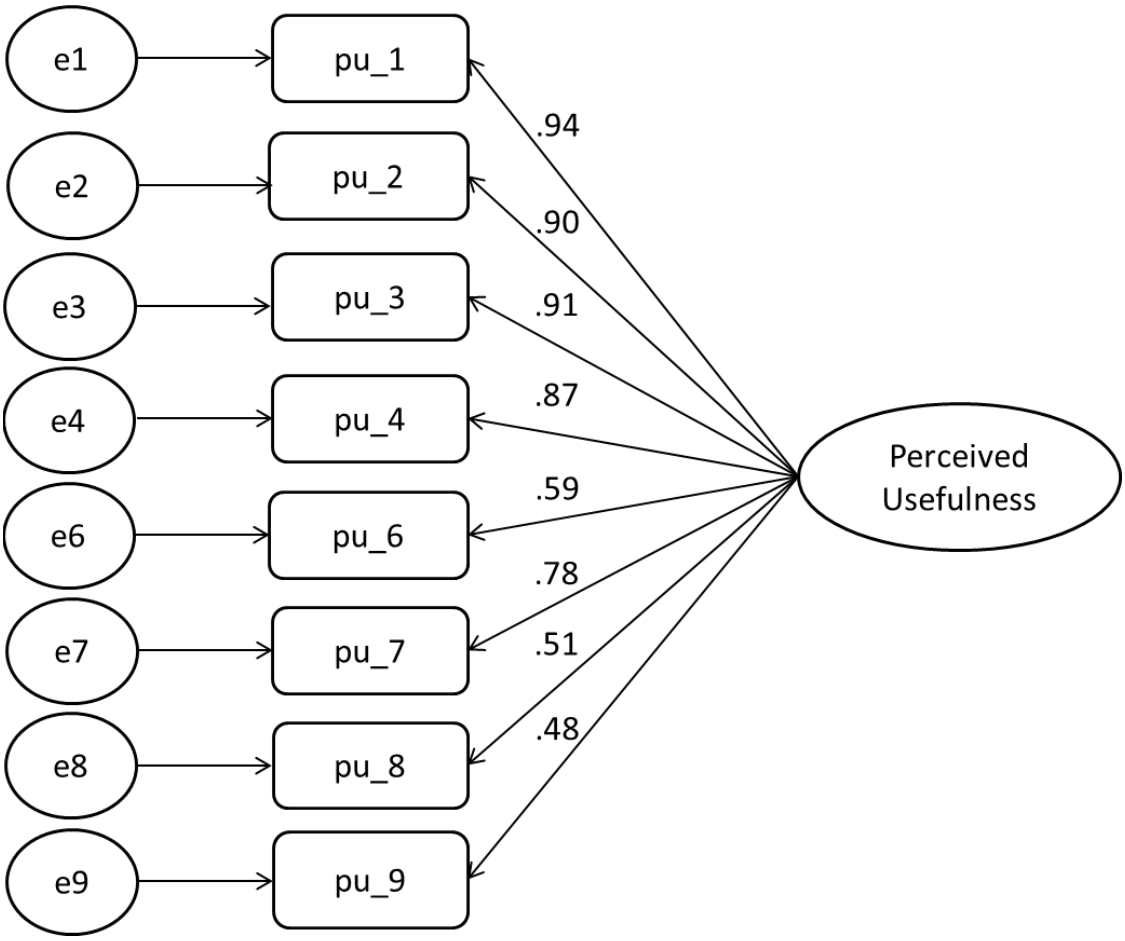


*Figure 2.* Factor structure and standardized factor loading on perceived usefulness items.

*CFA results for perceived ease of use.* Perceived ease of use was tested in CFA as a one-factor model (Figure 3) where all items were loaded onto a single factor with all items having independent errors. The CFA results revealed that the initial model displayed marginal acceptable fit results between the perceived ease of use model and the present data [$\chi^2$ = 21.22 (*df* = 5, *p* = .00); $\chi^2$ /*df* =4.24; CFI = .96; TLI = .89; RMSEA = .10 (90% CI = .06 - .14)]. In addition, all the items loaded on this one factor had loadings greater than .50, except for three items: Peou(5), “It is not difficult to use a mobile device during clinicals with my patient assignment”; Peou(6), “I could easily gain access to the internet on a mobile device for learning

at most places I go"; and Peou(8), "It is easier to use an electronic version of study material than a hard copy version of the same material because of the convenience of having the material on hand."

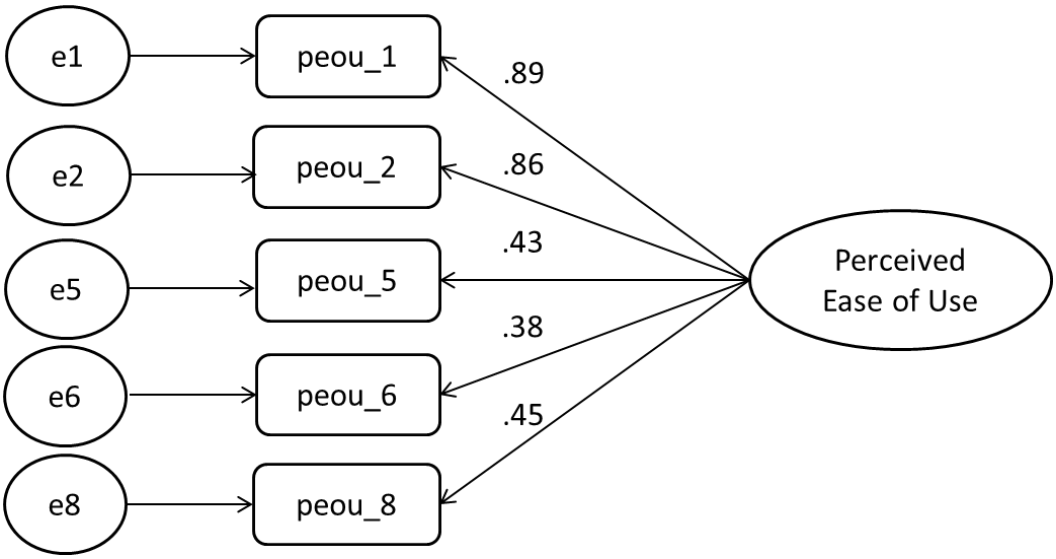


*Figure 3*. Factor structure and standardized factor loading on perceived ease of use items.

*CFA results for behavioral intention.* Behavioral intention was tested in CFA as a one-factor model (Figure 4) where all items were loaded onto a single factor with all items having independent errors. The CFA results showed saturated results [$\chi^2$ = .00 (*df* = 0, *p* = cannot be computed); CFI = 1.00; TLI = cannot be computed; RMSEA = .39 (90% CI = .35 - .43)]. Based on these results, the model was saturated, which yielded no data regarding acceptable fit.

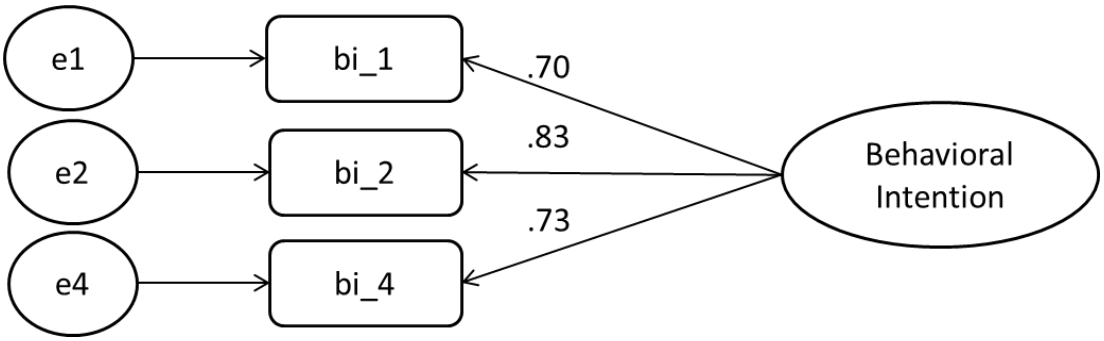


*Figure 4.* Factor structure and standardized factor loading on behavioral intention items.

*CFA results for mobile device self-efficacy.* Mobile device self-efficacy was tested in CFA as a one-factor model (Figure 5) where all items were loaded onto a single factor with all items having independent errors. The CFA results revealed marginal acceptable fit results between the mobile device self-efficacy model and the present data [$\chi^2$ = 26.54 (*df* = 2, *p* = .00); $\chi^2$ /*df* = 13.27; CFI = .96; TLI = .84; RMSEA = .19 (90% CI = .13 - .26)]. In addition, all the items loaded on this one factor had loadings greater than .50.

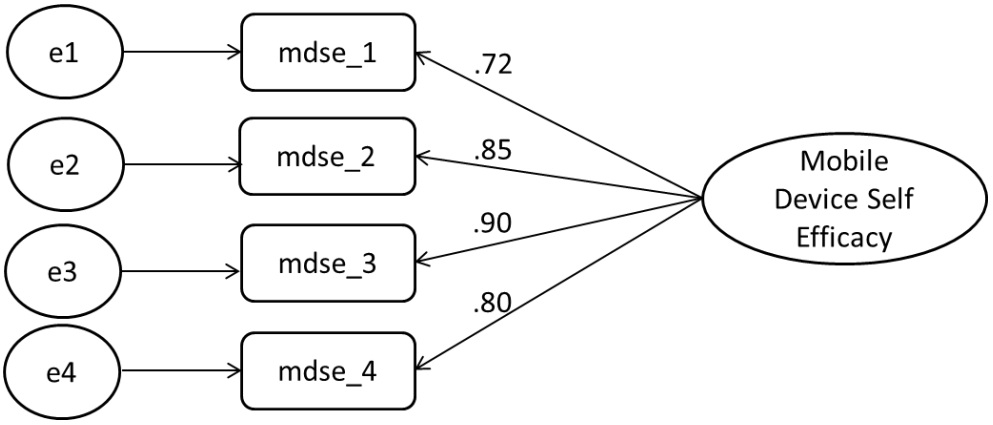


*Figure 5.* Factor structure and standardized factor loading on self-efficacy items.

*CFA results* for *past accomplishments.* Past accomplishments was tested in CFA as a one-factor model (Figure 6) where all items were loaded onto a single factor with all items having independent errors. The CFA results revealed marginal acceptable fit results between the past accomplishments model and the present data [$\chi^2$ = 85.35 (*df* = 2, *p* = .00); $\chi^2$ /*df* = 4.24; CFI = .77; TLI = -.15; RMSEA = .36 (90% CI = .30 - .42)]. In addition, all the items loaded on this one factor had loadings close to .50.

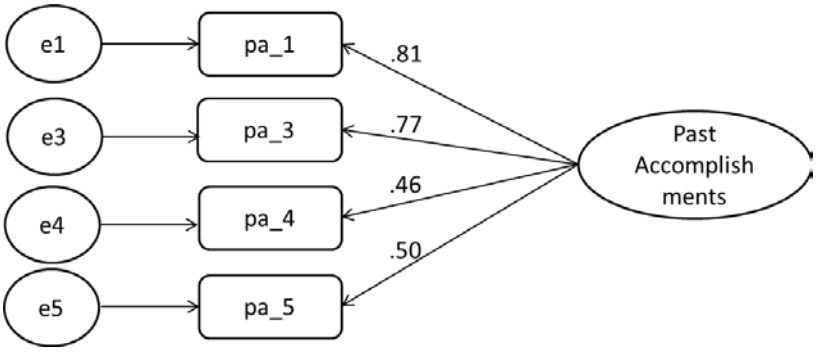


*Figure 6.* Factor structure and standardized factor loading on past accomplishments items.

*CFA results for vicarious experience.* Vicarious experience was tested in CFA as a two-factor model of peer vicarious experience (VE_1,2) and professional vicarious experience (VE_3,4,5; Figure 7), where all items were loaded onto the two factors with all items having independent errors. The CFA results showed acceptable fit results between the vicarious experience model and the present data [$\chi^2$ = 5.36 (*df* = 4, *p* = .25); $\chi^2$ /*df* = 1.34, CFI = .99; TLI = .99; RMSEA = .03 (90% CI = .00 - .09)]. In addition, all the items loaded on this one factor had loadings greater than .50.

