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Determinants Of Adopting Handheld Mobile Devices To Assist Learning Outside Of The Classroom: Learning Styles And Motivation

Jun Wang
Indiana State University

VITA

Jun Wang

EDUCATION

2016	Ph.D. Curriculum and Instruction (Educational Technology)
	Indiana State University, Terre Haute, IN
2009	Master of Arts, TESL/Linguistics
	Indiana State University, Terre Haute, IN, Spring 2009
2006	Bachelor of Arts, Applied English
	Guizhou Normal University, Guiyang, Guizhou, China

PROFESSIONAL EXPERIENCE

2014 – 2016	Graduate Assistant
	Office of Information Technology
	Indiana State University, Terre Haute, IN
2011-2013	Graduate Assistant
	Bayh College of Education
	Indiana State University, Terre Haute, IN
2008-2010	Graduate Assistant
	College of Technology
	Indiana State University, Terre Haute, IN
2008-2009	Teaching Assistant
	Department of Language, Literature, Linguistics
	Indiana State University, Terre Haute, IN

DETERMINANTS OF ADOPTING HANDHELD MOBILE DEVICES TO ASSIST LEARNING OUTSIDE OF THE CLASSROOM: LEARNING STYLES AND MOTIVATION

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Jun Wang

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COMMITTEE MEMBERS

Committee Chair: Susan Powers, Ed.D.

Professor, Teaching and Learning

Indiana State University, Terre Haute, IN

Committee Member: Eric Hampton, Ph.D.

Professor, Communication Disorder and Counseling, School and Educational Psychology

Indiana State University, Terre Haute, IN

Committee Member: Beth Whitaker, Ph.D.

Professor, Educational Leadership & Policy Analysis

University of Missouri, Columbia, MO

ABSTRACT

This study examined the motivation orientation towards using handheld portable devices (HPDs) among U.S. Millennial college students with different learning styles outside the classroom. It also aimed to identify students' behavior and perception towards using HPDs for educational activities. The sample consisted of 404 undergraduate students who were currently enrolled at Indiana State University and had taken at least one course required by the Foundational Studies upper division integrative elective. Participants were asked to complete a survey that consisted of three parts: demographic questions to explore current usage, perception, and activities of HPD use among the participants; Felder and Soloman's Index of Learning Styles (Felder & Soloman, n.d.) to identify participants' learning styles; and General Causality Orientations Scale (Deci & Ryan, 1985a) to determine participants' motivation orientation. The results of this study indicated that there was no relationship between participants' learning styles and types of HPDs adopted to facilitate learning outside of the classroom. The results also showed that types of motivation orientation had no significant effect on hours spent on using HPDs for educational activities per day.

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CHAPTER 1

INTRODUCTION

Ever since our great ancestors explored how to use stones to hunt, fight, and for self-defense, human beings have become a species that heavily rely on and are obsessed with tools. From stone to steel, the transformation of the use of tools took thousands of years. Yet, the progression from the first personal computer to the recent various mobile devices took only a few decades. Today, the ubiquity of handheld portable devices (HPDs), such as personal digital assistants (PDAs), digital tablets (e.g., iPads), e-readers (e.g., Kindles), and smart phones (e.g., iPhones), is forcing education to march into a mobile era where mobile devices are the main carrier of various instructional tools. In the past few years, a great number of studies have been conducted to identify the educational impact of HPDs. A number of studies looked closely at the integration of mobile technologies in the environment of college campuses (Cibulka & Crane-Wider, 2011). For example, Hussain and Aslam Adeeb (2009) conducted a study to examine the role of mobile technology in promoting a campus-wide learning environment. In addition, some studies investigated learning outcomes with the use of mobile technology and suggested that mobile technologies enhance learning (Valk, Rashid & Elder, 2010). Also, Kukulska-Hulme (2009) presented and synthesized previous empirical studies on the usability of mobile devices, especially PDAs in education. However, most of the mobile technologies in these previous

studies were PDAs and laptops. Only limited research on newer technologies exists on smart phones, digital tablets and other handheld devices.

Furthermore, learning is personal. Although customized curricula for every individual student seems impracticable, the need for creating a personalized learning environment and facilitating personalized learning ability is evident. Liegle and Janicki (2006) suggested that there is a significant relationship between customizing learning modules based on student types and learning outcomes. Recently, in some countries such as England, personalization has already been implemented in their curricula through government acts. According to Hartley (2007), the notion of personalization, in the case of British educational reform, is based not on an educational theory but on marketing theories. Now in the United States, with the tendency towards standardization, i.e. standardized tests in public schools, it is essential to understand personalization from an educator's point of view and analyze it based on educational theories within the context of a specific educational system. In order to understand and achieve personalized learning, it is important to grasp the fact that students learn at different paces and with distinctive behaviors; these are called learning styles.

Educators have been examining how learning styles affect students' learning outcomes and learning behaviors for decades. Some researchers found that matching teaching styles with students' learning styles helps students to gain better academic performance (Fahy & Ally, 2005; Graf & Tzu-Chien, 2009; Rogers, 2012; Simpson & Du, 2004). However, some studies indicated that considering learning styles in teaching does not affect students' learning outcomes (Davidson-Shivers, Nowlin, & Lanouette, 2002; Howard, Ellis, & Rasmussen, 2004; Miller, 2005). Despite the mixed results on learning outcomes, the studies above reached the same conclusion that students with different learning styles behave differently in various learning

environments. Hence, researchers need to conduct more investigation in this area in future studies, especially in contexts outside of the classroom.

Statement of the Problem

In the United States, most college students have access to at least one HPD for either leisure or learning, such as cell phones, and students with higher socio economic status tend to have more choices in terms of devices. As pointed out earlier, most research on using HPDs to assist learning studied older technologies and took place in the classroom setting with designed instruction. However, there is little research on how students use HPDs with newer technologies outside of the classroom. In addition, students who have HPDs, especially cell phones, are often warned that they cannot use their cell phones during class because of distraction concerns. Instructors with those concerns tend to take charge in selecting, managing, and monitoring instructional mediums. However, it raises the concern of teacher-centered instruction and the chance of neglecting students' learning styles. Hence, to achieve personalized learning, one should not only focus on how students behave with certain in-class instruction. It is also important to see what students' attitudes towards using HPDs for learning are and if they are willing and/or motivated to use them voluntarily outside of the classroom.

Purpose of the Study

This study examined the attitudes and levels of motivation towards using HPDs among U.S. college students with different learning styles outside the classroom. In addition, another purpose was to investigate the possible relationships between learning styles and learning behaviors when using HPDs for learning. Further, the study also intended to find out the differences between students' performance with matched learning styles using HPDs and students with mismatched learning styles and/or those who do not use HPDs at all.

Significance of the Study

Ever changing technology has great impact on both students' learning behavior and their personal lives, especially the ones who were born in the digital age, also known as Millennials. Generation study categorizes people who were born and living at about the same period of time and with similar social, cultural and demographical environments into different generations (Carlson, 2009). In the United States, there are three generations since 1946 to the present day, they are: The Baby Boomers (1946-1964), Generation X (1965-1980) and Millennials (1981-2000; Tapscott, 2009). For the current generation, known as the Millennials, mobile devices and the Internet are part of their lives (McGlynn, 2005). For educators, one should be aware of any factors that may influence students' learning behavior, which will ultimately affect their academic performance. For instance, HPDs play a crucial role in students' lives, and they certainly should be considered as a medium to facilitate learning. However, due to various reasons such as students' socio-economic status and their learning preferences, presenting course content on a mobile device does not work for all students. For instance, Gabarre, Gabarre, Din, Shah, and Karim (2014), along with Byrne and Diem (2014), introduced apps for learning languages on iOS and/or android based mobile devices, and they both received positive user feedback in their studies. However, the findings were only helpful if, hypothetically, every student in a classroom owned at least one type of HPD.

Since previous research reached contradicting results on examining the relationship between learning styles and learning outcomes, the current study is devoted to further investigate this topic by adding the use of HPDs as an additional variable. In previous research, researchers focused on how students behaved differently on assigned, online-based instruction according to their learning styles and how that affected their learning outcomes. In the current study, the

researcher considered students' choices and usability of mobile device outside of the classroom as variables associated with learning styles.

The following research questions were examined by studying a sample from the population of college students who had already accessed one of the HPDs discussed in this study. Data were collected via learning styles inventories, motivation scale questionnaires, questionnaires of perspectives, and surveys of general usage of mobile devices.

1. What are the educational activities Millennial students perform using HPDs to assist learning outside of the classroom?
2. Is there a relationship between the types of HPDs adopted for facilitating learning outside of the classroom and the Millennial students' learning styles?
3. Is there a significant relationship between Millennial students' orientation of motivation and the frequency of HPD usage to assist learning outside of the classroom?

Limitations

The study had a selective sample from students in one institution and all the participants already had access to at least one HPD. Therefore, the results might not be generalized for all students from different institutions across subjects. Also, there was no pre-test or pre-training for participants, so they might not know how many types of HPDs were available and how to use them for educational purposes.

Delimitations

Based on the main focus of this study, I did not take into consideration variables including gender and frequencies of participants used their HPDs for non-educational purposes. However, the questionnaire contained related questions. These data were intended to be used as references and/or suggestions for future studies.

Assumptions

The assumption of this study was that all participants had access and/or already possessed one of the HPDs discussed in this study. Another assumption was that all participants responded with honesty and accuracy.

CHAPTER 2

LITERATURE REVIEW

Mobile Learning

At the beginning of the last decade, mobile devices such as PDAs were rapidly adopted due to their portable size and mobility. Since then, researchers have been defining mobile learning based on different emphases on the subjects for their research interests, and each definition has its own insights and limitations (Wali, Winters, & Oliver, 2008). For example, some researchers believe that mobile learning refers to learning with the delivery by mobile technology, which allows learners to access learning materials without the limit of time and location; the mobility created by newer technology is the subject of mobile learning (Ally, 2009; El-Hussein & Cronje, 2010; Wang, Wu, & Wang, 2009). Several researchers pointed out that mobile learning is merely an extension for e-learning with the support of mobile devices and wireless networks (Quinn, 2000; Traxler, 2005; Walton, Childs, & Blenkinsopp, 2009). Sharples, Taylor, and Vavoula (2007) shifted the focus from technology to a conversation about learners. They think that mobile learning is "the process of coming to know through continuous conversations across multiple contexts among people and interactive technologies raises the issue of where the ownership of learning lies" (p. 244). However, mobile learning is more than just an update of technology, and mobile learning differentiates itself from e-learning with mobility and means of information exchange. Thus, based on previous definitions and for the

purpose of this study, mobile learning refers to the process of using personal mobile devices to achieve both formal and informal learning at any place and anytime through continuous conversations.

Previous research on mobile learning focused mainly on user experiences and benefits of using mobile devices to assist learning. It is believed that mobile devices create the most autonomy for students and address individualization by giving students the opportunity to receive one-to-one interaction with the devices for personalized content (Chang, Liang, Yan, & Tseng, 2013; Lai, Yang, Chen, Ho, & Liang, 2009; Song, Wong, & Looi, 2012). Lai, Yang, Chen, Ho, and Chan (2007) examined the relationship between using PDAs and knowledge creation through experiential learning. In this study, a group of fifth-graders used PDAs with cameras on a topic of exploring Africa. Another group of fifth-graders used traditional paper and pencil on the same topic. By comparing these two groups, results indicated using PDAs significantly increased students' ability to create knowledge during experiential learning. Ranson, Boothby, Mazmanian, and Alvanzo (2007) also explored the use of PDAs in patient care. They evaluated the Virginia Board of Medicine Continuing Competency and Assessment Form (CCAF) in a PDA version, which was to focus on analyzing and synthesizing practice and medical education. The results indicated that using PDAs was positively associated with accessing information in order to make medical decisions and to enhance patient care. Wu and Lai (2009) implemented PDAs in a clinic using a practicum course and then reported their findings on students' perceptions towards PDAs' physical attributes, the benefits of using PDAs in practicum sessions and the barriers to implementing a PDA-based practicum. The findings indicated that PDAs were time-saving, convenient and interactive.