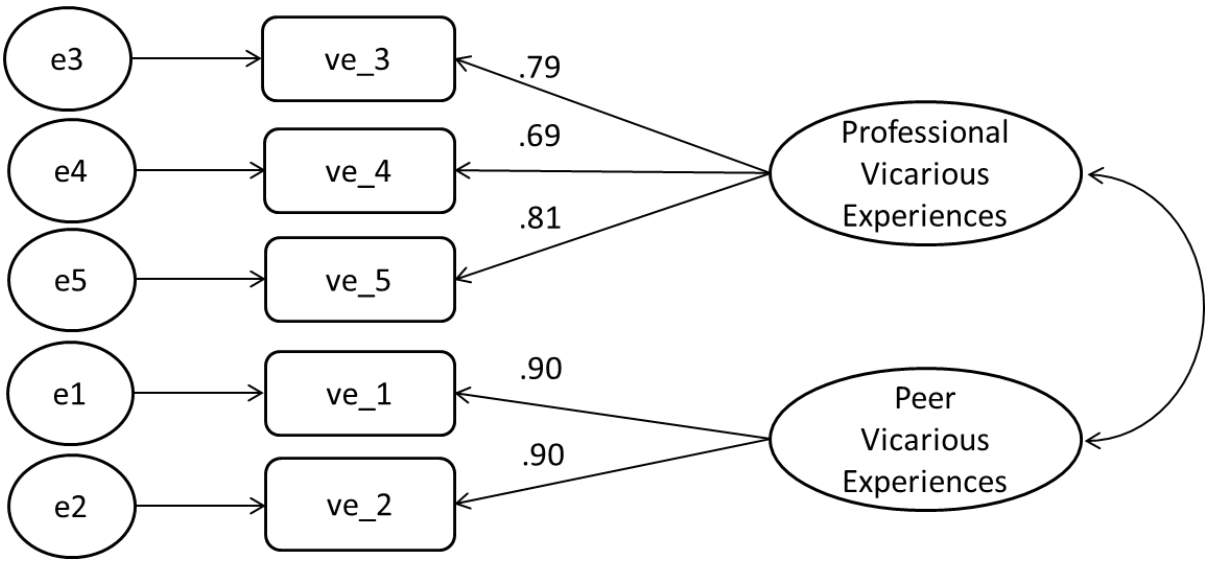


*Figure 7.* Factor structure and standardized factor loading on vicarious experience items.

*CFA results for social persuasion*. Social persuasion was tested in CFA as a three-factor model of various social supports (SP_1, 4, 5, 6), medical data security supports (Sp_7, 8, 9), and university system supports (SP_2, 3; Figure 8), where all items were loaded onto the three factors with all items having independent errors. The CFA results showed acceptable fit results between the social persuasion model and the present data [$\chi^2$ = 77.47 (*df* = 24, *p* = .00); $\chi^2$ /*df* = 3.23; CFI = .95; TLI = .90; RMSEA = .08 (90% CI = .06 - .10)]. In addition, all the items loaded on this one factor had loadings greater than .50.

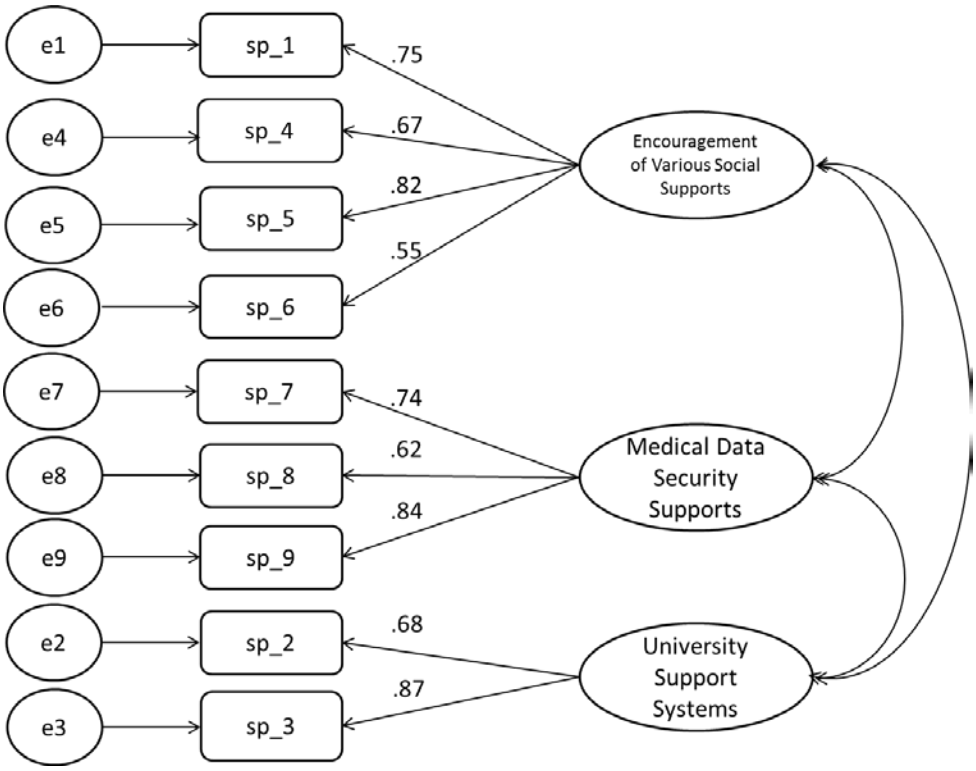


*Figure 8.* Factor structure and standardized factor loading on social persuasion items.

*CFA results for affective state.* Affective state was tested in CFA as a one-factor model (Figure 9) where all items were loaded onto a single factor with all items having independent errors. The CFA results revealed poor fit results between the affective state model and the

present data [$\chi^2$ = 192.70 (df = 5, p = .00); $\chi^2$ /df = 42.68; CFI = .83; TLI =.47; RMSEA = .34 (90% CI = .30 - .38)]. In addition, all the items loaded on this one factor had loadings greater than .50.

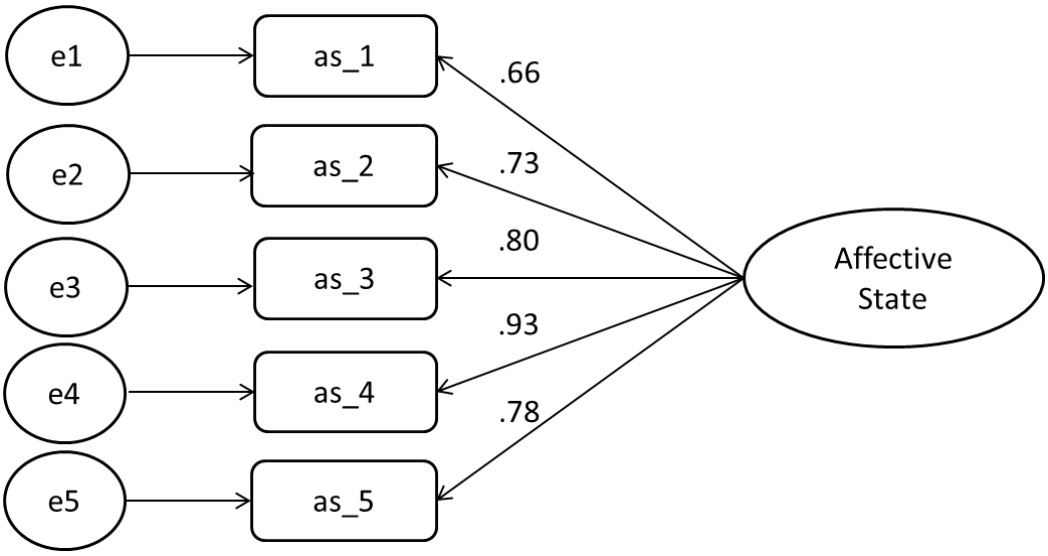


*Figure 9.* Factor structure and standardized factor loading on Affective State items.

**Research Question 2.** For the research question, "Is there a difference in the constructs of the MDA model between students of diverse and non-diverse backgrounds?" a series of t-tests comparing various characteristics of diverse and non-diverse nursing students' backgrounds on the nine constructs of the MDA model was performed. The independent variables were diverse and non-diverse nursing students. The dependent variable, for the series of t-tests, was the following MDA subscales: perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, affective state, and actual use.

***Difference among FGCS and non-FGCS.*** A t-test was performed on FGCS and non-FGCS to see if there were differences in the subscales of the MDA instrument (Table 13). The FGCS demonstrated higher scores (i.e., MDA subscales) than non-FGCS in every subscale

except actual use. However, only perceived usefulness ($p$ = .02), behavioral intention ($p$ = .01), and affective state ($p$ = .01) study measures reached statistical significance.

Table 13

*Comparison of MDA subscales among FGCS and non-FGCS*

| Construct | *M* (*SD*)/*M* (*SD*) | *t* | *df* | *p* |
|---|---|---|---|---|
| | FGCS/Non FGCS | | | |
| Perceived Usefulness | 4.31(0.60)/4.13(0.76) | 2.38 | 324 | .02 |
| Perceived Ease of Use | 3.79(0.69)/3.67(0.78) | 1.52 | 324 | .13 |
| Behavioral Intention | 4.02(0.80)/3.78(0.90) | 2.49 | 321 | .01 |
| Mobile Device Self-Efficacy | 4.06(0.71)/3.93(0.82) | 1.58 | 323 | .12 |
| Past Accomplishments | 3.97(0.75)/3.84(0.81) | 1.47 | 323 | .14 |
| Vicarious Experiences | 3.60(0.76)/3.43(0.82) | 1.92 | 323 | .06 |
| Social Persuasion | 3.28(0.70)/3.17(0.68) | 1.50 | 323 | .13 |
| Affective State | 3.93(0.83)/3.68(0.97) | 2.53 | 322.78 | .01 |
| Actual Use | 207.19(316.47)/229.28(384.62) | 0.55 | 307 | .58 |

***Pell grant eligibility.*** A t-test was performed on Pell grant eligible students and non-Pell grant eligible students to see if there were differences in the subscales of the MDA instrument (Table 14). There were no significant differences found among Pell grant and non-Pell grant eligible students, with $p$ values ranging from 0.21–0.92.

Table 14

*Comparison of MDA Subscales Among Pell and non-Pell Grant Eligible Students*

| Construct | *M*(*SD*)/*M*(*SD*) | *t* | *df* |
|---|---|---|---|
| | Pell Grant/Non-Pell Grant Eligible | | |
| Perceived Usefulness | 4.22(0.70)/4.21(0.70) | 0.16 | 314 |
| Perceived Ease of Use | 3.74(0.74)/3.72(0.75) | 0.25 | 313 |
| Behavioral Intention | 3.85(0.91)/3.91(0.84) | -0.61 | 311 |
| Mobile Device Self-Efficacy | 4.38(0.55)/3.97(0.72) | 1.21 | 313 |
| Past Accomplishments | 3.89(0.86)/3.90(0.75) | -0.10 | 313 |
| Vicarious Experiences | 3.44(0.78)/3.55(0.81) | -1.25 | 313 |
| Social Persuasion | 3.21(0.70)/3.23(0.68) | -0.35 | 313 |
| Affective State | 3.74(0.94)/3.81(0.91) | -0.65 | 313 |
| Actual Use | 242.98(364.55)/209.03(352.62) | 0.80 | 299 |

***ESL.*** A t-test was performed on ESL and non-ESL students to see if there were differences in the subscales of the MDA instrument (Table 15). The ESL students demonstrated higher study measures (i.e., MDA subscales) than non-ESL student in every subscale except perceived usefulness. Mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state study measures reached statistical significance with *p* values ranging from <0.01–0.03.

Table 15

*Comparison of MDA Subscales Among ESL and non-ESL Students*

| Construct | *M*(*SD*)/*M*(*SD*) | *t* | *df* | *p* |
|---|---|---|---|---|
| | ESL/Non-ESL | | | |
| Perceived Usefulness | 4.21(0.70)/4.32(0.75) | -0.68 | 323 | .50 |
| Perceived Ease of Use | 4.03(0.55)/3.71(0.75) | 1.82 | 323 | .07 |
| Behavioral Intention | 4.07(0.66)/3.88(0.87) | 0.93 | 320 | .36 |
| Mobile Device Self-Efficacy | 4.38(0.55)/3.97(0.78) | 2.22 | 322 | .03 |
| Past Accomplishments | 4.38(0.49)/3.87(0.79) | 2.64 | 322 | .01 |
| Vicarious Experiences | 3.89(0.75)/3.48(0.80) | 2.13 | 322 | .03 |
| Social Persuasion | 3.60(0.60)/3.20(0.68) | 2.47 | 322 | .01 |
| Affective State | 4.35(0.55)/3.76(0.92) | 4.25 | 23.16 | <.01 |
| Actual Use | 565.33(682.41)/201.40(320.55) | 2.05 | 14.32 | .06 |

***Welfare recipient.*** A t-test was performed on welfare recipient students and non-welfare recipient students to see if there were differences in the subscales of the MDA instrument (Table 16). The welfare recipient students demonstrated higher study measures (i.e., MDA subscales) than non-welfare recipient students in every subscale. Behavioral intention, past accomplishment, and affective state study measures reached statistical significance with *p* values ranging from 0.01–0.02.