Beside PDAs, researchers have studied cell phones and smartphones, too. Thornton and Houser (2005) sent out surveys to 333 Japanese students to identify the status of mobile phone usage among Japanese college students. They identified that 100% of participants reported owning a mobile phone and most of them used mobile phones to send emails regarding classes. Second, they emailed 44 Japanese university students lessons with English vocabulary, while other students were receiving lessons on paper or the web. A total of 71% of students preferred receiving vocabulary lessons from mobile phones rather than PCs or papers. Stav, Nielsen, Hansen-Nygård, and Thorseth (2010) reported their experience of using a prototype of the Student Response System (SRS) with the latest wireless technologies and handheld mobile devices with touch screens. Seven European counties had adopted this new prototype. Compared to the existing SRS, the authors said that the new SRS was more cost effective and available in distance teaching using WI-FI. The authors gave an example that a teacher remotely taught a class by using digital blackboards and two-way video while his students were at another physical location, which was 2,291 kilometers away. In addition, they also reported an increase in students' motivation.

However, some studies revealed users' negative feedback on usability and several drawbacks of using PDAs to assist learning. Some of the major complaints about PDAs are the physical attributes, such as size (for both screen and the actual device), weight, display, and storage space. For example, participants in Churchill and Churchill's (2008) study complained that the small screen made the content impossible to read. Another drawback is the software application. Research shows that some students were frustrated with learning how to use the devices even before the actual tasks were assigned. Plus, a lack of sufficient features, such as cut and paste, decreased the perceived usefulness for students (Hackemer & Peterson, 2005; Smørdal

& Gregory, 2005). Corlett, Sharples, Bull, and Chan (2005) conducted a study to investigate the usability, usefulness, impact, patterns and students' attitudes towards using PDAs to assist learning. After a ten-month trial, the authors found that limited memory, small screen size, wireless connectivity and software usability were the main limitation for participants with the tools provided. Also, the results did not indicate PDA usage assisted learning greatly.

These drawbacks, however, seem no longer to be issues with a typical characteristic of mobile learning, which is the rapid updating of digital devices. For instance, very much like the fate of other digital devices, PDAs were quickly replaced by newer version of mobile devices with more advanced technology. On June 29th, 2007, Apple Inc. released the first generation iPhone featuring multi-touch screen with a virtual keyboard. Later on April 3rd, 2010, Apple Inc. launched the first generation of a multi-touch touch screen digital tablet, called the iPad. During the same year, K-12 schools and colleges started to adopt iPads into their curricula across the United States. Later, according to the Chicago Tribune's news on April 6, 2011 ("N. Ind.", 2011), all second graders at a northern Indiana school would have an iPad to assist their learning within the next year. Until this point, research on this innovative technology was mainly focused on the usability of the devices (DiVall & Zgarrick, 2014; Kaganer, Giordano, Brion, & Tortoriello, 2013; MacLeod, 2015; Sloan, 2012), design of activities compatible with the devices (Kucirkova, 2014; Marin, Hargis, & Cavanaugh, 2013; McMahon, 2014) and users' perception towards using these devices (Gabarre et al., 2014; Mang & Wardley, 2013; Rossing, Miller, Cecil, & Stamper, 2012).

A few years after iPhones and iPads were released, the market now has smartphones and tablet-computers with more varieties and lower prices. For instance, in addition to the Apple iOS, there are more operating systems for mobile devices, such as Android and Windows 8/10.

With each operating system, one has a number of options in terms of choosing the tablet best suited for them. Some of the devices even have a two-in-one feature, so the device can be used as a tablet and/or a laptop based on users' preference. Not only are there more options in choosing devices, the number of people who own mobile devices has been rapidly increasing. Recently, based on a survey conducted in the period of 06/10/2015 to 07/12/2015, the Pew Research Center reported that 68% of Americans ages 18 and older have a smartphone, and 86% of the owners are younger adults ages 18 to 29. They also reported that 45% of American adults have a tablet (Anderson, 2015). Meanwhile, the International Telecommunication Union (2015) also reported that "mobile broadband is the most dynamic market segment; globally, mobile broadband penetration reaches 57 percent in 2015, a value that increased 12 times since 2007" (p. 2). Newly developed technology enhanced the usability for mobile devices and eliminated the physical drawbacks of the previous devices. It also increased creativity and curiosity for users in exploring the possibilities for adoption in a learning environment.

Regardless of the improvement of newer devices and the benefits of mobile learning, Vogel, Kennedy, and Ron (2009) argued that although educators could modify their curricula to be more compatible with mobile learning and institutions could equip students with more advanced mobile devices and applications with technological support, it still would not guarantee students' willingness to use provided mobile devices to achieve meaningful learning. This argument is based on a study Vogel et al. conducted in The City University of Hong Kong where three cohorts of 800 students were assigned PDAs for activities, such as downloading/uploading materials and taking quizzes. The authors concluded uncertainly in response to the question of whether or not mobile device applications lead to learning.

Similarly, from a formative assessment perspective, Chu (2014) conducted a study to examine the negative effects of mobile learning on students' learning achievement and cognitive load. The sample of this study consisted of 64 fifth graders in a course of required in-field learning activities. Chu assigned 33 PDAs to the experimental group and distributed a pre-test and post-test for both experimental and control groups. Results indicated that students learning without PDAs performed better than the ones learning with PDAs. The author also found that the experimental group students had a heavier cognitive load than the ones in the control group. In discussing the results of the study, the author proposed that the heavy cognitive load might be caused by poor lesson design.

The pedagogical limitation in mobile learning has been addressed in several studies (Cheon, Lee, Crooks, & Song, 2012; Hwang & Chang, 2011; Y. Park, 2011; Sharples et al., 2007; Wang et al., 2009). Cheon et al. (2012) gave an example of how mobile devices can interrupt class progress and distract students. However, in this example, it is not the devices that interrupt classes and/or distract students. Before any mobile devices had been created, students in class would also be distracted by passing notes on a piece of paper to each other, or they would interrupt the class for various reasons, such as misbehaving students or defective instructional materials. Park (2011), on the other hand, claimed that the pedagogical limitation of mobile assisted learning is mostly caused by the lack of a theoretical framework to guide instructional designs. He said that there is no original theory to conceptualize mobile learning, and current researchers are looking to adopt existing learning theories to analyze mobile learning. Sharples et al. (2007) are developing a theory of mobile learning based on activity theory and conversation theory, which examines how mobile learning affects learning, and vice versa. Their developing work is, at this point, not yet a theory, but a framework that attempts to illustrate the concept of

mobile learning (Wali et al., 2008). Nevertheless, it is established that mobile learning is not well conceptualized and the design of pedagogy limits the adoption of mobile learning in the classroom.

Therefore, the majority of the adoption of mobile learning occurs outside of the classroom based on students' own preference; a large number of studies focus on investigating students' acceptance of mobile learning by using different theories and models. Wang et al. (2009) demonstrated the unified theory of acceptance and use of technology (UTAUT). It is a unified model that merged eight different models to analyze the acceptance of mobile learning. Those theories are the theory of reasoned action (TRA), the technology acceptance model (TAM), the motivational model (MM), the theory of planned behavior (TPB), the combined TAM and TPB (C-TAM-TPB), the model of PC utilization (MPCU), the innovation diffusion theory (IDT), and the social cognitive theory (SCT). All the theories and modes listed are used to investigate why students choose to adopt a certain type of technological device.

Among those theories and models, the TAM has been used to predict the technology acceptance behavior in a number of studies. In 1989, based on the theory of reasoned action, Davis, Bagozzi, and Warshaw (1989) proposed TAM to investigate one's behavioral intention to accept the use of technology. It was initially targeted for the use of technology in the workplace, researchers then applied it to study mobile learning acceptance. The main goal of TAM, according to Davis et al., "is to provide a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions" (p. 985). They proposed that people's computer acceptance is heavily based on the perceived usefulness and perceived ease of use. Researchers have been successfully using TAM to illustrate the intention of adoption of mobile devices and

perceptions of using such devices in the field of education (S. Park, Nam, & Cha, 2012; Shin & Kang, 2015).

In addition to perceived usefulness and perceived ease of use, Davis, Bagozzi, and Warshaw (1992) employed motivation theory to explain another indicator of workplace technology adoption. They categorized two indicators of technology acceptance in the workplace based on the dichotomy of extrinsic and intrinsic motivation, where perceived usefulness is considered as extrinsic motivation and enjoyment is considered as intrinsic motivation. They conducted a study among 200 MBA students in a midwestern university to investigate their intention of to use computers and the output of their usage. The results indicated a positive relationship between usefulness/enjoyment and system usage; they also concluded that both usefulness and enjoyment affected the intentions of perceived output quality and perceived ease of use greatly. Although this study was originally conducted for the workplace, one can generalize the motivation model in educational settings by analyzing motivation theory in the field of education.

Learning Motivation

In the field of education, understanding what motivates students to learn better has long been a goal for educators. It makes sense that once educators determined students' motivation to learn, they would be able to create and implement curriculum that has all the elements to motivate students. In order to do so, one has to find out what motivation is. Psychologically, motivation is often defined as the drives and desires that lead people to perform a particular behavior or sequence of behaviors (Cheng & Yeh, 2009; Deci & Ryan, 1985b; Franken, 1994; Ormrod, 2008). By studying this topic, researchers learned that motivation is not a unitary phenomenon (Ryan & Deci, 2000). Instead, according to previous research, there were a number

of motivation theories that demonstrated from where motivation derives and how one could manipulate various elements in order to motivate their target. There are a lot of well-developed motivational theories in the field of psychology and education. Some of them are more often cited in the field of educational psychology. Below are three examples of motivation theories in the use of classroom settings. By discussing those theories, one might be able to understand better why it is important to use motivation theory as a guide to understand what motivates students to learn.

The Reinforcement Theory

Thorndike (1898) was one of the first theorists who proposed the illustration of human behavior. He suggested that when a situation occurred, there would be outcomes followed by the situation. If the outcomes satisfied people's needs, it would most likely recur. However, if people have feelings of discomfort and/or dissatisfaction, this situation would be less likely to recur. Later on, Clark Hall introduced the concept of need, or as he would state, "drive state" (Ericksen, 1974, p. 99-100). Hall believed that reinforcement requires a motivated learner. Yet, it was B. F. Skinner who took reinforcement into instruction and analysis of behavior. Skinner (1974) claimed that motivation is derived from the environment and behavior is determined by its consequences. Based on the consequences, there are positive and negative reinforcers. The former increases the probability of behaviors while the latter decreases the probability. For example, Skinner was able to teach pigeons to play Ping-Pong by using positive reinforcement, which was to feed the pigeons when they acquired a certain sequence of playing Ping-Pong (Stipek, 1998).

With the differentiating of positive and negative reinforcement and his experiment of changing behavior, Skinner (1971) established his theory of operant conditioning. The theory

demonstrates how to manage and change behavior based on three assumptions: positive and negative reinforcement and the schedule of reinforcement. The schedule of reinforcement refers to the ratio and interval of reinforcement, also known as the frequency and timing of when reinforcers occur. For example, ratio determines whether a student gets a test and/or bonus points from the teacher. Timing decides if this student will get feedback from his/her teacher immediately after the test.