Table 16

*Comparison of MDA Subscales Among Welfare and Non-welfare Recipients*

| Construct | *M*(*SD*)/*M*(*SD*) | *t* | *df* | *p* |
|---|---|---|---|---|
| | Welfare/non-welfare recipient | | | |
| Perceived Usefulness | 4.36(0.54)/4.20(0.71) | 1.42 | 323 | .15 |
| Perceived Ease of Use | 3.89(0.64)/3.70(0.75) | 1.51 | 323 | .13 |
| Behavioral Intention | 4.20(0.73)/ 3.85(0.87) | 2.44 | 320 | .02 |
| Mobile Device Self-Efficacy | 4.10(0.65)/3.98(0.79) | 0.93 | 322 | .35 |
| Past Accomplishments | 4.21(0.79)/3.86(0.78) | 2.71 | 322 | .01 |
| Vicarious Experiences | 3.63(0.84)/3.50(0.79) | 1.06 | 322 | .29 |
| Social Persuasion | 3.32(0.71)/3.21(0.68) | 1.03 | 322 | .30 |
| Affective State | 4.14(0.68)/3.75(0.94) | 3.24 | 62.15 | .01 |
| Actual Use | 313.29(377.46)/206.41(349.50) | 1.75 | 305 | .08 |

***Public housing.*** A t-test was performed on public housing residence and non-public housing residence to see if there were differences in the subscales of the MDA instrument (Table 17). There were no significant differences found among these groups. However, public housing recipients demonstrated lower study measures (i.e., MDA subscales) than non-public housing recipients except social persuasion and actual use. No significant data were found.

Table 17

*Comparison of MDA Subscales Among Public Housing and Non-public Housing Recipients*

| Construct | *M*(*SD*)/*M*(*SD*) | *t* | *df* | *p* |
|---|---|---|---|---|
| | Public Housing/Non-Public Housing | | | |
| Perceived Usefulness | 4.01(0.54)/4.23(0.70) | -1.61 | 322 | .11 |
| Perceived Ease of Use | 3.59(0.67)/3.74(0.74) | -1.05 | 322 | .29 |
| Behavioral Intention | 3.78(0.82)/ 3.90(0.87) | -0.68 | 320 | .50 |
| Mobile Device Self Efficacy | 3.87(0.91)/4.00(0.76) | -0.87 | 321 | .38 |
| Past Accomplishments | 3.87(0.71)/3.91(0.80) | -0.22 | 321 | .82 |
| Vicarious Experiences | 3.26(0.98)/3.53(0.78) | -1.72 | 321 | .08 |
| Social Persuasion | 3.36(0.76)/3.21(0.68) | 1.10 | 321 | .27 |
| Affective State | 3.60(0.95)/3.82(0.91) | -1.20 | 321 | .23 |
| Actual Use | 303.29(458.53)/210.60(342.00) | 1.32 | 305 | .19 |

***Ethnicity/minority.*** A t-test was performed on ethnicity/minority students and Caucasian students to see if there were differences in the subscales of the MDA instrument (Table 18). The ethnic minority students demonstrated higher study measures (i.e., MDA subscales) than Caucasian students in every subscale except past accomplishments. However, only perceived ease of use ($p = 0.03$) and social persuasion ($p = 0.02$) reached statistical significance.

Table 18

*Comparison of MDA Subscales Among Non-Caucasian and Caucasian Students*

| Construct | *M*(*SD*)/*M*(*SD*) | *t* | *df* | *p* |
|---|---|---|---|---|
| | Non-Caucasian/Caucasian | | | |
| Perceived Usefulness | 4.30(0.63)/4.20(0.71) | 1.02 | 324 | .31 |
| Perceived Ease of Use | 3.92(0.66)/3.69(0.75) | 2.14 | 324 | .03 |
| Behavioral Intention | 3.95(0.83)/3.88(0.87) | 0.57 | 321 | .57 |
| Mobile Device Self-Efficacy | 4.05(0.75)/3.98(0.78) | 0.60 | 323 | .55 |
| Past Accomplishments | 3.40(0.69)/3.89(0.80) | -0.90 | 323 | .37 |
| Vicarious Experiences | 3.69(0.84)/3.47(0.78) | 1.83 | 323 | .07 |
| Social Persuasion | 3.42(0.66)/3.18(0.68) | 2.42 | 323 | .02 |
| Affective State | 3.86(0.88)/3.78(0.92) | 0.60 | 323 | .55 |
| Actual Use | 292.26(486.99)/203.47(317.78) | 1.27 | 61.48 | .20 |

To summarize, Research Question 2 was "Is there a difference in the constructs of the MDA model between students of diverse and non-diverse nursing students?" Overall, diverse students had higher MDA subscale scores than non-diverse nursing students except for public housing recipients. Specifically, the following diverse variables were significant.

1. FGCS had higher perceived usefulness, behavioral intention, and affective state than non-FGCS.
2. ESL students had higher mobile device self-efficacy, past accomplishments, vicarious experiences, social persuasion, and affective state than non-ESL students.
3. Recipients of welfare had higher behavioral intention, past accomplishments, and affective state than non-recipients of welfare.
4. Ethnic minority students had higher perceived ease of use and social persuasion than Caucasian students.

**Research Question 3.** The next research question was "Are there moderator variables (age, gender, years of experience, and ethnicity) that could be included in the MDA model?" A series of separate multiple linear regression analyses was performed, where age, gender, years of

experience, and ethnicity, as well as their interaction terms, were tested to see if there was a moderating effect on the relationships of perceived usefulness and behavioral intention, perceived ease of use and behavioral intention, and mobile device self-efficacy and behavioral intention.

Gender and ethnicity (Caucasian or non-Caucasian) were coded into dummy variables for the following tests because both were considered nominal data (Hardy, 1993). A multiple linear regression analysis in each of the relationships, with the proposed moderator variables and the interaction variables, was performed to examine the significance of the model and the $R^2$ value (Cohen, Cohen, West, & Aiken, 2003; Gelman & Hill, 2007). Age, gender, prior experience, and ethnicity, as well as the interaction terms, were the moderating variables and entered as predictors, along with the predictor variable of perceived usefulness/perceived ease of use/mobile device self-efficacy, to measure the significance of the model and predictors with the outcome variable of behavioral intention.

For the relationship between perceived usefulness and behavioral intention, along with age, gender, prior experience, and ethnicity, as well as the interaction terms, a significant model emerged: $F$ (11, 307) = 30.698, $p < .01$. The model explained 50.7% of the variance, with an adjusted $R^2$ of .507. Table 19 displays the results of the multiple regression analysis for the predictor variables, including the interaction terms, entered into the model. Age was the only considered moderating variable that was a significant predictor in the relationship between perceived usefulness and behavioral intention.

Table 19

*Summary of Multiple Regression Analyses for Testing Variables Predicting Behavioral Intention Scores with Perceived Usefulness*

| Variable | ***β*** | ***t*** | ***R*** | ***R²*** | ***Adjusted R²*** | *F* |
|---|---|---|---|---|---|---|
| | | | .724 | .524 | .507 | 30.698** |
| Perceived Usefulness | .67 | 16.72** | | | | |
| Age | .32 | 2.04* | | | | |
| Gender | .19 | 1.10 | | | | |
| Years | .23 | 1.28 | | | | |
| Ethnicity | -.01 | -.06 | | | | |
| Age x Gender | .-.02 | -1.05 | | | | |
| Age x Years | -.27 | -1.35 | | | | |
| Age x Ethnicity | -.07 | -.35 | | | | |
| Years x Ethnicity | .11 | .75 | | | | |
| Years x Gender | -.01 | -.08 | | | | |
| Ethnicity x Gender | -.02 | -.26 | | | | |

*Note.* Standardized regression weights are reported. *$p < .05$, ** $p < .01$

For the relationship between perceived ease of use and behavioral intention, along with age, gender, prior experience, and ethnicity, as well as the interaction terms, a significant model emerged: $F$ (11, 307) = 33.18, $p < .01$. The model explained 52.7% of the variance, with an adjusted $R^2$ of .527. Table 20 displays the results of the multiple regression analysis for the predictor variables, including the interaction terms, entered into the model. Age was the only considered moderating variable that was a significant predictor in the relationship between perceived ease of use and behavioral intention.

Table 20

*Summary of Multiple Regression Analyses for Testing Variables Predicting Behavioral Intention Scores with Perceived Ease of Use*

| Variable | ***β*** | ***t*** | ***R*** | ***R²*** | ***Adjusted R²*** | *F* |
|---|---|---|---|---|---|---|
| | | | .737 | .543 | .527 | 33.18** |
| Perceived Ease of Use | .70 | 17.45** | | | | |
| Age | .30 | 1.98* | | | | |
| Gender | .04 | .22 | | | | |
| Years | .17 | 1.01 | | | | |
| Ethnicity | .06 | .35 | | | | |
| Age x Gender | .-.10 | -.59 | | | | |
| Age x Years | -.26 | -1.28 | | | | |
| Age x Ethnicity | -.04 | -.17 | | | | |
| Years x Ethnicity | .04 | .31 | | | | |
| Years x Gender | .06 | .60 | | | | |
| Ethnicity x Gender | -.07 | -.76 | | | | |

*Note.* Standardized regression weights are reported. *$p < .05$, ** $p < .01$

For the relationship between mobile device self-efficacy and behavioral intention, along with age, gender, prior experience, and ethnicity, as well as the interaction terms, a significant model emerged: $F$ (11, 307) = 34.36, $p < .01$ (Table 21). The model explained 53.6% of the variance, with an adjusted $R^2$ of .536. No moderating variable was a significant predictor in the relationship between mobile device self-efficacy and behavioral intention.

Table 21

*Summary of Multiple Regression Analyses for Testing Variables Predicting Behavioral Intention Scores with Mobile Device Self-Efficacy*

| Variable | ***B*** | ***t*** | ***R*** | ***$R^2$*** | ***Adjusted $R^2$*** | ***F*** |
|---|---|---|---|---|---|---|
| | | | .743 | .552 | .536 | 34.36** |
| Mobile Device Self Efficacy | .70 | 17.79** | | | | |
| Age | .11 | .75 | | | | |
| Gender | .13 | .78 | | | | |
| Years | .17 | .99 | | | | |
| Ethnicity | -.13 | -.84 | | | | |
| Age x Gender | .-.24 | -1.46 | | | | |
| Age x Years | -.17 | -.84 | | | | |
| Age x Ethnicity | .20 | .98 | | | | |
| Years x Ethnicity | -.06 | -.42 | | | | |
| Years x Gender | .08 | .80 | | | | |
| Ethnicity x Gender | -.04 | -.43 | | | | |

*Note.* Standardized regression weights are reported. *$p < .05$, ** $p < .01$

To summarize, Research Question 3 was "Are there moderator variables (age, gender, years of experience, and ethnicity) that could be included in the MDA model?"

1. Age has a main effect on behavioral intention with perceived usefulness in the model; however, it does not have moderating effect.
2. Age has a main effect on behavioral intention along with perceived ease of use in the model; however, it does not have moderating effect.

**Research Question 4a.** For the research question, "Is there a difference in the constructs of the MDA model between the preferred operating systems (Apple IOS, Google Android, and

Microsoft Windows)?" a series of one-way ANOVA analyses was performed to determine differences based on the participant's preferred operating system. The independent variable was the preferred operating system (Apple IOS, Google Android Platform, and Windows). The dependent variables were the following MDA subscales: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state. Perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state were all found to have homogeneity of variances as assessed by Levene's test with non-significant *p* values greater than .05 (Lix, Keselman, & Keselman, 1996). For each of these dependent variables, Tukey's post hoc test was used to assess for significance. Actual use violated the homogeneity of variances as assessed by Levene's test, with significant *p* values less than .05 (Lix et al., 1996). Therefore, Welch's *F* was used for actual use; the result was Welch's $F(2, 96.90) = 2.82$, $p = 0.06$. Subsequently, this was not a significant result. The one-way ANOVAs were not significant among the preferred operating systems: Apple IOS, Google Android Platform, and Windows (Table 22).

Table 22

*Preferred Brand of Device and Constructs of the MDA Model with Means, Standard Deviations, F and p Values*

| Construct | Apple Mean(*SD*) | Android Mean(*SD*) | Windows Mean(*SD*) | *F* | *p* |
|---|---|---|---|---|---|
| Perceived Usefulness | 4.23(0.71) | 4.22(0.56) | 4.15(0.82) | 0.24 | .78 |
| Perceived Ease of Use | 3.72(0.74) | 3.77(0.67) | 3.69(0.82) | 0.19 | .82 |
| Behavior Intention | 3.91(0.83) | 3.90(0.80) | 3.81(0.96) | 0.23 | .80 |
| Actual Use | 208.36(322.71) | 155.55(252.10) | 375.62(450.87) | 2.82 | .06 |
| Mobile Device Self Efficacy | 4.01(0.75) | 4.01(0.64) | 3.86(0.95) | 0.79 | .46 |
| Past Accomplishments | 3.93(0.80) | 3.90(0.75) | 3.89(0.72) | 0.07 | .93 |
| Vicarious Experiences | 3.33(0.80) | 3.78(0.72) | 3.60(0.78) | 0.26 | .77 |
| Social Persuasion | 3.21(0.69) | 3.19(0.63) | 3.31(0.76) | 0.44 | .64 |
| Affective State | 3.82(0.93) | 3.81(0.83) | 3.73(0.89) | 0.19 | .83 |

**Research Question 4b.** For the research question, "Is there a difference in the constructs of the MDA model between the sizes of mobile devices?" a series of one-way ANOVA analyses was performed to determine differences based on the preferred size of mobile devices. The independent variables were small (such as basic smartphone size), midsize (such as an iPad mini), or large (tablet). The dependent variable was the following MDA subscales: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state. Perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state were all found to have homogeneity of variances as assessed by Levene's test, with non-significant *p* values greater than .05 (Lix et al., 1996). For each of these dependent variables, constructs used the *F* value and Tukey post hoc test to determine the significant differences between the groups.