To apply the reinforcement theory into the classroom, students can be motivated in two ways. One is through receiving positive reinforcement. For instance, by observing a student's behavior in class, the teacher gives the student one bonus point adding towards the final grade. The other way is negative reinforcement. Say a student behaves poorly in class, the teacher might threaten to have a meeting with a student's parents or take one letter grade down from his/her final grade. However, while the reinforcement theory is one of the most popular motivation theories teachers adopt in class, it also has received a large number of critics over the years. One of the major critiques is that the reinforcement theory fails to acknowledge the role of cognitive process in learning. Chomsky (1959) argued that Skinner's theory supports low-level and intuitive behaviors, however, the human brain requires deep and complex information processing skills, and those skills can not be easily generated nor mirrored.

Self-Determination Theory

The self-determination theory (SDT) emphasizes people's inherent growth and innate psychological needs (Deci & Ryan, 1985b). Instead of seeing motivation as a unitary concept based on the form and quality of motivation, Deci and Ryan (1985b) argued that one may categorize human behavior based on three different motivation styles: intrinsic motivation, extrinsic motivation, and amotivation. Intrinsic motivation moves people to do things without

external rewords. Rather than performing a task to achieve certain goal(s), people do it out of interests and the outcome by doing such task will ultimately satisfy their internal needs (e.g., watching TV, writing in a diary, reading a novel).

Unlike intrinsic motivation, extrinsic motivation means one performs certain tasks to achieve the separable outcomes and the external rewards. For example, one studies for a test in order to obtain a better grade. However, the SDT suggested that there are various degrees of extrinsic motivation based on its autonomy. The first one, which is also the internalized one, is called external regulation. At this stage, motivation is purely driven by rewards/punishments (e.g., a student gets bonus points if he/she completes extra items in a test). The second type of extrinsic motivation is called introjection. It shows that not only do people perform a task based on external factors, they also do so to enhance their ego so that they would feel proud rather than guilty (e.g., one goes to a gym to work out, and one might feel bad about themselves if it was not done). The third type is called identification. Compared to the previous two, this one is more autonomous. At this point, people do things because they value the outcome and the self-endorsed goals (e.g., one wants to do an internship in a large firm because this will make his/her résumé look really good). Finally, the most autonomous type is called integration. It occurs when a person fully internalized reasons for doing a task then performs such task by choice (e.g., a college graduate student decides to go to graduate school because he/she believes an advanced degree will lead to higher income in the future).

Based on their SDT theory, Deci and Ryan (1985a) further hypothesized that people tend to orient in one of the motivation types. Those orientations can be measured in strength so that one can predict individual's affects, cognitions, and behaviors accordingly. Deci and Ryan

named the orientations as Causality Orientations. Evidently, there are three types of Causality Orientations and they are, autonomy orientation, control orientation, and impersonal orientation.

"The autonomy orientation involves a high degree of experienced choice with respect to the initiation and regulation of one's own behavior" (Deci & Ryan, 1985a, p. 111). Autonomy orientation people tend to have higher intrinsic motivations on things they want to do, and they most likely will self-determine their own external rewards that will meet their self-expectancy. For example, when an assignment is assigned in class, people with autonomy orientation tend to be more actively involved. They might plan ahead and finish the assignment before due date. They might also seek other effective tools to assist completing the assignment productively.

A person with control orientation tend be motivated by external rewards such as deadlines, structures, ego-involvements, and other controls. According to Deci and Ryan (1985a), sometimes, not only might a person with control orientation be driven to do things with real or imagined controls, they might also do things oppositely from the demanding results just for rebelling against the controls. For instance, students with control orientation tend to be motivated by due dates when they have assignments. Or they might be motivated by the negative consequences such as, fail the class, not able to graduate, and judgments from parents or the instructor.

People with impersonal orientation tend to believe that it is almost impossible to achieve desired outcomes. They think there is no efficient way to regulate their behavior to accomplish what is demanded with or without any external rewards. Impersonal orientation also shows in individuals with depression about a current situation and anxiousness of new situations. In classroom settings, students with impersonal orientation tend to be very anxious about an upcoming test and/or depressed about not being able to complete their current assignment or

project. They might also worry that they will never be able to finish the program successfully. Impersonal orientation students may have to force themselves to complete an assignment instead of personally intended to do so.

To measure the strength of each orientation, Deci and Ryan (1985a) developed the General Causality Orientations Scale (GCOS). There are two forms of GCOS, the original scale has 12 vignettes and 36 items. Each vignette describes a social or achievement orientation situation followed by three types of responses. There is another 17-vignette and 51-item version of GCOS. In this study, the original 12-vignette scale and the detailed discussion were used and are discussed in Chapter 3 under instruments.

Social Cognitive Theory

Social cognitivists agree that reinforcement and punishment have great influence on people's behavior; however, they do not agree that behavior is entirely based on external inference (Bandura, 1986). In addition, Bandura and Walters (1963) pointed out that an individual's personal factors also determined their behavior, such as, an individual's ability to imitate others. For instance, when one sees the other get positive reinforces, he/she will do the same thing in order to get the same or better reward.

In the social cognitive theory, personal factors, such as self-efficacy and self-regulation skills, are valued. According to Bandura (1977), self-efficacy refers to an individual's personal judgment of his/her ability to perform certain tasks or to achieve certain goals. Self-efficacy could be affected by "actual experience, vicarious experiences, verbal persuasion, and physiological arousal" (Stipek, 1998, p. 42-43).

In a classroom scenario, a student feels he/she will get a good grade only if he/she had good luck or got help from others. Also, as discussed above, a student would be more willing to

do the same task until he/she observed one of his/her peers had done the same task. Verbal persuasion may be found in situations where teachers or others say encouraging words to students who are hesitant to perform a task. As for physiological arousal, a student who has physical reactions because of physiological factors, such as shaken body because of anxiety, may affect his/her performance negatively.

Another social cognitivist, Atkinson (1964) proposed his expectancy x value theory in which he believed that expectations and emotions are also important variables of influencing one's behavior. To illustrate, he suggested that whether or not a person approached a task was determined by his/her expectations to accomplish the task and, at the same time, his/her fear of failure. According to Atkinson's formula, if one's expectation overcomes his/her fear, one would be more likely to approach a task.

The Millennials

The majority of previous studies on mobile learning took place in colleges and universities, and most of their participants were college students. Today, most college students are Millennials. Millennials were born between 1980 and 2000. They are the first generation to grow up with digital technology (McGlynn, 2005). According to Tapscott (2009), there are eight norms that form the unique characteristics of Millennials. These norms are freedom, customization, scrutiny, integrity, collaboration, speed and innovation. First, Millennials are eager for freedom, flexibility and variety. They have grown up with technology, especially the Internet, which allows them a variety of choices in many different areas of interest. This habit of freedom, flexibility and variety has been extended to their expectations for future work. Second, customization is the key for the Millennials. They want to express their uniqueness through personalizing a product or even their jobs. Also, based on the large amount of information that

the Millennials are exposed to, they have developed a system to search, verify and filter information before they make decisions. In addition, Millennials are confident and honest in many ways. However, at the same time, they have different points of view than other generations on whether or not downloading or self-sharing music for free is a kind of stealing. Further, Millennials like to share, they love group work and they also enjoy being a contributor for a project. They also believe that no matter what they do, it should be fun. Moreover, Millennials are impatient and they prefer living with a fast pace. Meanwhile, they are creative and innovative. Howe and Strauss (2007) say the Millennials are special, sheltered, confident, team-oriented, conventional, pressured and achieving.

Millennials as Learners

"In the fall of 2000, the first Millennials came to college" (Howe & Strauss, 2007, p. 3). Due to their unique characteristics when compared to other generations, researchers of generational studies have paid attention to the digital natives. Tapscott (2009) pointed out that while this generation has been entering college in massive numbers, the dropout rate remains a big problem in most schools. He suggests that teachers should focus more on students and be more interactive with students. Also, Tapscott proposed a more customized and collaborative instructional method than the one-size-fits-all method. From a librarian's point of view, Becker (2009) analyzed Millennials' research habits by viewing them in various contexts. In addition, Becker conducted a study on how faculty view their Millennial students in the classroom. The results indicated the need of learner-centered, practical, and inclusive methods when teaching the Millennials. However, there was little implication of the necessity of using technology in experiential learning. Then, Becker suggested that the myth that Millennials are experts at using technology because they were born with it should be broken, because the reality is that some

Millennial college students do not even know how to send an email with attachment(s). Considine, Horton, and Moorman (2009) argued that most educators are not aware that Millennials may bring a variety of literacy practices and backgrounds because of digital technology. Therefore, they introduced a model called text, audience, and production (T.A.P.). They believe that this model will benefit the Millennial students to "question, analyze and authenticate information" (Considine et al., 2009, p. 475).

The Use of HPDs among Millennials

Bennett, Maton, and Kervin (2008) examined previous empirical studies on the actual degree of technology literacy of today's Millennials, who are considered the digital natives. They found mismatches between the ability of using technology that some researchers have claimed Millennials have and limited competency in technological literacy in general. Becker (2009) also supported this finding.

Another important characteristic of how Millennials use technology is their obsession with mobile phones, especially the function of text messaging. On March 27, 2011, Boston.com reported an interesting story about a tenth-grader who sleeps with her cell phone under her pillow, because she did not want to miss any important text messages such as a friend who broke up with her boyfriend (Teitell, 2011). In this example, the teenager believed it to be imperative for reading her text messages immediately, even if this meant being awakened from sleep. To some people, this might be really difficult to understand since there was no indication of emergency. The degree of emergency might be different depending on different people. Nevertheless, there were reports about how people's thumbs swelled or they were injured because of texting, or people fell on the floor while walking and texting at the same time. According to the "Media Universe" report from Nielsen.co, there were 223 million people over

the age of 13 who are mobile phone users in the United States and 66% mobile phone users send text messages ("Media Universe", 2011). In addition, the report divided the population of text message users by age group; it showed that people from the age group of 13-17 sent the most text messages per month (3,705) and people who were from age 18 to 24 sent the second most text messages per month (1,707). Richardson, Littrell, Challman, and Stein (2011) acknowledged the importance of text messaging as a means of communication. In that study, the authors took advantage of cell phones' availability and cost effectiveness in enhancing particular course content. The results showed that text messaging was successfully adopted into this particular course and students were motivated by this means of communication.

As one of their basic characteristics, Millennials are excited about using and spreading the word about new gadgets and technologies (Prensky, 2006). I found limited studies performed on the latest technologies using HPDs. More importantly, it has been indicated that few of the previous studies investigated using HPDs as a means to assist learning are significantly related to students' learning motivation.

Personalized Learning

Personalized learning is no stranger to the field of education. In retrospect, in the 1960s, Keller (1968) developed the personalized system of instruction (PSI), which allowed students to study at their own pace and go after new material after mastering previous ones; it also suggested that lectures and demonstrations should act as "vehicles" of motivation (p. 83). The principles of Keller's PSI seem quite similar to the ones that constructivists suggested. Today's educators are still trying really hard to follow the characteristics of the PSI approach in the classroom. For example, currently, a typical university instructor imght have his/her students discuss a topic previously assigned instead of giving lectures. Following the class discussion, the instructor

might ask for written work and then have students peer evaluate the work. However, even though university class size is relatively small, instructors seldom let students work at their own pace due to the need to proceed with lesson plans.

In addition, it was the humanists of the 1970s who suggested that traditional education was "dream killers" for students (Silberman, 1970, p. 10). Therefore, Glasser (1969) indicated that education should be more humanistic, affective, and individualized. He went to illustrate that in order to genuinely acquire and exchange knowledge, one should at first acknowledge and foster individuality. At the same time, Foshay (1970) concluded that individuality should always be taken into account for instruction and learning.