Behavioral intention and actual use violated the homogeneity of variances as assessed by Levene's test with significant *p* values less than .05 (Lix et al., 1996). Therefore, Welch's *F* value and Games-Howell post hoc test were used for actual use. The effect size was calculated using $\eta^2$ and measured with the following guidelines: small = 0.01, medium = 0.059, and large = 0.138 (Munro, 2005).

Table 23

*Preferred Size of Device and Constructs of the MDA Model with Means, Standard Deviations, F and p Values*

| Construct | Small Mean(*SD*) | Medium Mean(*SD*) | Large Mean(*SD*) | *F* | *p* | $\eta^2$ |
|---|---|---|---|---|---|---|
| Perceived Usefulness | 4.10(0.74) | 4.41(0.57) | 4.30(0.65) | 5.97 | <.01 | .036 |
| Perceived Ease of Use | 3.61(0.78) | 3.97(0.70) | 3.75(0.62) | 6.16 | <.01 | .037 |
| Behavior Intention | 3.77(0.91) | 4.15(0.67) | 3.93(0.80) | 5.14 | .01 | .025 |
| Actual Use | 146.44(214.04) | 260.77(388.88) | 282.99(419.96) | 5.85 | <.01 | .037 |
| Mobile Device Self Efficacy | 3.82(0.81) | 4.20(0.61) | 4.13(0.72) | 8.53 | <.01 | .051 |
| Past Accomplishments | 3.82(0.80) | 4.07(0.86) | 3.86(0.86) | 3.37 | .04 | .021 |
| Vicarious Experiences | 3.33(0.80) | 3.78(0.72) | 3.60(0.78) | 9.06 | <.01 | .054 |
| Social Persuasion | 3.04(0.62) | 3.45(0.70) | 3.34(0.70) | 11.33 | <.01 | .067 |
| Affective State | 3.67(0.93) | 4.07(0.86) | 3.86(0.86) | 5.14 | .01 | .031 |

Every construct showed a significantly different result, with *p* values ranging from < .01–.04 (Table 23). All the constructs, except social persuasion, showed a small effect size.

For perceived usefulness, there was a significant difference with $F(2, 319) = 5.97$, $p = <.01$. The difference between the small-size device and the medium-size device was statistically significant ($p < .01$). However, the differences between the small-sized device and the large-sized device ($p = .06$) and between the medium-sized device and the large-sized device ($p = .56$) were non-significant.

For perceived ease of use, there was a significant difference with $F$ (2, 319) = 6.16, $p$ < .01. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ < .01). However, the differences between the small-sized device and the large-sized device ($p$ = .32) and between the medium-sized device and the large-sized device ($p$ = .11) were non-significant.

For behavioral intention, there was a significant difference with Welch's $F$ (2, 220.67) = 5.14, $p$ = .01. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ < .01). However, the differences between the small-sized device and the large-sized device ($p$ = .31) and between the medium-sized device and the large-sized device ($p$ = .21) were non-significant.

For actual use, there was a significant difference with Welch's $F$ (2, 126.32) = 5.85, $p$ < .01. The difference between the small-sized device and the large-sized device was significant ($p$ = 0.02). However, the differences between the small-sized device and the medium-sized device ($p$ = .06) and between the medium-sized device and the large-sized device ($p$ = .94) were non-significant.

For mobile device self-efficacy, there was a significant difference with $F$ (2, 318) = 8.53, $p$ < .01. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ < .01), and the increase from the small-sized device to the large-sized device was statistically significant ($p$ < .01). However, the increase from the medium-sized device to the large-sized device ($p$ = .83) was not significant.

For past accomplishments, there was a significant difference with $F$ (2,318) = 3.37, $p$ = .04. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ = .03). However, the differences between the small-sized device and the large-

sized device ($p$ = .41) and between the medium-sized device and the large-sized device ($p$ = .40) were non-significant.

For vicarious experiences, there was a significant difference with $F$ (2, 318) = 9.06, $p$ < .01. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ < .01), and the difference between the small-sized device and the large-sized device was statistically significant ($p$ = .02). However, the difference between the large-sized device and the medium-sized device was not significant ($p$ = .28).

For social persuasion, there was a significant difference with $F$ (2, 318) = 11.33, $p$ < .01. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ < .01), and the difference between the small-sized device and the large-sized device was statistically significant ($p$ = .002). However, the difference between the large-sized device and the medium-sized device was not significant ($p$ = .56).

For affective state, there was a significant difference with $F$ (2, 318) = 5.14, $p$ = .01. The difference between the small-sized device and the medium-sized device was statistically significant ($p$ < .01). However, the differences between the small-sized device and the large-sized device ($p$ = .24) and between the medium-sized device and the large-sized device ($p$ = .27) were non-significant.

**Research Question 4c.** For the research question, "Is there a difference in the constructs of the MDA model between preferred features/apps of mobile devices?" a series of one-way ANOVA analyses was performed to determine differences based on the preferred features/apps of mobile devices. The independent variables were communication/interaction, organization, reference material, or study aid apps. The dependent variables were the following MDA subscales: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile

device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state. Perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state were all found to have homogeneity of variances as assessed by Levene's test with non-significant *p* values greater than .05 (Lix et al., 1996). For each of the dependent variables, these constructs used the *F* value and Tukey post hoc test to determine the significant differences between the groups. Perceived usefulness and actual use violated the homogeneity of variances as assessed by Levene's test, with significant *p* values less than .05 (Lix et al., 1996). Therefore, Welch's *F* value and Games-Howell post hoc test were used for perceived usefulness and actual use.

Table 24

*Preferred Functions of Device for Nursing and Constructs of the MDA Model with Means, Standard Deviations, F and p Values*

| Construct | Communication Mean(*SD*) | Organization Mean(*SD*) | Reference Mean(*SD*) | Study Aid Mean(*SD*) | *F* | *p* | $\eta^2$ |
|---|---|---|---|---|---|---|---|
| Perceived Usefulness | 4.07(0.73) | 4.19(0.78) | 4.50(0.53) | 4.38(0.56) | 6.98 | <.01 | .066 |
| Perceived Ease of Use | 3.53(0.74) | 3.89(0.82) | 3.93(0.62) | 3.95(0.60) | 7.88 | <.01 | .074 |
| Behavior Intention | 3.73(0.87) | 3.99(0.84) | 4.11(0.78) | 4.14(0.71) | 4.85 | <.01 | .037 |
| Actual Use | 176.23(289.42) | 217.98 (326.73) | 284.82 (427.53) | 202.91 (321.05) | 1.55 | .20 | |
| Mobile Device Self Efficacy | 3.81(0.74) | 4.06(0.75) | 4.28(0.68) | 4.17(0.66) | 7.79 | <.01 | .073 |
| Past Accomplishment | 3.78(0.77) | 3.88(0.85) | 4.11(0.75) | 4.19(0.72) | 4.75 | <.01 | .046 |
| Vicarious Experiences | 3.38(0.81) | 3.45(0.84) | 3.68(0.78) | 3.66(0.69) | 2.84 | .04 | .028 |
| Social Persuasion | 3.12(0.68) | 3.32(0.57) | 3.31(0.72) | 3.30(0.64) | 1.86 | .14 | |
| Affective State | 3.63(0.87) | 3.94(0.98) | 4.08(0.84) | 3.99(0.82) | 5.13 | <.01 | .049 |

Every construct showed a significantly different result, with *p* values ranging from < .01–.04, except for social persuasion and actual use (Table 24). The effect size was calculated using $\eta^2$ and measured with the following guidelines: small = 0.01, medium = 0.059, and large = 0.138

(Munro, 2005). Every significant *F* value showed a small to medium effect size. In all of the constructs except actual use and social persuasion, the mean for reference or study aid was higher than communication or organization function preference.

For perceived usefulness, there was a significant difference with Welch $F(3, 117.47) = 6.98$, $p < .01$. The difference between communication and reference was statistically significant ($p < .01$), and the increase from communication to study aid was statistically significant ($p = .02$). However, the differences between communication and organization ($p = .77$), organization and study aid ($p = .56$), and study aid and reference ($p = .69$) were non-significant.

For perceived ease of use, there was a significant difference with $F(3, 297) = 7.88$, $p < .01$. The differences between communication and reference ($p < .01$), between communication and study aid ($p = .004$), and between communication and organization ($p = .01$) were statistically significant. However, the differences between organization and reference ($p = .99$), organization and study aid ($p = .98$), and reference and study aid ($p = .99$) were non-significant.

For behavioral intention, there was a significant difference with $F(3, 294) = 4.85$ $p < .01$. The differences between communication and reference ($p = .01$) and between communication and study aid ($p = .02$) were significant. However, the differences between communication and organization ($p = .24$), organization and reference ($p = .86$), organization and study aid ($p = .83$), and reference and study aid ($p = 1.00$) were non-significant.

For mobile device self-efficacy, there was a significant difference with $F(3, 296) = 7.79$, $p < .01$. The differences between communication and reference ($p < .000$) and between communication and study aid ($p = .02$) were statistically significant. However, the differences between communication and organization ($p = .16$), organization and reference ($p = .35$), organization and study aid ($p = .88$), and reference and study aid ($p = .85$) were non-significant.

For past accomplishments, there was a significant difference with $F$ (3, 296) = 4.75, $p$ < .01. The differences between communication and reference ($p$ = .02) and between communication and study aid ($p$ = .01) were significant. However, the differences between organization and reference ($p$ = .37), organization and study aid ($p$ = .23), reference and study aid ($p$ = .97), and communication and organization ($p$ = .87) were non-significant.

For affective state, there was a significant difference with $F$ (3, 296) = 5.13, $p$ < .01. The difference between communication and reference ($p$ < .01) was significant. However, the differences between communication and organization ($p$ = .15), communication and study aid ($p$ = .08), organization and study aid ($p$ = .99), organization and reference ($p$ = .82), and study aid and reference ($p$ = .95) were non-significant.

To summarize, there were three parts to Research Question 4. Research Questions 4b and 4c had significant results. Research Question 4a was "Is there a difference in the constructs of the MDA model between the preferred operating systems (Apple IOS, Google Android Platform, and Windows)?"

1. There were no differences among the preferred operating systems and MDA.

Research Question 4b was "Is there a difference in the constructs of the MDA model between the sizes of mobile devices?" Although the majority of students (48%) owned a small device, students who used a larger device had higher MDA constructs scores.

1. Students who preferred a medium-sized device had higher scores in perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, vicarious experience, social persuasion, past accomplishments, and affective state than those who preferred a small-sized device.

2. Students who preferred a large-sized device had higher scores in mobile device self-efficacy, vicarious experiences, social persuasion, and actual use than those who preferred a small-sized device.

Research Question 4c was "Is there a difference in the constructs of the MDA model between preferred features/apps of mobile devices?" Although the majority of students (44%) preferred to use their mobile device for communication purposes, students who preferred to use their mobile device for reference (e.g., Google/eBooks) or study aid apps (e.g., Quizlet) had higher MDA scores.

1. Students who preferred to use their mobile devices for reference compared to those who preferred to use their mobile devices for communication had significantly higher scores in perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, and affective state.
2. Students who preferred to use their mobile devices for study aid apps compared to those who preferred to use their mobile devices for communication had significantly higher scores in perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, and past accomplishment.
3. Students who preferred to use their mobile devices for organization compared to those who preferred to use their mobile devices for communication had significantly higher scores in perceived ease of use.

**Research Question 5a.** For the research question, "Is there a relationship between the constructs of the MDA model with diversity and ATI test scores?" multiple linear regression was performed using the following study variables: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious

experiences, social persuasion, and affective state, along with diversity and ethnicity, were entered as predictors. A diversity scale was constructed by having each diversity factor (FGCS, Pell grant eligibility, ESL student, recipient of welfare, and residence in public housing) converted to a dummy variable. Higher values in the scale related to higher diversity for this scale. Ethnicity was separated from the diversity scale because of the profound impact of ethnicity in society (Freire, 2000). Ethnicity, either Caucasian or non-Caucasian, was also put in the model as predictors. The outcome variable was the ATI test scores.

A statistically significant relationship was found between the key constructs of the MDA model and ATI test scores with $F$ (12, 188) = 2.30, $p < .01$ (Table 25). The model explained 7.2% of the variance, adjusted $R^2 = 0.072$. A weak yet still significant relationship between ATI scores and MDA model key constructs existed. Social persuasion, affective state, and diversity were the significant predictors. However, because the adjusted $R^2$ (0.072) is the measure of predictive power and strength of the relationship, there was a weak yet significant relationship between ATI scores and MDA model key constructs (i.e., diversity, social persuasion, and affective state; Munro, 2005).

Table 25

*Summary of Multiple Regression Analyses for Variables Predicting ATI Scores*

| Variable | ***β*** | ***t*** | ***R*** | ***R²*** | ***Adjusted R²*** | *F* |
|---|---|---|---|---|---|---|
| | | | .358 | .128 | .072 | 2.29* |
| Perceived Usefulness | .08 | .74 | | | | |
| Perceived Ease of Use | -.10 | -.94 | | | | |
| Behavioral Intention | -.01 | -.10 | | | | |
| Actual Use | -.03 | .-.46 | | | | |
| Mobile Device Self Efficacy | .12 | .96 | | | | |
| Past Accomplishment | -.19 | -1.84 | | | | |
| Vicarious Experiences | .12 | 1.24 | | | | |
| Social Persuasion | -.32 | -3.29* | | | | |
| Affective State | .23 | 2.06* | | | | |
| Diversity | .17 | 2.33* | | | | |
| Ethnicity | .00 | .04 | | | | |

*Note.* Standardized regression weights are reported. *$p < .05$, ** $p < .01$

**Research Question 5b.** For the research question, "Is there a relationship between the constructs of the MDA model with diversity and GPA?" multiple linear regression was performed. Each of the following key constructs—perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state, along with diversity/ethnicity, were the predictor variables, and the outcome variable was GPA. There was a non-significant model produced among the key constructs of the MDA model, along with diversity/ethnicity, and GPA with $F$ (12, 281) = .977, $p$ = 0.47 (Table 26), although, vicarious experience was a significant predictor in the model. The model explained 0% of the variance, adjusted $R^2$ = -0.001.

Table 26

*Summary of Multiple Regression Analyses for Variables Predicting GPA*

| Variable | ***β*** | ***t*** | ***R*** | ***R²*** | ***Adjusted R²*** | *F* |
|---|---|---|---|---|---|---|
| | | | .200 | .04 | -.001 | .977 |
| Perceived Usefulness | -.07 | -.66 | | | | |
| Perceived Ease of Use | -.07 | -.75 | | | | |
| Behavioral Intention | .07 | .50 | | | | |
| Actual Use | -.02 | -.26 | | | | |
| Mobile Device Self Efficacy | -.06 | -.60 | | | | |
| Past Accomplishment | .10 | 1.18 | | | | |
| Vicarious Experiences | .20 | 2.24* | | | | |
| Social Persuasion | -.07 | -.83 | | | | |
| Affective State | -.06 | -.61 | | | | |
| Diversity | -.05 | -.82 | | | | |
| Ethnicity | .06 | .94 | | | | |

*Note.* Standardized regression weights are reported. *$p < .05$, ** $p < .01$

To summarize, there were two parts to Research Question 5. The first question was "Is there a relationship between the constructs of the MDA model with diversity and ATI test scores?" Based on the $R^2$ adjusted values, a weak significant statistical relationship was found. The second question was "Is there a relationship between the constructs of the MDA model with diversity and GPA?" Based on the $R^2$ adjusted values, there was no statistical relationship found.

## Chapter 5: Discussion and Conclusions

The current literature described the need for informatics in the nursing curriculum in order to prepare nursing students to practice in the 21st century. The use of mobile devices for nursing education may lay the foundation for informatics. Mobile device use increased patient-centered care and teamwork/collaboration (Dearnley, Haigh, & Fairhall, 2008; Galvão & Püschel, 2012; Jenkins, Hewitt, & Bakken, 2006; Kneebone, Nestel, Ratnasothy, Kidd, & Darzi, 2003; Koeniger-Donohue, 2008; Martyn et al., 2014; Schlairet, 2012; Secco et al., 2013; Smith & Pattillo, 2006; Stroud, Erkel, & Smith, 2005; Wu et al., 2011; Wu, 2014). Also, mobile device use supported evidence-based practice (Garrett & Jackson, 2006; Koeniger-Donohue, 2008; Lai & Wu, 2012; Williams & Dittmer, 2009; Wittmann-Price, Kennedy, & Godwin, 2012), quality improvement (Lee et al., 2009; Trangenstein et al., 2007), and safety (Garrett & Jackson, 2006; Koeniger-Donohue, 2008; Lai & Wu, 2012; Williams & Dittmer, 2009; Wittmann-Price, Kennedy, & Godwin, 2012). However, more research is needed regarding the decision to use mobile devices as an educational tool in non-mandated settings in the US.

Past research has shown that the digital divide adversely affects diverse students who do not have a strong underlying structure to support technology (Goodman, 2013; Gorski, 2003; Hilbert, 2012; Richtel, 2012; Yu, 2011). In this current study, diverse students were characterized by the following: FGCS, Pell grant eligibility, ESL students, prior or present recipient of welfare, past or present residence in public housing, and ethnicity. While the U.S. population continues to become more diverse, RNs and nursing students continue to exhibit a lack of diversity (Jeffreys, 2012; Xue & Brewer, 2014). Nursing educators need to continue not only to support informatics in the curriculum but also to support diverse students in assisting them to practice twenty-first-century nursing care (Traylor et al., 2010).

One way to support diverse nursing students may involve using mobile devices in education. While the U.S. population continues to use mobile devices for a variety of purposes, the current healthcare environment, especially nursing, is making strides using mobile devices in the nursing curriculum. However, there are factors that have not yet been studied that may impact mobile device use in nursing education in non-mandated settings. More research needs to focus on how diversity may impact mobile device use. Also, a need for research exists regarding a conceptual framework and instrument describing MDA, the decision to use mobile devices as educational tools to enhance nursing education. MDA may support diverse nursing students, assisting them to continue in the nursing program, with higher completion rates and higher educational outcomes than they have currently.

The procedure of this study was the following. The researcher examined the reliability and validity measures of the MDA instrument and investigated diverse nursing students regarding differences in scores related to the constructs of the MDA Model. The researcher identified possible moderator variables (age, gender, prior experience, and ethnicity) that impacted behavioral intention in the educational setting. The researcher investigated how the preferred brand, size, and features/apps explained differences in scores related to the constructs of the MDA model, in order to provide information and recommendations for integrating mobile technology into the nursing curriculum. The relationship between the constructs of the MDA model in regard to diversity and educational outcomes was examined. There were 327 BSN students who participated in the study. The specific statistical tests were carried out with the chosen research questions, and the results were displayed in Chapter 4.

Chapter 5 discusses the results of the current study and draws conclusions from the findings. Each research question is presented, followed by discussion of the sample. The

implications drawn may serve future research and theory, specifically in the field of nursing education. This chapter concludes by presenting the limitations and the summary of the current study.

## Discussion by Research Question and Study Sample

First, each research question is discussed. Second, the sample is discussed. This section leads the reader into the implication section.

**Research Question 1.** The following is the discussion for the research question, "Is the MDA instrument a reliable and valid instrument?" The psychometric results of the current study showed that the 43-item MDA instrument had acceptable internal consistency and promising results for validity.

***Cronbach's alpha.*** In particular for internal consistency, Cronbach's alpha coefficient for the entire MDA instrument was 0.95, with Cronbach's alpha coefficients of subscales ranging from 0.73–0.91 (Table 9). Chow et al.'s (2013) CSES focused on SEM first, resulting in a five-factor solution; therefore, the Cronbach's alpha was warranted on only the subscales. The CSES did not provide a Cronbach's alpha of the entire instrument. In contrast, a Cronbach's alpha on the entire MDA instrument was performed to test for possible unidimensionality, because SEM was not conducted prior to reliability testing. The entire MDA instrument did exhibit a high Cronbach's alpha of 0.95, possibly showing unidimensionality. However, according to the TAM and self-efficacy theory, eight subscales existed and were tested as such (i.e., adequate Cronbach's alpha) in the further research questions.

Another strength of the MDA instrument compared to the CSES was that the MDA instrument measured all four sources of self-efficacy, according to the self-efficacy theory

(Bandura, 1987). The addition of the sources of self-efficacy provides a more complete model to explain behavior than solely using the TAM, on which the CSES was based.

***Validity testing.*** In the CSES study, Chow et al. (2013) found that the validity tested yielded five factors with the following subscales: perceived usefulness, perceived ease of use, behavioral intention, self-efficacy, and affective state. In the current study, based on the promising reliability results, exploratory factor analysis using PCA was first performed. During the initial exploration, the analyses did not yield interpretable results. In the next phase, PCA was repeated and performed separately for each subscale. Six subscales yielded one-factor structure for the subscales of perceived usefulness (eight items), perceived ease of use (five items), behavioral intention (three items), mobile device self-efficacy (four items), past accomplishments (four items), and affective state (five items). Vicarious experience yielded a two-factor structure, and social persuasion yielded a three-factor structure. After further examination of the conceptual definitions of vicarious experience and social persuasion, it made sense to have two or more factors extracted, based on the wording in both the conceptual and operational definitions.

Next, a more advanced statistical analysis using CFA was performed with factor structure results from EFA to further examine the construct validity of the MDA instrument. Based on the model fit indices, the CFA results on the perceived usefulness, perceived ease of use, mobile device self-efficacy, vicarious experience, and social persuasion subscales were satisfactory except three subscales: past accomplishment, affective state, and behavioral intention. It was surprising that the three subscales did not yield a better fit, considering their acceptable Cronbach's alpha and PCA results. Perhaps with past accomplishment and affective state, the modification analysis may suggest correlations between errors on two or more items. Perhaps

with behavioral intention, additional items added to this construct did not yield a better fit, because the current model fit reproduced the data, yielding saturated results (Kenny, 2015). The work in this dissertation study provides additional validity testing information that strengthens the current literature since no previous studies were found that applied CFA in psychometric testing. Nevertheless, the results from the current study can serve as a foundation for future examination of MDA, including using modification indices to test different models among MDA subscales as well as using SEM to examine the entire model, which may yield stronger results.

An important outcome of these results is the principle that nursing education needs to incorporate CFA on all instruments to provide further construct validity, instead of only reporting reliability and content validity (Acton, 2013). If this current study had solely used the Cronbach's alpha and content validity, the results would not have been interpreted with as much caution.

**Research Question 2.** The following is the discussion for the research question, "Is there a difference in the constructs of the MDA model between diverse and non-diverse nursing students?" To investigate the impact of the digital divide with mobile devices, the characteristics used for categorizing students as "diverse" were as follows: FGCS, Pell grant eligibility, prior or present recipient of welfare, past or present residence in public housing, ESL students, and ethnicity. These characteristics were examined along with the constructs of the MDA model (perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, affective state, and actual use).

The findings from the current study showed that FGCS exhibited higher scores in perceived usefulness, behavioral intention, and affective state than non-FGCS. As the results are the first known to be reported with this population, it is difficult to compare or contrast past

research. These results could be related to the study that found that low resource populations were using mobile devices for more purposes than the rest of the population (Smith & Zickuhr, 2012). FGCS, although considered a low resource population, are optimistic about the future, with hopes of climbing the social ladder, and are persistent in overcoming obstacles in their education (Contreras, 2012; Dumais et al., 2013; Wang, 2012; Wilson & Kittleson, 2013). This may explain why the results of the current study indicated that FGCS were characterized by increased perceptions (perceived usefulness) and positive feelings (affective state), along with increased intentions (behavioral intention) of their mobile devices.

The findings from the current study showed that recipients of welfare had higher scores in behavioral intention, past accomplishments, and affective state than non-recipients of welfare. As the results are the first known to be reported with this population, it is difficult to compare or contrast past research. The surprising results of the current study aligned with Smith and Zickuhr's (2012) findings that lower income level and lower educational level populations, who had been previously affected by the digital divide, now own smartphones and use them as the main source of internet access. Smith and Zickuhr's (2012) populations had higher use of mobile devices across multiple functions (accessing the Internet, playing games, listening to music, participating in social networking, downloading apps, viewing and recording videos, using online banking, checking email, and participating in video call or chat) than the rest of the population. Hence, their findings may confirm the current study results: that welfare recipients were characterized by having positive experiences (past accomplishment), feelings (affective state), and intentions (behavioral intention) with their mobile device.

The findings from the current study showed that ESL students had higher scores in mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and

affective state than non-ESL students. However, a limitation was that only 18 ESL nursing students participated in the current study. As the results are the first known to be reported with this population, it is difficult to compare or contrast past research. In explaining these significant results of the current study, self-efficacy was examined more closely in ESL students. It is known that those ESL students who have higher self-efficacy of language mastery have higher standardized English scores across all educational institutions compared to those ESL students with lower self-efficacy of language mastery (Raoofi, Hoon Tan, & Chan, 2012). The higher self-efficacy of language mastery could be linked with the higher self-efficacy of the current study results. To explain the association further, for ESL students to be accepted into highly competitive nursing programs, they need to exhibit higher levels of English than what is necessary to gain admission into other college majors. ESL students are accepted into nursing programs only if they have high English scores. Therefore, one could assume these ESL students also have obtained higher self-efficacy of language mastery. Since there are many apps that increase language mastery, these ESL students may have obtained the self-efficacy of MDA through using the apps on their mobile devices. Future research needs to investigate the possible relationship between language mastery self-efficacy and mobile device self-efficacy.