So far, it looks like for the last few decades, personalization and individualization have been interchangeably used across disciplines. However, for the purpose of this study, and based on current understandings of personalization, it is acknowledged that personalized and individualized, or their other variation, are not interchangeable; they are distinctive. Individualized learning requires tailored curricula that fit everyone's needs. Such curricula may fall into capitalism and consumerism (Campbell, Robinson, Neelands, Hewston, & Mazzoli, 2007; Hartley, 2007). From my point of view, personalized learning in this context is to allow learners to determine the learning objectives in addition to the ones determined by the instructor. Also, personalized learning performs best when learners are completely in control of their own acts.

Learning Styles

No one would assume that different people would look, think, and/or behave in the same way. In a traditional classroom setting, the same instructor delivers the same content to a group of students by using exactly the same instructional method(s). By the end of the instruction,

students are going to achieve the same goal, which is to obtain the highest score possible. Unfortunately, not every student can achieve the same goal within such context. According to Keefe (1987), in the process of learning, each student has a unique combination of cognitive, affective, and psychological factors that indicate how they perceive, process, and apply to the learning environment. Such combination of characteristics is called learning style. Besides Keefe, a number of researchers have been studying how to identify different learning styles and how to apply them to facilitate effective learning.

The study of learning style arises from the theory of cognitivism. Cognitivism is the study of the mind. The focus of the theory is how one perceives, stores, and retrieves information received. In the early 60s, during the process of looking for answers, cognitivists were aware of the differences that exist among individuals and thus began the study of individuality (Kolb, 1984). The study led researchers to re-examine the process of learning. Curry (1983) redefined several terminologies including learning, learning style, instructional preference, and more. She defined learning style as "the general area of interest concerning individual differences in cognitive approach and process of learning" (p. 3). Curry also proposed the onion theory. The theory categorized different models and instruments of measuring learning style by drawing an analogy that measurement of learning style is like the layers of an onion. The outermost layer is called instructional preference, the second layer is called information process style, and the third one, which is also the innermost layer, is called the cognitive personality style. Later, Curry (1987) added a fourth layer, inserted between instructional preference and information process style. The deeper the layer gets, the more stable the characteristic is. Researchers developed several models and instruments to measure learning style based on the theoretical foundation of the onion theory.

Keefe and Monks' Learning Style Profile (LSP) measures cognitive personality style, instructional preference and social interaction. This model is an assessment tool that has 126 items for secondary students (Keefe & Monks, 1986). LSP assesses cognitive skills (information process), perceptual response (various stimuli), and study and instructional preferences (personal preference on motivational and environmental activities). LSP "was based on the premise that cognitive skills development is a prerequisite for effective learning" (Riding & Rayner, 1998, p. 75). However, according to Riding and Rayner (1998), LSP is significantly correlated with other instruments such as Dunn, Dunn and Price's (1989) Learning Style Inventory. Curry (1987) reported the limited evidence on both reliability and validity of LSP.

The Dunn, Dunn and Price Learning Style Inventory (LSI) has a 100 item questionnaire, and it is based on Dunn et al.'s (1989) learning style theory, also known as the VAK learning model. According to Dunn et al., learners learn differently by receiving information via different sensory channels. During the process of receiving information, environmental, emotional, sociological, and physical factors are key indicators of how learners receive information. Based on these effects, they illustrated three different types of learners. The first one is the visual learner. Visual leaners learn by seeing. They think in pictures and like to read. Often time, visual leaners obtain contents by observing, drawing, and/or writing. The second one is the auditory leaners. Auditory learners learn by hearing. They are sensitive to rhythm and outgoing. Usually, auditory learners prefer to read contents out aloud in order to master it. And written words may be difficult for them. Finally, there are kinesthetic learners. Kinesthetic learners learn by doing. They like physical activities and prefer practice than theory. Mostly, kinesthetic learners acquire new content by relating it to real life experience. It is also important to know that Dunn, et al. stressed that learners might use different styles for different tasks and learning styles also would

be changing from childhood to adulthood. Curry's (1987) review tested the LSI's reliability and validity.

Gregorc Style Delineator (GSD) focuses on cognitive personality (Gregorc, 1982). Based on the Mind Styles theory, Gregorc proposed the GSD to differentiate learning styles, and demonstrated four mind styles including the concrete sequential (CS), abstract sequential (AS), abstract random (AR), and concrete random (CR). For CS learners, learning should be sequential and organized. They prefer hands-on projects and step-by-step instructions with concrete materials. AR learners, however, prefer learning in an unstructured environment and collaboration. They often enjoy multi-sensory experiences and stress the importance of their feelings and emotions when tackling a task. AS learners learn by reading and listening. They prefer written words and reflective thinking and they often have great verbal skills and are highly skeptical about new ideas. CR learners like to take risks and solve problems. They tend to work individually or in small groups and prefer to experiment with new ideas. The GSD is an inventory that has 40 items of ranking orders of words. Riding and Rayner (1997) tested GSD's validity and reliability.

Kolb (1984) proposed the Kolb's experiential learning model (ELM) with the Learning Style Inventory (LSI) as its instrument. The ELM is a four-stage interactive learning cycle that represents four different ways of processing information, namely concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). To illustrate, CE means learning by experiencing and feeling. RO requires learner to reflect and learn by watching. AC indicates learning by thinking where conceptual and analytical thinking takes place in processing information. Finally, AE shows learning by doing. Based on the four information processing types, ELM forms two-dimensional learning, including prehension and

transformation. The prehension dimension contains ways in which information is grasped from experience, while transformation relates to how learners transfer information. Learners grasp experience either via apprehension, such as feelings, or comprehension such as concepts. Learners transfer information either via extension or intention. By further analyzing these two dimensions, Kolb introduced the four learning styles, including the divergent (CE/RO), the convergent (AC/AE), the assimilative (RO/AC), and the accommodative (AE/CE). Divergent learners rely mainly on concrete experience and observation. Convergent learners prefer to conceptualize the immediate experience abstractly to perform active processing. Assimilative leaners rely on their observation and develop theories that explain the reality. Accommodative learners rely on concert experience and hands-on experience.

Felder and Silverman's (1988) Learning Style Model distinguished four dimensions of learners' preference of learning styles based on how learners process information. The first dimension is about processing information and there are active and reflective learners. Active learners learn by applying and doing. They prefer working with large groups and communicating with others. And reflective learners learn by thinking and reflecting. They tend to work alone and are less willing to participate than active learners in class. The second dimension deals with students' perception, and there are sensing and intuitive learners. For sensing learners, facts and concrete content will help them learn better, while intuitive learners like abstract content. Also, sensing learners are more detail oriented while intuitive learners are more innovative. The third dimension covers input information, and there are visual and verbal learners. Visual leaners learn with what they see and verbal learners learn with writing and speaking. Finally, the fourth dimension categorizes learners' understanding, and there are sequential and global learners. Sequential learners learn by specific steps that are provided. They solve problem in a linear

process. However, global learners tend to see the big picture, and the process of their understanding is just like finishing a puzzle. Global learners cannot work with materials that they understand partially like the sequential learners do. Felder and Soloman (1997) designed and developed the Index of Learning Styles (ILS) to detect learning styles described in the Felder and Silverman Learning Style Model. ILS is a 44-item questionnaire, and it was placed on the World Wide Web in 1996 to allow users to submit and have the questionnaire scored automatically. Felder and Spurlin (2005) tested ILS's reliability and validity.

With the development of instructional technology and online learning, researchers are now paying more attention on how to associate learning style with facilitating effective online learning. Roy (2006) conducted a study to exam whether or not learning styles have a positive effects on interactivity in asynchronous e-learning. The study had three parts: expert interviews, surveys, and literature review. A review of literature indicated no significant relationship between learning styles and student performance. Distant learning experts from the interview section suggested that developing online courses should only ground in learning theories and instructional design principles. They believed that matching students different learning styles was not practical, and the best way should be speaking to different learners without compromising the basic instructional design principles. Although survey results indicated that students preferred to have choices of interactions with their instructor, the author still concluded that learning styles had little effect on interactivity in asynchronous e-learning; and he suggested that as long as the instructional design is sound, it should benefit most students.

By reviewing previous related studies on learning style-based adaptive educational systems (LSAES), Popescu (2010) reached a distinctively different conclusion than Roy (2006). Popescu pointed out that previous studies on how learning styles affected learning process in

technology-enhanced environments were confusing, and it was important to further investigate this topic and take more variables into consideration. Therefore, the author presented a study that contained a dedicated system called the web-based educational system with learning style adaptation (WELSA) and a learning model called the unified learning style model (ULSM). Sixty-four undergraduate students participated in this study. Participants spent the first two hours on WELSA without adaptation. Then, they were randomly assigned to two different groups, one with matched learning styles and the other with mismatched learning styles. The participants also took a survey after finishing both sessions. Popescu concluded there was a positive relationship between matching learning styles and students' performance.

Lu, Jia, Gong, and Clark (2007), also believed that previous research on learning styles and learning outcomes were "confusing" (p. 188). Some findings suggested that matching students learning styles during teaching would improve students' performance. However, there were studies that reached the conclusion that learning styles had nothing to do with students' performance. Thus, the authors determined to find out if learning styles matters in terms of students' performance. They also wanted to see if students behaved differently with different learning styles in an online course. The authors conducted the study in a university computer laboratory and 40 third-year undergraduate students participated. The authors divided participants into four different groups based on their learning styles. Later, the authors assigned 120 minutes to participants to design an animation using Flash. The authors observed and recorded participants' discussion time, observation time, reading time, and designing time while they worked individually and/or collaboratively. The results indicated that learning styles only affected discussion and reading time; and there was no significant relationship between learning styles and learning outcomes

Lai, Wang, and Lei (2012) conducted a study to determine what factors impact students' use of technology for learning. They designed a survey that mainly focused on exploring the roles of students' perceived usefulness and attitude, educational compatibility, facilitating conditions, and computer self-efficacy play in adopting technology for learning. There were 264 valid questionnaires collected through self-select sampling. Results suggested that among all the tested variables, students' attitude towards using technology plays an "unignorable" (p. 575) role, while perceived usefulness and computer self-efficacy were less powerful. The results also indicated that students will mostly likely adopt technology-assisted learning if it fits their learning style.

Summary

A review of literature shows that mobile learning has become a trending topic in the field of education. In the process of adopting mobile learning into current college pedagogy, all stakeholders, including educators, students, instructional designers, and institutional personnel, are facing several obstacles, such as the ever changing innovation of devices, lack of theoretical support for pedagogical development, and sustainability of mobile learning models for the leadership to consider. It is obvious that at the stage, mobile learning is informally adopted by students outside of the classroom. Educators have to ask what determines students to accept mobile learning as a part of their educational experience and if this experience matters in terms of in-class formal learning.

CHAPTER 3

METHODOLOGY

The main goal of this study was to examine the relationship between learning styles and Millennial students' adoption of HPDs to facilitate learning outside of the classroom. The second goal was to identify Millennial students' learning behaviors of using HPDs to assist learning. The third goal was to discover the relationship between the levels of motivation towards learning a subject and the frequency of using HPDs to facilitate learning on the subject outside of the classroom. Furthermore, this study explored the current use of mobile devices among Millennials, including the types of activities they perform with their choice of mobile devices and the time they spend on using those mobile devices.

Research Questions

1. What educational activities do Millennial students perform using HPDs to assist learning outside of the classroom?
2. Is there a relationship between types of HPDs adopted for facilitating learning outside of the classroom and the Millennial students' learning style?
3. Are there significant differences between motivation orientations on frequency of HPD usage to assist learning outside of the classroom?

Null Hypotheses

1. There is no relationship between type of HPD adopted and student's learning style.
2. There is no significant difference across motivation orientations on frequency of HPD usage to assist learning outside of the classroom.

Design of Study

Participants

The study utilized a convenience sample of undergraduate students who were born between the years of 1980 and 2000, and were enrolled at Indiana State University (ISU) as full-time students. ISU is a comprehensive four-year, medium sized, state-supported university that offers doctoral, graduate and undergraduate degrees. All current ISU undergraduate students who were born between the years of 1980 and 2000 were considered as potential participants to be selected for this study. The detailed participant selection process is discussed in the procedure section below. A brief demographic overview, including gender, age, and years of program, is presented in Chapter 4. All participants had to have access to at least one of the HPDs discussed in this paper. Each participant was entered into a raffle for one of ten, $50 gift cards.

Instruments

A survey was created to identify participants' demographic information and usage description of HPDs. There were 12 questions in the survey, in which the first three questions, including two multiple choices and one drop-down list question, identified participants' gender, academic level, and age. One multiple choice, one matrix table, one open-ended question, and one drop-down list question were presented to identify participants' current adoption of HPDs, types of educational activities performed by using HPDs, and frequencies of use of HPDs for educational/ non-educational purposes. Difficulties and issues that participants had with using

HPDs for educational purposes were asked via a multiple choice question. Two additional questions specifically asked about access of Blackboard Learn® with HPDs. The data for the last drop-down list question regarding participants' preference of possible formal adoption of HPDs in class was used only as a reference in this paper. The survey is available as Part I in Appendix A.

Felder and Soloman's (n.d.) Index of Learning Styles (ILS) was used to identify the learning style of each participant. The possible results were active and reflective learnings, sensing and intuitive learners, visual and verbal learners, and sequential and global learners. Each participant might have a tendency towards a specific learning style in each dimension, or they might be balanced on all dimensions. Felder and Soloman created the ILS in 1991 based on the Felder and Silverman learning style model in 1987 (Felder & Soloman, n.d.). The ILS is a web-based, self-administrated, and automatically scored questionnaire containing 44 items. For each item, participants have to choose from answers *a* and **b** to a sentence, and final answers are calculated from the 44 items to assess preferences on four dimensions. Felder and Spurlin (2005) conducted a study to test the validity and reliability of ILS. In their study, the authors used Cronbach's alpha to test the reliability for ILS and scored a range from .41 to .76; test-retest correlations were from .50 through .87. The results supported the reliability ILS. They also found that the instrument is correlated with various theoretically related constructs. The survey appears as Part II in Appendix A.

The General Causality Orientations Scale (GCOS; Deci & Ryan, 1985a) was used to assess participants' three different motivational orientations, namely, autonomy, controlled, and impersonal orientations. The GCOS describes 12 different scenarios, such as social interaction and/or new job expectancy; those scenarios are called vignettes. Under each vignette, there are

three types of responses that correlate with the three types of motivational orientation. For each type, participants have to give their choices on a 7-point Likert-type scale. Administrators of the GCOS obtain a copy of a key for individual styles responses, and marks a specific motivational orientation for each item under the 12 vignettes. By giving answers to all the 36 items, each participant receives a total score corresponding to each type of motivational orientation based on the highest score received for each type of orientation. This study used the motivational orientation in which participant scored highest as a variable. Deci and Ryan (1985a) tested the reliability and validity of GCOS, and it scored about .75 for the Cronbach alpha and .74 over two months for a test-retest coefficient. They also found that the instrument is correlated with various theoretically related constructs. The GCOS is available in Part III of the survey found in Appendix A. All instruments were distributed via Qualitrics, an online survey tool. The authors were contacted for permission to re-create the surveys and administer the surveys through Qualtrics.

Procedure

This research study was designed to investigate whether learning styles affect Millennial students' adoption of HPDs to assist their learning. ISU has a Foundational Studies (i.e. general education) course requirement called an upper division integrative elective (UDIE) required of all students and taken by students with at least 45 earned credits. After obtaining approval from the Institutional Review Board, a list of students and their email address who were registered in all UDIEs, along with the associated faculty, was obtained from the Office of Registration and Records. An email invitation to complete the survey was sent to the students. Another email was sent to the instructors to inform them about this study and offer to answer potential questions. The emails explained the nature of this study, provided informed consent information, and

explained how they could provide separate information if they chose to enter the raffle. A link to the survey in Qualtrics, along with a descriptions of the surveys, instruction on how to answer, and how the data was being collected by the researcher were included in the email. A total of 10 winners were chosen from the pool using the random selection function in Excel with the formula. An email was sent to the participants for the confirmation of their prizes.

Data Analysis

To answer Research Question 1, a survey was utilized to collect descriptive data including the current use of mobile devices, types of devices (none, smartphones, tablets, e-readers, PDAs, and others), time spent, frequency of usage, activities, gender, and the availability of instructional tools on their HPDs from participants. The participants were also asked to select a list of educational activities they performed by using selected HPDs outside of the classroom. Activities included, but were not limited to, receiving/sending school emails, accessing course materials, downloading course materials, participating in course forums, working on assignments/projects, and attending virtual classes. Data were collected and analyzed through SPSS as descriptive data.

Next, to answer Research Question 2, Felder and Soloman's (1997) ILS was distributed to participants to determine their learning style tendency. The possible outcomes of this survey were the tendency of preference in four different dimensions: sensing/intuitive, visual/verbal, active/reflective, and sequential/global. A chi square test was utilized to analyze whether there was a connection between learning style dimensions and each choice of HPDs (collected in the descriptive portion). For instance, chi square test was used to test if there is a connection between students with visual learning style and their choice of tablets.

To answer Research Question 3, the GCOS was given to all participants to assess their

general motivation orientation. The possible orientations were autonomy, controlled, and impersonal orientation. Data on the average hours spent on mobile devices for educational purpose per week was collected from question #8 of the survey. A one-way ANOVA was used to test the significance between the independent variable (type of motivation orientation) and the dependent variable (hours spent on using HPDs for educational purposes).

CHAPTER 4

RESULTS

The primary purpose of this study was to examine the relationship between learning styles and Millennial students' adoption of HPDs to facilitate learning outside of the classroom. In addition, Millennial students' orientation of motivation was added as another variable to determine its relationship with how frequently participants used HPDs to assist learning outside of the classroom. Another goal of this study was to identify participants' behaviors, frequencies, and activities of using HPDs to assist learning outside of the classroom.

In spring 2016, a list of email contacts of all ISU students who had taken at least one class required by the Foundational Studies UDIE was obtained from the Office of Registration and Records. There were 8,121 students' emails in that list. A list of email contacts of all the instructors who were teaching at least one of the required courses was also obtained which numbered 272 instructors. Once the study was approved by the IRB, an email with a Qualtrics link to the survey was sent to the students to request participation in the survey. An email explaining the survey and the intentions of the study was also sent to the instructor contact list. Two weeks after the initial email invitation, a reminder email was sent to all students who had not started the survey, and the survey was closed two weeks later. At the time the survey was closed, 712 people started the survey, 680 responses were recorded, and 404 participants completed the survey.

Sample

As seen in table 1, of the 404 participants who completed the survey, 274 (67.8%) were female and 130 (32.2%) were male. As for academic grade level, 120 (29.7%) participants were freshmen, 118 (29.2%) were juniors, 75 (18.6%) were sophomores, and 84 (20.8%) were seniors. There was also one instructor (0.2%), and five graduate students (1.2%) in the participant pool. Since this study targeted Millennial students who were born between 1980 and 2000, participants were asked to answer which year they were born. To exclude those not born in this range, the answer to this question only had a drop down list from 1980 to 2000. The majority of the participants (86.4%, $n = 349$) were born in the 90s, especially the year of 1996 (24.0%, $n = 97$). Missing data shows there were 14 (3.5%) participants who, by definition of this study, were not Millennials.

Data Organization

Data was first downloaded from Qualtrics in Excel format, and then divided into three different parts. The first part was demographics. All 12 questions were analyzed using SPSS, version 24. Among the 404 participants, data from the instructor, and the ones who were not born in the 1980 to 2000 year range were deleted. Therefore, the final number of participants for Research Question 1 was 389.

The second part of downloaded data was learning styles, with the same total number of participants of 389. Based on the answer key of the Felder and Soloman's (n.d.) ILS, participants who scored 9-11 had higher preference in one of the two dimensions and were categorized either active, reflective, sensing, intuitive, visual, verbal, sequential, or global, depending on where the high score fell. These characteristics were discussed in Chapter 2. Those who scored 5-7 on the scale had moderate preference on either of the styles. For the purpose of this study, participants

with moderate preferences were categorized as balanced learners. Also, there were participants who scored 9-11 on more than one dimension and these participants were also categorized balanced learners. There are six types of learning styles in the ILS. In this study, balanced was added to the existing styles. At the request of Dr. Felder (personal communication, February 2, 2016), the scoring of the results cannot be discussed within this document.

Table 1

Frequencies for Demographic Variables (n = 404)

Variable	Category	Frequency	Percentage (%)
Gender			
	Female	274	67.80
	Male	130	32.20
Grade			
	Freshman	120[1]	29.70
	Sophomore	75	18.60
	Junior	118	29.20
	Senior	84	20.80
	Graduate	5	1.20
	Instructor	1	0.20
Year Born			
	1980 - 1985	23	5.70
	1986 - 1990	18	4.50
	1991 - 1995	183	45.30
	1996 - 1998	166	41.10
	Missing	14	3.50

[1] It is noted that 45 credits or more are required to enroll in a UDIE, so technically there should be no freshman enrolled. However, there are a quantity of first-year students who identify as freshman who bring credits to the institution therefore the number is not unrealistic.

The third part of downloaded data was participants' motivation orientation. Based on the scoring key, for each of the 12 vignettes, there were A, B, and C choices, and each answer indicated a tendency toward a certain motivation orientation. For instance, by choosing B for Vignette 1, the participant's motivation tended toward control, while A represented impersonal and C represented autonomy. After completing this survey, participants who had 12 or more As were identified as having impersonal motivation, those who had 12 or more Bs were identified as having control motivation, and those who had 12 or more Cs were identified as autonomy motivation. During the data review process, it was found that some participants scored the exact same numbers for all three choices, and their original data had the same answer to all 12 vignettes. These entries were determined to be invalid data and were not included as part of the analysis for Research Question 3. The usable sample for Question 3 was 314.

Data Analysis

Research Question 1

1. What educational activities do Millennial students perform using HPDs to assist learning outside of the classroom?

To answer question 1, descriptive statistics were generated from question number five to 12 of the survey. Question 5 of the survey asked how often participants use their HPDs for the following activities: receiving/sending school emails, accessing course materials, downloading course materials, participating in course forums, working on assignments/projects, and attending virtual classes. There was also a follow up open-ended question that asked if there were other activities participants did with HPDs that were not included in the list of the previous question. Table 2 shows types of activities and how many times per week participants performed certain activities.

Table 2

Educational Activities Performed With HPDs Among Millennial Students (n=389)

Activities	Frequency (times/week)									
	Never		1-3		4-6		7-9		≥ 10	
	f	%	*f*	%	*f*	%	*f*	%	*f*	%
Receiving/sending school emails	20	5.10	35	9.00	50	12.90	51	13.10	233	59.90
Access course materials	37	9.50	105	27.00	1	0.30	54	13.90	192	49.50
Downloading course materials	111	28.50	109	28.00	66	17.00	39	10.00	63	16.20
Participating in course forums	159	40.90	103	26.50	0	0.0	36	9.30	91	23.40
Working on assign/projects	199	51.20	71	18.30	45	11.60	28	7.20	46	11.80
Attending virtual classes	265	68.10	48	12.30	1	0.30	16	4.10	59	15.20

As shown in Table 2, the most popular activity with HPDs was to receive/send school related emails. Most participants (59.90%, *n* = 233) engaged in this activity more than 10 times per week. Also, 49.50% participants engaged more than 10 times per week in accessing course materials using their HPDs. On the other hand, the majority of participants (68.10%, *n* = 265) never attended virtual classes, such as Blackboard Collaborate, using their HPDs; and most (51.20%, *n* = 199) of them never used HPDs to work on their assignments and projects. Another activity most participants never did with HPDs was participating in course forums, such as Blackboard discussion board. In addition to the listed activities, 268 (68.90%) participants used their HPDs for educational activities that were not listed. The answer for other educational

activities that were not listed in the previous table is presented in Table 3.