The findings from the current study showed that ethnic minority students had higher scores in perceived ease of use and social persuasion than Caucasian students. As the results are the first known to be reported with this population in education, it is difficult to compare or contrast past research. Regarding technology in the US, historical patterns of ethnic minorities indicate a lack of access to or the use of technology compared to Caucasians (NTIA, 1999). The technology divide in history included all technology inventions, such as the telephone, radio, and television (Norris, 2001). However, this was not the same trend found in two other studies based

on the general U.S. population. Smith (2013) found that more minorities own smart phones (i.e., 64% of African American and 60% of Hispanics compared to 53% of Caucasian), and Smith and Zickuhr (2012) found that the Black and Hispanic populations had significantly higher use of mobile device functionalities (internet, games, music, social networking, and video) than Caucasians. Similarities may exist comparing the results of Smith and Zickuhr's (2012) and Smith's (2013) findings to the current study findings. The current study found that ethnic minority students had effortless incorporation of mobile device use as learning tools to enhance nursing education. Although social persuasion was not examined in any other study with minorities, it could be assumed that minorities, because of their higher use based on Smith and Zickuhr's (2012) study, feel social persuasion to a greater extent than their Caucasian peers.

**Research Question 3.** The following is the discussion for the research question, "Are there moderator variables (age, gender, prior experience, and ethnicity) that could be included in the MDA model?" Age, gender, prior experience, and ethnicity, along with their interaction terms, were tested to see if there was a moderating effect between the relationship of perceived usefulness and behavioral intention, perceived ease of use and behavioral intention, and mobile device self-efficacy and behavioral intention. The moderating roles of age, gender, prior experience, and ethnicity were tested in the MDA model because of the importance of these variables (Venkatesh et al., 2003) as well as the lack of research in nursing education regarding the impact of these variables.

The results from the current study showed that age was a significant predictor, not a moderator, on the relationship between perceived usefulness and behavioral intention and also on the relationship between perceived ease of use and behavioral intention. No moderating variables

or other significant predictors were found for the relationship between mobile device self-efficacy and behavioral intention.

***Age as a predictor variable.*** According to the results of the current study, age was a significant predictor between perceived usefulness and behavioral intention and perceived ease of use and behavioral intention. The results found that the older the student, the higher the behavioral intention. In particular, older students had higher perceived usefulness and perceived ease of use, then reported greater behavioral intention, for mobile device use as an educational tool. These results were similar to the findings that graduate students used smartphones for academic purposes more than younger undergraduate students (Chen & Denoyelles, 2013). According to Dahlstrom and Bichsel's (2014) study, older students rated themselves higher in technical inclination than younger students. It is likely that older students have been exposed to mobile devices longer than their younger student counterparts and became more at ease and also found mobile devices more useful for educational purposes. The results of the current study and the above research did not support the theory of digital immigrants and digital natives (Prensky, 2001). Also, this study did not support the findings in education that younger students moderated mobile device learning more so than older students (Wang, Wu, & Wang, 2009). However, in the current study, age was a significant predictor impacting behavioral intention whereas older nursing student participants tend to report higher behavioral intention for mobile device.

**Research Question 4a.** Is there a difference in the constructs of the MDA model between the preferred operating systems? The preferred operating systems were Apple IOS, Google Android, and Microsoft Windows. Differences were examined regarding the constructs of the MDA model: perceived usefulness, perceived ease of use, behavioral intention, actual use,

mobile device self-efficacy, past accomplishments, vicarious experiences, social persuasion, and affective state, and no significant differences were found among the operating systems.

No other study in nursing education has been known to compare operating systems in non-mandated settings. It is clear that competition for market share remains among the various operating systems (Chien et al., 2014; Puder & Antebi, 2013). As of February 2016, Google Android had the greatest market share in the US for smartphones at 52.7%, followed by Apple IOS at 43.9%, and then Windows at 2.5% (Statistics Portal, 2016). The majority in the sample, combining smartphone and tablet use, preferred Apple IOS at 62.1%, followed by Google Android at 22.3% and Windows at 13.8%. The higher preference for Apple and Windows in this current sample as compared to the U.S. market share may be due to stricter security measures (Lee et al., 2013). However, students' cognitions, perceptions, experience, feelings, and use were not affected by their preferred operating system on their mobile device. For future nursing students or faculty choosing an operating system for a mobile device, evidence from this study found that no particular operating system increased MDA.

**Research Question 4b.** Is there a difference in the constructs of the MDA model between the sizes of mobile devices? Small, medium, and large device sizes were examined to investigate differences among the constructs in the MDA model: perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state.

In this current study, although the majority of students (48%) owned a small device, students who used midsize or large devices scored higher in all of the MDA constructs. In particular, students who preferred a midsize device had higher scores in perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, vicarious experience,

social persuasion, past accomplishments, and affective state than those who preferred a small device. Students who preferred a large device had higher scores in mobile device self-efficacy, vicarious experiences, social persuasion, and actual use than those who preferred a small device.

When screen size was examined on knowledge acquisition during the nursing program, mixed results were found. According to Farrell and Rose (2008) and Martyn, Larkin, Sander, Yuginovich, and Jamieson-Proctor (2014), nursing students did not like the small screen in that it was difficult to navigate when used for clinicals and classroom. In contrast, Kenny, Neste-Kenny, Park, Burton, and Meiers (2009) found that nursing students enjoyed using the small screen because of the portability of information. Swan et al. (2013) found that portability was important to students, although no exact size was mentioned in the study. The current study extended the results of the above studies in that more specific additional information was gained regarding the sizes of devices. Using a medium-sized device may specifically demonstrate more positive cognitions (mobile device self-efficacy) and feelings (affective state), increased greater perceptions (perceived usefulness, perceived ease of use) and experiences (past accomplishment, vicarious experience, social persuasion), and subsequently greater intentions (behavioral intention). Using a large device may specifically increase more positive cognitions (mobile device self-efficacy) and experiences (vicarious experience, social persuasion), and subsequently greater use (actual use). The current study results demonstrated a need for faculty to encourage the use of larger-sized devices.

**Research Question 4c.** Is there a difference in the constructs of the MDA model with regard to preferred features/apps of mobile devices? The preferred features/apps of mobile devices were communication/interaction, organization, reference material, or study aid. These features/apps were examined to investigate differences among the constructs in the MDA model:

perceived usefulness, perceived ease of use, behavioral intention, actual use, mobile device self-efficacy, past accomplishment, vicarious experiences, social persuasion, and affective state.

Although the majority of students (44%) preferred to use their mobile device for communication purposes, the results from the current study showed that nursing students who preferred to use their mobile device for reference, such as Google/eBooks, or study aid apps, such as Quizlet, reported higher MDA scores. Students who preferred to use their mobile device for reference had significantly higher scores in perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, past accomplishment, and affective state than those who preferred to use it for communication. Students who preferred to use their mobile device for study aid apps had significantly higher scores for perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, and past accomplishment than those who preferred to use it for communication.

While a previous study by Lai and Wu (2012) reported that students may be more accustomed to using a mobile device for communication, several other studies have documented the reference feature to aid in learning (Kenny et al., 2009; Secco, Doiron-Maillet, Amirault, & Furlong, 2013; Swan et al., 2013; Wolters Kluwer Health, 2012). The current study emphasizes the importance of helping nursing students value the reference and study aid feature of mobile devices. As more students are desiring electronic resources (Pearson Foundation, 2012), encouraging them to use the reference and study aid features of mobile devices may help increase use as learning tools in the nursing program.

With the expectation that nursing students incorporate evidence-based practice, the reference feature will become more valuable during practice. However, it was found that RNs incorporated electronic resources less than nursing students did (Cibulka & Crane-Wider, 2011).

This finding places a greater importance on educating students in how to incorporate mobile devices as a reference tool for evidence-based practice (Bristol, 2014; Kowalski & Smith, 2012), which may increase more positive cognitions (mobile device self-efficacy) and feelings (affective state), increase greater perceptions (perceived usefulness, perceived ease of use) and experiences (past accomplishment), and, subsequently, greater behavioral intention.

Apparently, nursing students found study aid apps helpful and useful when deciding to use mobile devices as a learning tool. However, according to Ozdalga, Ozdalga, and Ahuja (2012), study aid apps and reference apps have not yet been tested for learning efficacy. Because of the insufficient research (Bristol, 2014; Swan et al., 2013), it was surprising to find that students who preferred the function of study aid apps had higher perceived usefulness, perceived ease of use, behavioral intention, mobile device self-efficacy, and past accomplishment than students who preferred the communication function. Few studies examine the effectiveness of reference/study aid apps and learning outcomes (Bristol, 2014; Swan et al., 2013; Ozdalga, Ozdalga, & Ahuja, 2012), yet students in this current study preferred reference and study aid apps, viewed mobile device use more positively, had more confidence about its use, and reported higher intention for use, which eventually has potential to assist them in their education.

**Research Question 5.** "Is there a relationship between the constructs of the MDA model with diversity and ATI test scores?" Also, "Is there a relationship between the constructs of the MDA model with diversity and GPA?"

Diversity was based on the following factors: FGCS, Pell grant eligibility, ESL student, recipient of welfare, and residence in public housing. Ethnicity was a separate predictor variable. For the relationship between the constructs of the MDA model with diversity and ATI test scores, a weak yet significant relationship existed with this model. The significant beta predictors

were social persuasion, affective state, and diversity. For the relationship between the constructs of the MDA model with diversity and GPA, no statistical relationship was found. However, both models did not produce large variance.

No known study in nursing education exists comparing MDA, diversity, ethnicity, GPA, and ATI test scores in non-mandated settings. It is known that in mandated settings, educational outcomes such as test scores and course grades increase when faculty intentionally use mobile devices as learning tools rather than traditional learning without mobile devices (Wu et al., 2012; Wu, Hwang, Tsai, Chen, & Huang, 2011; Wu, 2014; Wu & Sung, 2014). According to the results of the current study, in non-mandated settings, students who had higher affective state, diversity, and lower social persuasion had higher ATI scores, although this model produced a weak yet still significant model.

Although no study has been published specifically in nursing education, higher education faculty are very concerned with the distraction to learning that mobile devices may bring into the classroom. Of the 75,000 undergraduate students surveyed in 213 institutions across 45 states in the US, 69% of students stated that professors banned or strongly discouraged the use of smartphones in the classroom (Dahlstrom & Bichsel, 2014). Based on the results of the current study, 98.2% of mobile device owners are using the device for learning nursing. Having less social persuasion while having increased affective state increased ATI scores. This, in turn, along with diverse students, who use technology more than their peers, could help explain the significant predictors in the model. However, future research can address other predictor variables that may impact ATI test scores to produce a stronger model than the current results.

The APA (2015) and the NLN (2009) implore that institutions create inclusive educational environments. In non-mandated settings, MDA is not an educational barrier among diverse students.

**Sample discussion.** The following is the discussion of the sample. A convenience sample of BSN nursing students at two different universities (one public and one private) in two different states was used. The students were available to the researcher by means of personal connection with the deans at both universities. A convenience sample can be a threat to external validity in that the sample may not be representative of the general population. Table 27 was created with the national percentages compared to the sample in regard to demographic data. In terms of gender and age, the sample had similar characteristics than national nursing student statistics, which minimizes the threat of external validity. Differences between the sample and national averages in terms of ethnicity existed. There were 82.9% Caucasian nursing students in the sample study compared to 65.3% Caucasian nursing students nationally. In terms of specific ethnic groups, while the study sample had a lower number of ethnic minorities for African Americans and Hispanics, the study had a minor increase in the Asian and Native American ethnic groups compared to the national averages. However, the study sample reflects the current RN population. Given the area where the two universities were located, the ethnicity mirrored the geographical area, which minimizes the threat of external validity.

To summarize, according to Jeffreys (2012), the majority of nursing students are Caucasian females. This finding holds true to the current study and the current statistics of nursing students nationally.

Table 27

*Study Sample, National Nursing Students, RNs, and General Population Characteristics*

| Characteristics | Study Sample | National Nursing Students [a,b] | RN Population [d] | General Population [e] |
|---|---|---|---|---|
| Ethnicity/Race | | | | |
| Caucasian | 82.9% | 65.3% | 83% | 77.7% |
| African- American/Black | 5.2% | 12.8% | 6% | 13.2% |
| Hispanic | 2.4% | 7.3% | 3% | 17.1% |
| Asian | 6.7% | 5.8% | 6% | 5.3% |
| Native American | 0.9% | 0.7% | 1% | 1.2% |
| Other | 1.5% | 8.1% | 1% | 0.2% |
| Total non-Caucasian | 16.7% | 34.7% | 17% | 22.3% |
| Gender | | | | |
| Male | 16.8% | 15% | 7% | 49% |
| Female | 82.6% | 85% | 93% | 51% |
| Age | Mean age in years= 24.8 | 70% are age 25 and under[c] | NA | NA |

a.(NLN, 2014a)

b.(NLN, 2014b)

c.(NLN, 2010)

d.(U.S. Department of Health & Human Services, 2010)

e.(U.S. Department of Health & Human Services, 2010)

## Implications of the Study

The implications of the study will be presented. This section will conclude with the limitations of the study and the summary.

**Implications for research.** In regard to the current study, overall conclusions were reached. Regarding the psychometric properties of the MDA instrument, future testing is needed.