Table 3

Additional Educational Activities Performed with HPDs (n=268)

Activities	Frequency	Percentage (%)
Blackboard	5	1.90
Check grades	22	8.20
Look up campus info	9	3.40
Communication for group projects/assignments	24	9.00
Continuing educational credit	1	0.40
Degree audits	1	0.40
Utility tools	26	9.70
Reading	13	8.60
Educational apps	29	10.80
Everything	2	0.70
Google search	68	25.40
Manage school work	23	8.60
Watch class recordings/Tegrity	6	2.20
Take a quiz/test/survey	6	2.20
Take notes (with pictures/voice over)	10	3.70
Working on projects/assignments	5	1.90
YouTube on research topics	4	1.50
In-class participation	1	0.40
Kahoot.it (educational game)	11	4.10
Pinterest (for project ideas)	1	0.40
Teach Chinese students English	1	0.40

According to the results, 68 (25.40%) participants were comfortable using their HPDs to conduct research related to their assignments, projects, and other class related information.

Besides using HPDs to access library materials and other databases, Google scholar was a common tool used for researching academic topics for 68 participants. One of the participants specifically stressed that using HPDs to do a quick search was more convenient than doing so with a laptop. There were 29 (10.80%) participants who described using educational apps, such as Quizlet, Flashcard, Anatomy, DuoLingo, McGraw-Hill, Pearson and Office Suite to assist their course work. Another related activity was Kahoot.it. There were 11 (4.10%) participants who said that they played this educational game both in and outside of the classroom. A total of 26 (9.70%) participants prefer using utility tools on their HPDs, such as the calculator, unit conversion, calendar, dictionary, thesaurus, timer, translator, voice memo and video recording to assist learning. One participant suggested, "Often times, I utilize scientific or engineering calculators, as well as unit conversion tools for course work. This help [*sic*] to decrease the financial burden of expensive materials." Twenty-three (8.60%) participants used HPDs mostly for managing their schoolwork, including scheduling, registration, setting alarms for classes, printing, reminders, and to-do lists. Twenty-four (9.00%) participants use HPDs to communicate with group members for group projects, or share class information and documents by using communication tools such as text messaging and GroupMe. Another frequently mentioned activity was checking grades. Twenty-two (8.20%) participants found it was easier to check grades on their HPDs, and two (0.80%) participants claimed that checking grades was the only activity they did with HPDs. Thirteen (4.90%) participants used their HPDs to read digital textbooks, course related materials, and news. Some participants (3.70%) liked using HPDs to take notes, especially the function of taking notes with pictures or voice over. They said that whenever they have instructors present PowerPoint slides, they would take screen shots of those slides just in case the instructor did not post the slides on Blackboard after class. Only six (2.20%)

participants said that they used their HPDs to take a quiz/test/survey, and five (1.90%) would use HPDs to work on their assignments and/or projects. Other activities that were mentioned in the data were: look up campus information/ISU portal (3.40%, *n* = 9), watch class recording/Tegrity videos (2.20%, *n* = 6), Blackboard (1.90%, *n* = 5), YouTube on research topics (1.50%, *n* = 4), continuing education credit (0.40%, *n* = 1), degree audits (0.40%, *n* = 1), in-class participation (0.40%, *n* = 1), Pinterest (0.40%, *n* = 91), and teach Chinese students English (0.40%, *n* = 1). Two participants (0.70%) said that they did everything with their HPDs.

ISU started to require all instructors to use Blackboard, an interactive online learning platform provided by a third party, to record and report students' grades starting in fall 2015. Some participants have already mentioned they used Blackboard and instructional tools such as Tegrity as parts of their educational activities. Question 11 asked all participants if they ever used their HPDs to access Blackboard. If their answer was yes, they had to select what instructional tools or functions they used. The number of participants who accessed Blackboard with their HPDs and the tools they used were presented in Table 4.

There were 362 (93.10%) participants that accessed Blackboard with their HPDs, and the most accessed information was course materials (78.70%, *n* = 362). A total of 171 (44.00%) participants accessed their regular Blackboard assignments with HPDs, while only 53 (13.60%) accessed Turnitin assignments with HPDs. Discussion board was another frequently accessed tool, 157 (40.40%) participants used it with their HPDs. Wiki and Blog were less often accessed; 31 (8.90%) participants used Wiki, and 43 (11.10%) used Blog with their HPDs. As for virtual interactive tools, using their HPDs, 31(8.00%) participants accessed Tegrity and 47 (12.10%) accessed Blackboard Collaborate at least once. A total of 63 (16.20%) participants used their HPDs to access tests on Blackboard. Besides the activities and tools listed, 66 (17.00%)

participants said that they accessed Blackboard for other reasons. The answers could be categorized into two major parts: checking grades, and checking announcements.

Table 4

Information on Accessing Blackboard With HPDs Among Millennial Students (n=389)

Instructional tool/Activities	Frequency	Percentage (%)
Blackboard	362	93.30
Discussion board	157	40.40
Course material	306	78.70
Tegrity	31	8.00
Blackboard Collaborate	47	12.10
Wiki	31	8.00
Blog	43	11.10
Turnitin assignment	53	13.60
Regular Blackboard assignment	171	44.00
Tests	63	16.20
Others	66	17.00

For the final question of Part 1 of the survey, participants were asked to choose if they would like their instructors to make all of their course work accessible for their HPDs. There were three answers to their question: yes, maybe, and no. The total number of participants who answered this question was 388. A total of 163 (41.90%) participants said yes, 167 (42.90%) said maybe, and 58 (14.90%) said no.

In addition to the educational activities Millennial students did with their HPDs, the survey also inquired about other information such as frequency participants used their HPDs in general on a daily basis and the issues they encountered when using HPDs for educational activities. The hours that participants used their HPDs for all activities per day are presented in

Table 5 and the issues participants had when using HPDs for educational activities are presented in Table 6.

Table 5

Frequencies for Using HPDs in General in a Typical Day (n=389)

Hours per day	Frequency	Percentage (%)
1	6	1.50
2 -10	310	80.0
11 - 23	70	18.0
24	3	0.80

Data in Table 5 demonstrates that on average, the 389 students spent 7.39 hours per day (*SD* = 4.4) using their HPDs. Among those participants, three (0.80%) indicated that they used their HPDs 24 hours per day, and six (1.50%) participants only used their HPDs one hour per day. The majority of participants (80%, *n* = 310) spent from 2 to 10 hours a day using their HPDs, while 18% (*n* = 70) of the participants spent more than 12 hours using their HPDs.

As shown in Table 6, 235 (60.40%) participants believed that the screen size of their HPDs were too small, and 225 (57.80%) of them said they have issues with Wi-Fi connections on their HPDs. A total of 191 (49.10%) participants said they have compatibility issue, in that the content provided by their instructors were not compatible with their HPDs. There were 149 (38.30%) participants that had visibility issues with the content. As for their HPDs, 150 (38.60%) participants complained that their HPDs had a short battery life. In addition, 16 participants suggested issues that were not listed in this question: download time (0.50%, *n* = 2), not enough space (0.30%, *n* = 1), temptation of using HPDs for non-educational purposes (0.30%, *n* = 1), the

layout/navigation of different websites/apps (1.00%, *n* = 4), Microsoft office was difficult to use on HPDs (0.30%, *n* = 1), laptop is more efficient (0.70%, *n* = 3), keyboard is not conducive (0.30%, *n* = 1), and mostly not allowed by instructors (0.30%, *n* = 1).

Table 6

Frequencies for Issues Encountered Using HPDs (n=389)

Issues	Frequency	Percentage (%)
Screen size is too small	235	60.40
Compatibility issue	191	49.10
Visibility issues of the content	149	38.30
Wi-Fi connection issues	225	57.80
Battery life is too short	150	38.60
Others	16	4.10

Research Question 2

2. Is there a relationship between types of HPDs adopted for facilitating learning outside of the classroom and the Millennial students' learning style?

In order to determine the relationship between types of HPDs adopted and types of learning styles, a chi-square test of independence was conducted four times due to the identification of four types of devices participants owned. As previously discussed, types of learning styles of participants were identified based on the Felder and Soloman (n.d.) ILS. Although survey results identified eight types of learning styles, there were not enough participants who had certain learning styles to achieve the necessary expected counts for a Chi-square test. In order to have valid results for the Chi-square test, only the major learning styles

with sufficient participants (10 or more) were used. The results are shown in Table 7. Types of HPDs adopted were identified by question number four of the survey, and results are shown in Table 8.

Table 7

Frequency for Types of Learning Styles Among Millennial Students (n = 389)

Types of learning styles	Frequency	Percentage (%)
Active	12	3.10
Balanced	255	65.60
Global	8	2.10
Intuitive	41	10.50
Reflective	8	2.10
Sensing	7	1.80
Sequential	2	0.50
Verbal	56	14.40

The results showed that the majority (65.60%, $n = 255$) of participants were balanced learners. There were 56 (14.40%) participants who were verbal learners, and 41 (10.50%) of them were intuitive learners. A total of 12 (3.10%) participants were active learners, and there were eight (2.10%) global and reflective learners respectively. Seven (1.80%) participants were identified as sensing learner, and only two (0.50%) participants were sequential learners. As discussed above, there were only four types of learning styles that had participants of 10 or more and they were: active, balanced, intuitive, and verbal. The Chi-square test was used to assess whether type of learning style influence the probabilities of ownership of each type of device.

Table 8

Frequency for HPDs Currently Adopted by Millennial Students (n = 389)

	Owned		Not owned	
Types of devices	Frequency	Percentage (%)	Frequency	Percentage (%)
Smart phone	381	97.90	8	2.10
Tablets	140	36.00	249	64.00
E-readers	74	19.00	315	81.00
PDAs	1	0.30	388	99.70

Data in Table 8 demonstrate that among the 389 participants, 381 (97.90%) owned smart phones, 140 (36.00%) owned tablets, 74 (19.00%) owned e-readers, and only one (0.30%) owned a PDA. Tables 9 and 10 present the results of a chi-square test conducted to test the relationship between types of learning styles and the adoption of smart phones among the participants.

Table 9

Crosstabulation of Learning Styles and Smart Phones (n = 364)

Smart phones		Learning styles			
Owned		Active	Balanced	Intuitive	Verbal
	Count	12	252	41	53
	Expected count	11.8	250.80	40.30	55.10
Not owned					
	Count	0	3	0	3
	Expected count	0.20	4.20	0.70	0.90

Table 10

Chi-square Test Results of Learning Styles and Smart Phones (n = 364)

	Value	*df*	*Sig.*
Pearson chi-square	5.990	3	.112
Likelihood ratio	5.148	3	.161

The chi-square test revealed no significant relationship between participants' types of learning styles and whether or not a smart phones was currently owned, X^2 (3, n = 364) = 5.99, p =.112, two-tailed.

Another chi-square test was conducted to test the relationship between learning styles and owning a tablet. The results of crosstabulation of learning styles and tablets are presented in Table 11. Chi-square test results of learning styles and tablets are presented in Table 12.

Table 11

Crosstabulation of Learning Styles and Tablets (n = 364)

Tablets		Learning styles			
Owned		Active	Balanced	Intuitive	Verbal
	Count	4	87	12	23
	Expected count	4.20	88.30	14.20	19.40
Not owned					
	Count	8	168	29	33
	Expected count	7.80	166.70	26.80	36.60

Table 12

Chi-square Test Results of Learning Styles and Tablets (n = 364)

	Value	*df*	*Sig.*
Pearson chi-square	1.586	3	.663
Likelihood ratio	1.574	3	.665

The chi-square test revealed that no significant relationship was found between participants' types of learning styles whether or not a tablet is owned, X^2 (3, n = 364) = 1.59, p = .663, two-tailed.