Because of the CFA's mixed model fit results with the initial models, the results of the remainder of the study need to be viewed with caution. Further examination of individual items is needed that incorporates modification indices in CFA for testing the model fit between data and proposed instrument. Nevertheless, the results can serve as a foundation for future full model testing with SEM that may yield stronger statistical results than simply examining the individual subscales. Test-retest reliability measures could examine the consistency of the MDA instrument over time to further strengthen psychometric properties. Also, in regard to instrumentation, because the survey was conducted in an electronic format and also in a paper/pencil format, future research could test to see whether participants responded differently to the items depending on the survey method used.

Regarding nursing students and MDA, diverse students, FGCS, ESL, Pell grant-eligible, recipient of welfare, and ethnic minorities had higher MDA scores in most subscales than non-diverse students. Future research can focus on other health-related disciplines to see whether the findings of the current study also apply to other majors.

Ethnic minority nursing students had a higher attrition rate in nursing programs than Caucasians (Condon et al., 2013; Jeffreys, 2012). Educators can encourage and support diverse students as the educators encourage and support the use of mobile devices in the nursing curriculum. Because ethnic minority students believe that mobile devices help support learning, nursing educators need to continue to integrate mobile device use into the curriculum. Creative uses of social media for learning and support purposes may aid in ethnic minority education. Nieslen (2015) found in the general population that African Americans were avid users of social media and blogging. Nurse educators can find innovative ways to engage ethnic minority learners through the use of social media. Using social media for learning purposes engages

students, increases higher-order/reflective/collaborative learning, facilitates student-faculty interactions, and creates a supportive environment (National Survey for Student Engagement, 2014). Also, social media can contribute to informal learning (Ali & Santos, 2012; Rung, Warnke, & Mattheos, 2014). Students who used Twitter for a course as a learning tool had higher GPAs and engagement than those students who used traditional methods of learning (Junco, Heiberger, & Loken, 2011). However, in contrast, students who frequented Facebook on mobile devices had significantly lower GPAs than students who did not use Facebook (Chen & Denoyelles, 2013). Minorities frequent social media more than other populations (Junco et al., 2011; Smith & Zickuhr, 2012). Could nurse educators incorporate social media into the nursing program for the ethnic minorities' advantage, to help decrease their high attrition rate?

Regarding moderating variables and the MDA model, age could be examined further in future model testing as a moderating/mediating variable with the relationship between perceived usefulness and behavioral intention and also between perceived ease of use and behavioral intention. The moderating variable of age could be examined further with SEM testing incorporating with other demographic variables of the MDA model, whereas the direct and indirect paths can be investigated in full range with path analysis.

**Implications for practice.** Regarding the preferred operating system, size, and function of mobile devices, nurse educators can integrate or encourage the following characteristics. First, the operating system of the device is not important. Students who prefer one operating system over another could be allowed that preference. Second, using medium- or large-sized devices can be encouraged by faculty or integrated into the nursing curriculum as these devices showed greater MDA scores than small devices. Last, educators can incorporate more learning activities centered on using reference and study aid apps, as these functions increased MDA scores more

than communication apps. Future research can examine the impact of a mobile device integration program incorporating the results of the current study.

Faculty are in a great position to better prepare nursing students to work in a technology-rich environment (NLN, 2014b). Currently, RNs are already using mobile devices for communication (Mickan et al., 2014; Neft & Greenier, 2013; Ozdalga et al., 2012; Ventola, 2014). Based on the findings from this dissertation study, students already preferred using the communication function for nursing school. However, the most significant functions for using mobile devices as learning tools were some of the least preferred. Faculty modeling and supporting appropriate mobile device use is important for students to learn how to use these devices as learning tools for education to prepare them for nursing practice (Cibulka & Crane-Wider, 2011; Farrell & Rose, 2008; Strandell-Laine, Stolt, Leino-Kilpi, & Saarikoski, 2014; Swan et al., 2013). Using appropriate reference material on their mobile devices may help increase evidence-based practice and informatics. Therefore, faculty should to continue to model and support nursing students in this endeavor for future practice.

Regarding the educational outcomes and diversity, the constructs in the MDA model did not thoroughly explain the education outcomes (i.e., GPA and ATI scores) in the current study. Students who have higher MDA scores did not have higher GPAa than their counterparts, while three predictor variables (i.e., greater diversity, lesser social persuasion, and greater affective state) explained a small percentage of variance in ATI scores. Although less social persuasion predicted higher ATI scores, which was the opposite result according to self-efficacy theory, the results again produced a weak model. ATI scores are more narrowly focused and more recent than GPA, which could explain the different results in the models. Faculty understand that other

variables could explain GPA more than solely the MDA model. Future research can focus on the informatics impact that the use of mobile devices brings to education.

**Implications for nursing education.** The current study sample found that both schools of nursing had a considerably higher Caucasian nursing student population than the overall university's Caucasian population. Only 65% of the full-time students attending the public university in the current study were Caucasian. However, the percentage of Caucasian students in this pre-licensure nursing program at the public university was 78% (personal communication, 2016). Similarly, only 74% of full-time students attending the private university in the current study were Caucasian, but the percentage of Caucasian students in this pre-licensure nursing program at the private university was 91.4% (personal communication, 2016). Both nursing programs were not as ethnically diverse as the universities represented in the sample. The ethnic makeup of the target population was not available to the researcher prior to the study, and it was difficult for the researcher to obtain these values after the study was conducted. Does the ethnic makeup of the nursing student population need to mirror the universities' ethnic makeup? No known nursing education study investigates diversity factors to examine whether differences exist between the nursing school demographics and the university demographics. In addition, according to the results of the current study, diverse nursing students had higher MDA scores than non-diverse nursing students. Given the constraints and highly competitive admission requirements, the higher MDA values may be due to the diverse nursing students' perseverance and determination brought on by overcoming educational barriers. Those students not selected into the nursing programs need to be studied in relation to demographic factors to examine the possible impact of the digital divide.

Because of these findings of the current study, future research of demographic variables of nursing intent students who do not gain admission into nursing is warranted. Further research is required to examine practices that may be unintentionally hindering diverse, not just ethnic minority, students' gaining acceptance into competitive nursing programs (NLN, 2015). Are nursing programs' admission criteria unintentionally discriminating against diverse students? Are there unintentional barriers that diverse students face that the university could address in order to support diverse students gaining acceptance into highly competitive programs? No known studies examine the diverse characteristics of nursing intent students who do not gain acceptance into the program. This study exposes the need to examine this phenomenon. Such a future study would be congruent with the NLN's (2016) call to expand diversity to include socioeconomic and cultural factors in nursing education.

As mentioned previously in this chapter, another surprising result was that age predicted behavioral intention. Older students intended to use mobile devices to enhance nursing education. Nurse educators cannot assume that younger students intend to use their mobile devices for education. These digital natives, and also the younger students, will still need guidance and education regarding how to use mobile devices for nursing education. Future research could investigate the specific age brackets where this behavioral intention disparity exists and also examine possible reasons for the disparity; results from the study could aid effective interventions to motivate nursing students of different age groups for their mobile device use. Regardless, VanSlyke (2003) asserted that both digital natives and digital immigrants need more information and communication technology skills to enhance critical thinking and to research the vast amount of resources available to use for educational purposes.

**Limitations.** The lack of stronger validity measures for the MDA instrument may be a threat to validity and generalization of the results. The results may be interpreted with caution because of the some of the model fit indices with the CFA testing. In regard to the sample, having 18 ESL students may have impacted validity. Increasing the ESL students to 30 may produce more accurate results. A proportion of the study participants in the current study were second-degree baccalaureate students, who have more college credits and are older. For future research, the group of second-degree baccalaureate students can be separated from the traditional BSN students and this can be used as a variable to examine the difference between these two groups. Also, students used self-report with their data on the survey. The students may have incorrectly recalled responses, which can cause measurement errors. For example, the item "prior experience" requires more description to insure that it refers to more than prior experience with mobile devices. More than half the students had ten or more years of experience while the smartphone went mainstream in 2007 (Martin, 2014). For example, during the paper/pencil survey, one student counted cell phone experience as part of mobile device experience. Cell phones that do not have Internet capabilities are not considered mobile devices. The researcher assumes that most students were confused on the "prior experience" item, which may have focused on non-smartphone mobile devices.

**Summary.** This study examined the decision to use mobile devices as educational tools in nursing education. Mobile device use increased patient-centered care and teamwork/collaboration (Dearnley, Haigh, & Fairhall, 2008; Galvão & Püschel, 2012; Jenkins, Hewitt, & Bakken, 2006; Kneebone, Nestel, Ratnasothy, Kidd, & Darzi, 2003; Koeniger-Donohue, 2008; Martyn et al., 2014; Schlairet, 2012; Secco et al., 2013; Smith & Pattillo, 2006; Stroud, Erkel, & Smith, 2005; Wu et al., 2011; Wu, 2014). Also, mobile device use supported

evidence-based practice (Garrett & Jackson, 2006; Koeniger-Donohue, 2008; Lai & Wu, 2012; Williams & Dittmer, 2009; Wittmann-Price, Kennedy, & Godwin, 2012), quality improvement (N.-J. Lee et al., 2009; Trangenstein et al., 2007), and safety (Garrett & Jackson, 2006; Koeniger-Donohue, 2008; Lai & Wu, 2012; Williams & Dittmer, 2009; Wittmann-Price, Kennedy, & Godwin, 2012). Mobile device use as an educational tool may help prepare nursing students to practice in this technology-embedded environment. However, as the U.S. population becomes more diverse, there is a critical need in nursing education for innovative pedagogy strategies to better support diverse nursing students. The current study contributes to the evidence base to understand decision-making of mobile device use among nursing students in non-mandated settings.

The study results verified the reliability and validity of the revised MDA instrument. Diverse nursing students (i.e., FGCS, ESL, Pell grant eligibility, recipients of welfare, and ethnic minority) had higher MDA scores in most subscales than non-diverse students. In the current study, age was a significant predictor between perceived usefulness and behavioral intention as well as perceived ease of use and behavioral intention. More research is needed to examine age as a predictor and also additional moderators in the relationships with SEM testing. A medium- or large-sized device, along with the preference of using reference and study aid apps, increased MDA scores. The regression analysis showed that three predictor variables (i.e., diversity, social persuasion, and affective state) explained a small percentage of variance in ATI scores with the MDA model; however no significant relationships existed with the MDA model constructs and GPA.

This study was unique in that it was one of the first to test the MDA model and instrument in order to understand mobile devices in non-mandated settings in the US and to

examine correlates in the nursing student population. In the current study, several variables were used to categorize diversity. Also, students' experience with mobile device use and educational outcomes was explored. This study sample had less diversity than national statistic indicate, which may be due to the competitive admission requirements by the nursing programs. However, the sample diversity was representative of the geographical area. Other measures of diversity, such as socioeconomic and cultural factors in nursing education variables, should be monitored in order to comply with the NLN's (2016) expanded diversity characteristics. As a result, educators can encourage and support diverse students for the use of mobile devices in the nursing curriculum. As health care integrates mobile devices into practice, nurse educators have a great opportunity for continued integration of mobile devices in the educational setting to prepare students to practice in the twenty-first century.

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## Appendix A: Email to the Nursing Directors

Hi XXXXX,

I am XXXXXXXXXX for the XXXXXX at XXXX. I have XXXXXXXX since XXXXX. I have been in the process of getting my PhD for the last couple of years. I just found out yesterday that I passed comps, and I am a PhD candidate.

For my dissertation, I would like to survey pre-licensure students about the use of mobile devices to enhance the nursing curriculum. I would like to have a large sample size for my project. I am already using the pre-licensure student population at XXXXXXXXXX. Could I talk with you about the possibility of accessing the pre-licensure students at XXXX?

DeAnna

## Appendix B: Introductory Email to the Nursing Students

I'm DeAnna Gapp, a part-time lecturer and doctoral student in the nursing department, and I'm conducting research on the use of mobile devices (smartphones/tablets) in nursing education. If you can please take a survey about your thoughts on using mobile devices for nursing education, that would help me with my doctoral studies. It will take approximately 20 minutes of your time. Your participation is completely voluntary and you may withdraw at any time without negative consequences. I will be sending you the online survey soon in the form of an email. Please consider helping me out and helping nursing with your thoughts about mobile devices.

Thanks for your time!!!

DeAnna Gapp

P.S. To make this worth your time, one student that completes the survey will be randomly chosen for a slightly used iPad mini (wi-fi only/1st generation/16GB data) and two students that completes the survey will be randomly chosen for a $25 visa card.

## Appendix C: Informed Consent

## Consent Form and Link to Survey

**Purpose:** The purpose of this research study is to identify factors of MDA in nursing education.

**Funding:** This research is unfunded.

**Study Procedures:** Participation in this study involves completing an online survey. It should take approximately 20 minutes to complete the survey.

**Risks:** There is minimal risk expected. The primary risk of participation in this study is a potential loss of confidentiality. Some of the survey questions are personal in nature and may make you feel uncomfortable. You do not have to answer any questions that make you uncomfortable or that you do not want to answer. If this happens, please exit the survey by exiting the window and none of your answers will be submitted.

**Benefits:** You will not directly benefit from participating in this research. Benefits to nursing include understanding factors that influence MDA.