Another chi-square test was conducted to test the relationship between learning styles and whether or not an e-readers is owned. The results of crosstabulation of learning styles and e-readers are presented in Tables 13. Chi-square test results of learning styles and e-readers are presented in Table 14.

Table 13

Crosstabulation of Learning Styles and E-Readers (n = 364)

E-readers		Learning styles			
Owned		Active	Balanced	Intuitive	Verbal
	Count	0	54	8	8
	Expected count	2.30	49.00	7.90	10.80
Not owned					
	Count	12	201	33	48
	Expected count	9.70	206.00	33.10	45.20

Table 14

Chi-square Test Results of Learning Styles and E-Readers (n = 364)

	Value	*df*	*Sig.*
Pearson chi-square	4.362	3	.225
Likelihood ratio	6.683	3	.083

The chi-square test revealed that no significant relationship was found between participants' types of learning styles and ownership of an e-readers, X^2 (3, n = 364) = 4.36, p = .225, two-tailed.

Another chi-square test was conducted to test the relationship between learning styles and ownership of a PDAs. The results of crosstabulation of learning styles and PDAs are presented in Table 15. Chi-square test results of learning styles and PDAs are presented in Table 16.

Table 15

Crosstabulation of Learning Styles and PDAs (n = 364)

E-readers		Learning styles			
Owned		Active	Balanced	Intuitive	Verbal
	Count	0	1	0	0
	Expected count	0	0.70	0.10	0.20
Not owned					
	Count	12	254	41	56
	Expected count	12.00	254.30	40.90	55.80

Table 16

Chi-square Test Results of Learning Styles and PDAs (n = 364)

	Value	*df*	*Sig.*
Pearson chi-square	.429	3	.934
Likelihood ratio	.713	3	.870

The chi-square test revealed that no significant relationship was found between participants' types of learning styles and e-reader ownership, X^2 (3, n = 364) = 0.43, p = .934, two-tailed.

Research Question 3

3. Are there significant differences between types of motivation orientation on frequency of HPD usage to assist learning outside of the classroom?

To test the differences between the two variables, types of motivation orientation and frequency of HPD usage to assist learning outside of the classroom, the GCOS (Deci & Ryan, 1985a) was adopted to identify participants' motivation orientation. There were six types of motivation orientations. Data in Table 17 present the descriptive statistics of this variable. Participants were asked how many hours they spent in a typical day using HPDs for educational activities in the survey, and the descriptive statistics are described after Table 17. Before running a one-way ANOVA test, skewness and kurtosis values were retrieved for testing normality on the hours spent per day using HPDs variable. The skewness value is 2.30 with a standard error of 0.14 and Kurtosis value is 7.40 with a standard error of 0.28. The results indicated that normality is violated. However, a one-way ANOVA was still conducted because skewness and kurtosis might have been too sensitive due to the large sample size.

Table 17

Descriptive Statistics for Types of Motivation Orientations (n = 389)

Types of motivation orientations	Frequency	Percentage (%)
Autonomy	245	68.40
Impersonal	27	7.50
Control	44	12.30
Impersonal & Control	4	1.10
Control & Autonomy	25	7.00
Impersonal & Autonomy	13	3.60
Autonomy & Impersonal & Control	31	7.90

Among all the participants, based on the answering key, 245 (68.40%) were identified as autonomy orientation, 27 (7.50%) were impersonal, and 44 (12.30%) were control. There were also participants identified as more than one motivation orientation. Four (1.10%) participants were identified as impersonal and control orientation, 25 participants were identified as control and autonomy orientation, and 13 (3.60%) participants were identified as impersonal and autonomy orientation. Also, 31 (7.90%) participants had scores that indicated they had three orientations. Since Deci and Ryan (1985a) did not discuss this issue in their theory, it was not able to determine whether or not it is possible for one person to have two or three motivation orientations. Based on the purpose of this paper, only the data of three types of motivation orientation discussed in Deci and Ryan's theory: autonomy, control, and impersonal, were analyzed. The average hours spent daily on educational activities using HPDs was 2.86 hours (n = 314, SD = 2.51). Means and standard deviations of hours spent for each orientation type are

be presented in Table 18. Data in Table 19 present the results of a one-way ANOVA of the differences between the two variables. A test of homogeneity of variances are presented in Table 20. The results of test of normality are presented in Table 21.

Table 18

Means and Standard Deviations of Hours Spent for Each Orientation Type (n = 314)

Orientation type	N	*M*	*SD*
Autonomy	244	2.85	2.58
Impersonal	26	3.15	2.82
Control	44	2.77	1.89

Table 19

Results of One-way ANOVA of Differences in Hours Spent Between Types of Orientation (n = 314)

	Sum of Squares	df	Mean Square	F	Sig
Between groups	2.61	2	1.31	0.21	.814
Within groups	1966.50	311	6.32		

Table 20

Test of Homogeneity of Variances (n = 314)

Levene Statistic	df1	df2	Sig
3.040	5	350	.011

Table 21

Test of Normality of Variables (n = 314)

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Motivation Orientation	Statistic	df	Sig.	Statistic	df	Sig.
Hours Spent	Autonomy	0.24	244	.000	0.73	244	.000
	Impersonal	0.23	26	.002	0.73	26	.000
	Control	0.23	44	.000	0.83	44	.000

A one-way ANOVA was conducted to test the effect of types of motivation orientations on the hours spent on using HPDs for educational activates per day. An analysis of variance showed that types of motivation orientation had no significant effect on hours spent on using HPDs for educational activities per day, $F(2, 311) = 0.21$, $p = .814$.

The data were randomly and independently sampled. Scores on the direct variable, which were hours spent using HPDs per day, violates the assumption of normality, as shown in Table 20. Based on the Levene's test, the independent sample of scores come from population with equal variances on hours spent using HPDs per day. Hours spent using HPDs per day is measured on an interval scale.

CHAPTER 5

DISCUSSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

This study had three major purposes. The first one was to examine the relationship between learning styles and Millennial students' adoption of Handheld Portable Devices (HPDs) to facilitate learning outside of the classroom. The second one was to determine the relationship between students' orientation of motivation with how frequently participants use HPDs to assist learning outside of the classroom. The third goal was to identify participants' behaviors, frequencies, and activities of using HPDs to assist learning outside of the classroom.

Discussion

Data for this study were collected from a Qualtrics-based online survey that consisted of four parts and a total of 70 questions. Findings were analyzed using SPSS version 24. The first part of the survey contained demographic questions about participants' gender, age, grade, current HPD ownership, activities, frequencies, and feedback on using HPDs, their overall opinion on usability of HPDs, and the use of HPDs in both formal and informal learning environments. Results were analyzed as descriptive data. Felder and Soloman's (n.d.) ILS was used as a second part of this survey to identify participants' types of learning styles. Dr. Felder granted one-time access to use this 44-item instrument with answering key. The third part of this survey was the GCOS (Deci & Ryan, 1985a) that contained 12 vignettes and determined participants' orientations of motivation.

Research Question 1

Results indicated that participants of this study mostly used their HPDs to communicate on school-related subjects, accessing Blackboard, and formal/informal academic research. There were six educational activities listed in Question 5 of the survey. Participants chose how often they performed an activity each week, and these activities were: receiving/sending school emails, accessing course materials, downloading course materials, participating in course forums, working on assignments/projects, and attending virtual classes. In addition, question #6 was an open-ended question that allowed participants to add educational activities that were not listed in the previous question. A total of 389 participants used their HPDs for at least one educational activity one time per week. The most popular educational activity was sending and receiving school-related emails. A total of 369 (94.9%) participants used their HPDs to send or receive school-related emails at least one time per week, and most of them spent more than 10 times per week performing such activities (n = 233, 59.9%). In 2005, Thornton and Houser's study reported a 100% mobile phone ownership among 333 Japanese college students. They also identified that the most accessed activity on the participants' mobile phone was to send emails regarding classes. After 11 years, according to the results of the current study, among 389 American college students, 381 (97.9%) of them owned at least one smart phone, and sending/receiving emails was still one of the major activities performed with their mobile devices.

Unlike the mobile phones from 11 years ago, today's smart phones have easier ways to set up an email application. With simpler steps for set up, the email app allows users to receive emails instantly on their phones, and emails can also be synchronized to their other mobile devices such as tablets and laptops. With this function, students can send and respond to their

school-related emails promptly without any physical limitation. It works almost as easily as sending and receiving text messages. As previously discussed, according to "Media Universe" (2011), on average, people who are from age 13 to 17 send 3,705 text messages per month. To these people, mobile devices obviously are an important means of communication. Five years later, most of the people from that study are now in college. With newer technology, communication was still considered to be the major usage among them. For instance, in this study, in addition to formal communication like receiving/sending school emails, a number of participants (n = 24, 9.0%) claimed that they also use their HPDs to communicate for group projects/assignments via text messaging or other social media.

Besides communication for school-related subjects, another major usage of HPDs among the participants was accessing Blackboard (n = 363, 93.3%). Blackboard is an interactive online learning platform powered by a third party and utilized by Indiana State University. Blackboard allows instructors to post course materials, assignments, tests/quizzes, and other instructional tools such as, discussion boards, virtual classrooms, and lecture recordings. Students can access and download most course documents from Blackboard and engage in different means of communication via various instructional tools. Results show that participants preferred to use their HPDs to access course material (n = 306, 78.7%) over communicating via various tools, such as discussion boards (n = 157, 40.4%), Wikis (n = 31, 8.0%), or Blogs (n = 43, 11.1%) on Blackboard.

It is important to know that Blackboard offers two versions for most HPDs and that might impact why some participants prefer using their HPDs for only certain activities. Blackboard offers a traditional web layout for all mobile devices. It works the same as one might access on a desktop or laptop with an Internet browser. Participants in this study have full access to this

version, and ISU's information technology department offers full support and tutorials to participants with this version. When opening up the web version on most HPDs, there will be compatibility issues for the contents because students have to adjust the size of the screen manually, as the page was designed to be opened on a full-size computer screen. In addition, most students will not be able to download documents such as Word documents (i.e., syllabus) and PowerPoint slides, unless they install external software, like Dropbox, on their devices. Limited access and compatibility issues might cause some participants to avoid using certain features of Blackboard on their HPDs.

The other version of Blackboard on HPDs is a mobile application (app). It has different versions for various operating systems and students can access most tools with this app. However, at the time the data were collected, students at ISU had to purchase for the Blackboard app version and ISU did not provide technical support for the app version. Also, some instructional tools such as Tegrity, a lecture recorder tool that allows instructors to pre-record and/or record live lectures for students to view on-demand, had its own app. Only 31 (8.0%) participants reported that they used their HPDs to access Tegrity. This study did not collect data on how many participants paid for and used the app version of Blackboard on their HPDs.

Using HPDs for research on a project and/or academic paper was also one of the most frequently performed activities among the participants. In some occasions, some participants would use their HPDs for quick research on a certain topic discussed in class or within a study group. For instance, when a group of students were working on creating lesson plans for teaching fourth graders about the Industrial Revolution, they might start with a quick research on Pinterest looking for some ideas. For some participants, they would write their term paper using Google scholar in addition to access the school library website. For both a quick search and formal

academic research paper writing, HPDs seems to be sufficient for some participants.