**Confidentiality:** There is no personal identifying information kept on this survey. However, if you want to be entered into the drawing for iPad mini or gift cards, you will put your email address into a separate window browser that is located at the end of the first survey. Your email address will be kept confidential. There is no way to link your answers on the first survey because you will register your email into a different window browser. Emails will be deleted as soon as the winners are chosen. Your information will be stored in a password-protected computer file.

We may share your information with other researchers outside of Eastern Michigan University. If we share your information, we will remove any and all identifiable information so that you cannot reasonably be identified.

The results of this research may be published or used for teaching. Identifiable information will not be used for these purposes.

**Compensation:** You will be entered into a drawing for a slightly used iPad mini (wi-fi only/1st generation/16GB) or 2- $25 gift cards. We will collect your email address at the end of the survey, which is located in a different window, so that we can send you the iPad mini or gift card, if chosen.

**Contact Information:** If you have any questions about the research, you can contact the Principal Investigator, DeAnna Gapp at dgapp@emich.edu or by phone at 734.487.2310. You can also contact DeAnna Gapp's adviser, Dr. Tsu-Yin Wu, at twu@emich.edu or by phone at 734.487.6946.

For questions about your rights as a research subject, you can contact the Eastern Michigan University Office of Research Compliance at human.subjects@emich.edu or by phone at 734-487-3090.

**Voluntary participation:** Participation in this research study is your choice. You may refuse to participate at any time, even after signing this form, with no penalty or loss of benefits to which you are otherwise entitled. You may choose to leave the study at any time with no loss of benefits to which you are otherwise entitled. If you leave the study, the information you provided will be kept confidential. You may request, in writing, that your identifiable information be destroyed. However, we cannot destroy any information that has already been published.

**Statement of Consent:** I have read this form. I have had an opportunity to ask questions and am satisfied with the answers I received. I click "continue" below to indicate my consent to participate in this research study.

HERE'S THE LINK TO TAKE THE SURVEY:

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Thanks again for your help and go XXX Nursing!!!!
DeAnna Gapp, RN, MSN, PhD Candidate

## Appendix D: IRB Exempt Approval

UHSRC Determination: EXEMPT

DATE: October 27, 2015

TO: DeAnna Gapp, MSN

School of Nursing

Eastern Michigan University

Re: UHSRC: # 804558-1

Category: Exempt category 2

Approval Date: October 27, 2015

Title: Diversity and MDA on Educational Outcomes in Nursing

Your research project, entitled Diversity and MDA on Educational Outcomes in Nursing, has been determined Exempt in accordance with federal regulation 45 CFR 46.102. UHSRC policy states that you, as the Principal Investigator, are responsible for protecting the rights and welfare of your research subjects and conducting your research as described in your protocol.

Renewals: Exempt protocols do not need to be renewed. When the project is completed, please submitthe Human Subjects Study Completion Form (access through IRBNet on the UHSRC website).

Modifications: You may make minor changes (e.g., study staff changes, sample size changes, contact information changes, etc.) without submitting for review. However, if you plan to make changes that alter study design or any study instruments, you must submit a Human Subjects Approval Request

Form and obtain approval prior to implementation. The form is available through IRBNet on the UHSRC website.

Problems: All major deviations from the reviewed protocol, unanticipated problems, adverse events,subject complaints, or other problems that may increase the risk to human subjects or change the category of review must be reported to the UHSRC via an Event Report form, available through IRBNet on the UHSRC website

Follow-up: If your Exempt project is not completed and closed after three years, the UHSRC office will contact you regarding the status of the project.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via

e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,

Heather Hutchins Wiese

Chair

CHHS Human Subjects Review Committee

## Appendix E: Printed Survey

Instructions: Please fill out the questions to the best of your ability about your thoughts on mobile devices. Mobile devices are highly portable electronic devices that can access the internet such as smartphones or tablets. Laptop computers are not considered mobile devices.

What is your age? _____

What is your gender? ☐Male ☐Female

What year are you in nursing school? Sophomore Junior Senior

How many college credits you have completed?_____

What is your ethnicity?

☐African-American/Black ☐Caucasian ☐Hispanic ☐Asian ☐Middle Eastern ☐Native American

6a. Did at least one of your parents receive a baccalaureate degree? ☐ Yes ☐ No

If no, did at least one of your parents attend a college or university? ☐Yes ☐No

b. Are you eligible for the Pell grant? ☐Yes ☐No

c. Is English your first language? ☐Yes ☐No

d. Were you ever a recipient of welfare? ☐Yes ☐No

e. Have you ever lived in public housing? ☐Yes ☐No

f. Do you consider yourself a minority student? ☐Yes ☐No

7. How many years of experience do you have with mobile devices? ___

8. How many mobile devices (smartphone, tablet [i.e., Kindle Fire, Galaxy, iPad, etc…]) do you own?___

8a. How many years have you owned a mobile device?_____

8b. What is your preferred operating system of a mobile device to use to enhance nursing content? (Select one) ☐Apple IOS ☐Google Android Platform ☐Windows

8c. What is your preferred size of a mobile device to use to enhance nursing content? (Select one)

☐small (such as basic smartphone size) ☐mid-size (such as phablet, iPad mini) ☐large- (tablet)

8d. Which feature on your mobile device helps you the most to successfully go through nursing school? (Select one)

☐communication/interaction such as text, email, social media etc..

☐organization such as calendar/to do lists

☐reference material such as Googling terms or eBooks

☐study aid apps such as Quizlet.

Mobile Device Use

How often do you use your mobile device(s) for NURSING EDUCATION purposes?

☐Never ☐Seldom ☐Once per month ☐Once per week ☐Once per day ☐2-5 times per day ☐6+ times per day

On the average week, please recall the approximate number of minutes you spend on your mobile device for nursing content? _____

Among these total minutes, approximately how many minutes do you spend Mon-Fri for nursing content? _____

Among these total minutes, approximately how many minutes do you spend Sat.-Sun for nursing content? _____

Among these total minutes, approximately how many minutes do you spend on each of the following functions of a mobile device for nursing content and program.

communication/interaction (such as text, email, etc.. ) with your classmates, faculty, etc.?___

organization (such as calendar, to do lists) related to your nursing program?_____

reference materials (such as Googling terms or eBooks) related to nursing program?_____

study aid apps (such as Quizlet, Study Blue) related to nursing program/curriculum?_____

other- please specify function and minutes (if applicable)? _____

How often do you use your mobile device(s) for NON nursing education purposes?

☐Never ☐Seldom ☐Once per month ☐Once per week ☐Once per day ☐2-5 times per day ☐6+ times per day

On an average week, please recall the approximate number of minutes that you spend on your mobile device with non-nursing content? _____

Among these total minutes, approximately how many minutes do you spend during the weekdays (i.e., Mon-Fri) in non-nursing content? _____

Among these total minutes, approximately how many minutes do you spend during the weekend (i.e., Sat. & Sun) in non-nursing content? _____

Among these total minutes, approximately how many minutes do you spend on each of the following functions of a mobile device not related to nursing curriculum and/or program:

communication/interaction (such as text, email, etc.. ) with your friends & family, etc.?_____

organization (such as calendar, to do lists)?_____

reference materials (such as Googling terms or eBooks) on non-nursing related areas?_____

entertainment (such as movies, music, games)?_____

other- please specify function and minutes (if applicable)? _____

9. What was your last proctored ATI test score?_____

What was the topic area of the ATI test?

☐Fundamentals ☐Med-Surg ☐Mental Health ☐Pediatrics ☐Community ☐Maternity ☐ Leadership

10. What is your current cumulative college GPA?_____

11. Have you considered leaving the nursing program? ☐Yes ☐No

10a. If yes, are you planning on leaving the nursing program without graduating? ☐Yes ☐No

| Please check the box according to your thoughts…. | 1- strongly disagree | 2 disagree | 3- neutral/ don't know | 4- agree | 5- strongly agree |
|---|---|---|---|---|---|
| A mobile device can improve my learning efficiency for nursing school. | | | | | |
| A mobile device can enhance my knowledge for nursing school. | | | | | |
| A mobile device increases my learning output for nursing school. | | | | | |
| I find a mobile device useful for my learning in nursing school. | | | | | |
| I find it hard to concentrate on learning nursing content when using a mobile device. | | | | | |
| Using a mobile device can help me learn with others in the nursing program. | | | | | |
| A mobile device is very convenient to use for nursing content. | | | | | |
| I can use a mobile device anytime/anywhere to learn nursing content. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| It is easier to carry an electronic device than to carry the hard copy books with me wherever I go to study nursing material. | | | | | |
| It will be easy to operate a mobile device for getting information I need for lab, clinicals, and lectures in nursing school. | | | | | |
| I find that a mobile device could be easy to use for lab, clinicals, and lectures in nursing school. | | | | | |
| It will be hard to navigate nursing content on a mobile device. | | | | | |
| I will not find what I am looking for when using a mobile device for learning in nursing school. | | | | | |
| It is not difficult to use a mobile device during clinicals with my patient assignment. | | | | | |
| I could easily gain access to the internet on a mobile device for learning at most places I go. | | | | | |
| Campus Tech Support will help if problems arise using a mobile device. | | | | | |
| It is easier to use an electronic version of study material than a hard copy version of the same material because of the convenience of having the material on hand. | | | | | |
| Given that I had access to a mobile device at clinicals, I predict that I would use it. | | | | | |
| I intend to use a mobile device as often as needed for my nursing education. | | | | | |
| A mobile device costs too much for me to use one for nursing education. | | | | | |
| **Please check the box according to your thoughts….** | **1- strongly disagree** | **2 disagree** | **3- neutral/ don't know** | **4- agree** | **5- strongly agree** |
| A mobile device is worth the cost of the device so that I could use it for nursing education. | | | | | |
| I predict that I will not use a mobile device in the future for learning nursing content. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| I would become too dependent (over reliant) on a mobile device if I used it with the nursing curriculum. | | | | | |
| I predict that a mobile device will be mandatory as part of a job requirement when I become a nurse. | | | | | |
| I expect to become proficient in using a mobile device for nursing curriculum. | | | | | |
| I would feel confident that I can use a mobile device for nursing school. | | | | | |
| I am confident that I could use a mobile device to learn nursing material. | | | | | |
| Mobile devices can empower me to learn nursing content. | | | | | |
| My close nursing student friends use a mobile device for learning nursing content. | | | | | |
| Many of my classmates use a mobile device for enhancing nursing content. | | | | | |
| Many of my clinical instructors use a mobile device for nursing practice. | | | | | |
| Many of my nursing lecturers use a mobile device during class for nursing content. | | | | | |
| Many of the nurses on the clinical floor use a mobile device for nursing practice. | | | | | |
| The university encourages mobile device use for learning. | | | | | |
| Campus Tech Support assists with the use mobile devices. | | | | | |
| I know there are university systems in place that make sure that data is secure when using a mobile device. | | | | | |
| My clinical placements encourage the use of mobile devices for nursing practice. | | | | | |
| My nursing professors encourage me to use a mobile device for learning. | | | | | |
| My classmates encourage me to use a mobile device for enhancing nursing education. | | | | | |
| I know the medical systems in place make sure that data is secure when using a mobile device for patient information. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| I know how to use a mobile device for patient data to NOT violate HIPPA. | | | | | |
| There are systems in place that ensure that patient data remains private and secure. | | | | | |
| **Please check the box according to your thoughts….** | **1- strongly disagree** | **2 disagree** | **3- neutral/ don't know** | **4- agree** | **5- strongly agree** |
| In the past, I have used a mobile device for learning nursing content. | | | | | |
| I have never used a mobile device for nursing school. | | | | | |
| I consider myself to be very proficient at using a mobile device for nursing education because of my past experience. | | | | | |
| I only have past experience using a mobile device for other uses and not for nursing school. | | | | | |
| My past attempts of incorporating mobile devices for nursing school have been unsuccessful. | | | | | |
| Using a mobile device is a good idea for nursing students. | | | | | |
| I like the idea of using a mobile device for nursing school. | | | | | |
| I would feel overwhelmed if I used a mobile device for learning. | | | | | |
| Using a mobile device for nursing education would be frustrating. | | | | | |
| Using a mobile device will distract me from nursing content. | | | | | |

## Appendix F: Permission to Use Instrument for Modification

Dear DeAnna,

Sure, no problem.

Meyrick

**From:** DeAnna Gapp [mailto:dgapp@emich.edu]
**Sent:** Monday, February 03, 2014 8:34 AM
**To:** Chow, Meyrick [SN]
**Subject:** Computer Self-Efficacy Instrument

Hello Ms. Chow,
I am a doctoral student working on an instrument to measure nursing student's self-efficacy using mobile devices for nursing education. Can I have your permission to modify your computer self-efficacy instrument for a paper and possibly for my dissertation?

The instrument appeared in

Chow, M., Chan, L., Lo, B., Chu, W.-P., Chan, T., & Lai, Y.-M. (2013). Exploring the intention to use a clinical imaging portal for enhancing healthcare education. *Nurse Education* Today, *33*(6), 655–662. doi:10.1016/j.nedt.2012.01.009

Thank you,
DeAnna

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Permission to Use Instrument for Modification