In relation to the educational activities participants performed, the survey also asked about issues students had when using their HPDs for educational activities. The majority of participants (*n* = 235, 60.4%) complained about the size of the screen being too small, and more than half of them believed that Wi-Fi connection issues (*n* = 225, 57.8%) limited their experiences of using HPDs for educational purposes. In addition, compatibility issues were another major constraint of their user experience (*n* = 191, 49.1%) because some content provided by their instructors were not compatible with the devices. Besides the potential issues listed in Question 11, participants were also asked to provide additional issues they had encountered that were not in the list. Mostly, physical attributes such as keyboard not being conducive, low storage space, and compatibility issues with Microsoft Office were mentioned. There were also psychological aspects that prevented participants from using their HPDs for educational activities. For example, one participant said that it was very difficult to fight the temptation of using HPDs for non-educational activities. One pointed out that HPDs were usually not allowed by instructors. A few participants (*n* = 3, .7%) specifically stressed that they preferred using laptops instead of HPDs in educational settings.

The results of the issues participants encountered when using their HPDs for educational activities, were consistent with the findings of the study on PDAs conducted by Churchill and Churchill (2008), Hackemer and Peterson (2005), Smørdal and Gregory (2005), and Corlett et al. (2005). A decade later, even with the advanced and enhanced features of HPDs, as well as the sharply increased broadband penetration (International Telecommunication Union, 2015), the physical drawbacks from the previous devices could still not be eliminated.

Recommendations for future study. This study focused on the general educational usage of all HPDs. For future studies, it might be worth distinguishing each type of HPDs, e.g., iPads or smart phones, and find out what specific educational activities participants performed with such device. It is also necessary to identify issues preventing participants from or causing difficulties performing educational activities with certain types of HPDs. This study also only focused on participants' experiences of using HPDs. A suggestion for future studies is to try to adopt a systematic pedagogy that is compatible with HPD environment based on mobile learning theories such as the TRA, the TAM, and/or the MM {Wang et al., 2009), then compare students' feedback and perceptions from the ones using their HPDs voluntarily. Such research might help educators understand if formal pedagogy intervenes and how much intervention might affect students' perception and experiences of using HPDs for educational purposes.

Research Question 2

In order to determine if there was a relationship between the types of HPDs adopted for facilitating learning outside of the classroom and the Millennial students' learning styles, a chi-square of independence test was conducted four times. All four tests were insignificant, learning styles and smart phones: X^2 (3, n = 364) = 5.99, p =.112, two-tailed; learning styles and tablets: X^2 (3, n = 364) = 1.59, p = .663, two-tailed; learning styles and e-readers: X^2 (3, n = 364) = 4.36, p = .225, two-tailed; and learning styles and PDAs: (3, n = 364) = .43, p = .934, two-tailed. There is no relationship between types of HPDs adopted for facilitating learning outside of the classroom and the Millennial student's learning style.

The study utilized Felder and Silverman's (1988) Learning Style Model and the instrument created based on the model called the ILS to identify different learning styles. Based on the descriptions of the learning styles discussed in Chapter 2, it was expected that most

participants in this study would be active and intuitive learners based on the general characteristics of Millennials. Tapscott (2009) believed that Millennials like collaboration and love working as a group, and communicating with each other. They are also innovative, giving that they are the digital generation. Howe and Strauss (2007) also suggested that Millennials are team-oriented.

However, results indicated more than half (n = 255, 65.6%) had either a higher tendency of more than one learning styles or no tendency toward any learning style. Only 12 (3.1%) participants were active learners and 41 (10.5%) were intuitive learners. In Felder and Silverman's 1988 model, they categorized the ones with no clear or mild preference on any of those learning styles as a balanced learner. There was no detailed discussion on the characteristics of participants with more than one learning styles other than those learners would most likely be less influenced by various learning environments and teaching styles. In this study, data shows that some students had strong preferences on more than one learning style, and they were categorized as balanced learners, too. They could learn more easily in more than one teaching environment.

Felder and Silverman's (1988) model distinguished eight learning styles, including active, reflective, sensing, intuitive, visual, verbal, sequential and global. The results of this study did not identify any visual learners, and there were less then 10 participants identified as global (n = 8, 2.1%), reflective (n = 8, 2.1%), sensing (n = 7, 1.8%) and sequential learners (n = 2, .5%). Since those learning styles did not have enough participants to meet the expected count in a chi-square test, only four learning styles were used in this study to test research question #2. These categories were: active (n = 12, 3.1%), balanced (n = 252, 65.6%), intuitive (n = 41, 10.5%), and verbal (n = 56, 14.4%). According to Felder and Silverman (1988), active learners learn by

applying and doing. They prefer working with large groups and communicating with others; intuitive learners like abstract content and are more innovative; verbal learners learn with writing and speaking; and matching learning styles would have less effects on balanced learners, and they tend to accept various learning environments more easily than others.

The results of this study show that there were four types of HPDs owned by the participants: smart phones (n = 381, 97.9%), tablets (n = 140, 36.0%), e-readers (n = 74, 19.0%), and PDAs (n = 1, .3%). Before collecting data, based on previous studies and the percentage of the current mobile device ownership provided by Pew Research Center (2015), it was expected that all participants owned at least one smart phone, most would own at least one tablet, some would own at least one e-reader, and none would have any type of PDAs. The results were somewhat consistent with this expectation. It is important to mention that there were a few (n = 4, 1.0%) participants who said they owned at least one smart watch. However, the smart watch is considered as a wearable device, and not sophisticated enough to be used for educational purposes. Therefore, smart watches were disregarded as a type of HPDs in this study.

Previous studies on the relationship between matching learning styles and learning outcomes were confusing. Some studies suggested matching learning styles would not affect students' learning outcomes, while others concluded that students would learn better if they were taught by their favored styles. Some previous research (Lai et al., 2012; Lu et al., 2007) found a positive relationship between students' learning styles and their online learning behavior. Results of those studies also revealed students' learning styles had strong indication on their use of technology for learning. However, based on previous learning, this study utilized the chi-square of independence study and did not find a positive relationship between learning styles and students' use of HPDs for learning.

Recommendations for future study. For various reasons, this study adopted Felder and Soloman's (n.d.) ILS to detect learning styles among the participants. A different instrument might be able to better define and identify participants' learning styles and further test the hypothesis. Another recommendation for future study is to categorized types of HPDs by their usage. For instance, one might study if there is a relationship between learning styles and the type of HPDs students adopted for reading e-textbooks or taking mobile-friendly quizzes. Also, in the study, majority of participants (n = 255, 65.6%) were identified as balanced learners. It is suggested that future study might explore the notion of the balanced learners and find out what it means to have moderate preference in more than one learning styles. For instance, future study might want to explore if balanced learners really mean that they could learn well in any teaching environment.

Additionally, beyond the limitations on the study previously discussed, it is also suggested by some current research that the construct of learning styles are just perpetuating neuromyths. Lethaby and Harries (2016) conducted a study to explore if learning styles really improved learning and if learning styles influence teaching styles. The results suggested that the idea of addressing learning styles has no scientific evidence and is important to consider in light of the results of this study. It would be important to evaluate whether there were inherent issues with the ILS to differentiate learning styles, whether they age of the students impacted learning styles, or if Lethaby's and Harries' argument that considering of learning style is moot is relevant.

Research Question 3

A one-way ANOVA was conducted to test the effect of types of motivation orientations on the hours spent on using HPDs for educational activities per day. An analysis of variance showed that types of motivation orientation had no significant effect on hours spent on using

HPDs for educational activities per day, F (5, 350) = .91, p = .476. There is no significant difference across motivation orientations on frequency of HPD usage to assist learning outside of the classroom.

There was no research conducted to learn how motivation would affect students' frequency of using HPDs for educational purposes. In this study, the major purpose for this research question was to determine if self-motivated students would spend more hours using their HPDs to assist learning than the ones who need more external intervention. In order to identify one's motivation orientation, this study utilized Deci and Ryan's (1985b) GCOS. According to Deci and Ryan, people with autonomy orientation tend to have higher intrinsic motivation, which means they are more self-motivated in doing things than others. Thus, it was expected before data analysis that participants with autonomy orientation would spend more time using their HPDs for educational purposes. Deci and Ryan also suggested that people with control orientation are more motivated if there were external rewards such as deadlines and other controls. Therefore, in this study, participants who were control oriented were expected to spend less time using HPDs for educational activities than autonomy participants, but they would spend distinctively more time than impersonal participants because with or without external rewards, it is very difficult for impersonal oriented people to finish a task.

After running a one-way ANOVA test, no significant difference was found between the hours spent on using HPDs for educational purposes per day and participants with different motivation orientations. Nevertheless, it is crucial to note that there was no requirement that participants in this study had to use their HPDs for educational purposes, nor was there any program at ISU that requires them to use their HPDs for any educational activities. Therefore, the results of this study might not sufficiently explore the research question. In addition, the

GCOS instruments used to identify motivation orientations had confusing results with some participants having more than one orientation, which might have also influenced the results.

Recommendations for future study. For future studies, one might consider to establish a co-requisite program to participants' current lesson plans, to allow students to use certain HPDs to enhance their learning experience. For example, by learning passive tense in English grammar, students are able to use their HPDs to play a mobile-friendly educational game to practice. In this case, the researcher should first identify students' motivation orientation with, preferably, a different instrument and then collect their frequency of using HPDs of this educational game., the follow-up to identify if there was a significant difference between different orientations.

Recommendations for Practice

In classroom settings, participants in this study had raised several issues that instructors might want to consider when planning their instructions. First of all, HPDs are more than just a means of communication, and they are as functional and important as other technological tools in class. For instance, some participants said they were not allowed to use any HPDs in class. One of the reasons that HPDs are banned in some classrooms is that some instructors see HPDs as distractions. As one of the participant in this study suggested, when using HPDs, it was very easy to be distracted by the social media apps. However, results of this study also show a lot of student using their HPDs for educational purposes without any distraction. Therefore, either in or out of the classroom, students with great interest and confidence in using HPDs for educational purposes would not be distracted because they know what they are doing. On the other hand, previous studies (Cheon et al., 2012; Chu, 2014; Vogel et al., 2009) concluded that students could be distracted by more than just HPDs.

Pedagogically, there is not yet a sound theory to conceptualize adopting HPDs to assist learning. In this study, participants used their HPDs based on their preferences or what they already had in terms of devices. They also chose a certain instructional tool, such as Kahoot.it and Pinterest because those tools are free to use and easy to set up. To design instructions with the adoption of HPDs and instructional tools for all students in one classroom, instructors might want to reference current models of technology adoption theories such as TRA and TAM (Wang et al., 2009). Those theories help instructor investigate why students choose to adopt a certain type of technological device.

In addition, based on the results of the study, some students hesitate to use their HPDs for educational activities because the content provided by their instructors were not compatible with their HPDs. It is recommended that before introducing certain HPDs in class for any instructional purposes, instructors might want to work with their IT personnel to learn how to set up and transfer their content so that students can access with most HPDs. For example, students at ISU could take a quiz online that is perfectly compatible with their HPDs on Blackboard. It requires instructors to set up the quiz to be compatible with mobile devices beforehand. It is recommended that instructors obtain proper education on how to transfer and manage instructional contents before they adopt HPDs in classrooms to avoid frustration and inconveniences for students.

The results of this study also showed that participants with certain learning styles did not necessarily adopted certain HPDs. For instructors, it means that when adopting HPDs in the classroom, there is not necessarily a preference on what types of HPDs is best for students. It is recommended that for instructors with no budget on obtaining the same HPDs for all students,

allow students to work on the devices they currently have and prepare content that is compatible for most devices.

It was expected that students with higher motivation would use their HPDs more frequently than those who were less motivated. However, results of this study suggested that there is no relationship between motivation orientation and the frequency of using HPDs. The results are important for instructors to understand that when introducing a type of HPDs in their classrooms, all students should have an equal preference and perception toward the devices. Therefore, knowing that students with all types of learning styles and motivation orientation might adopt and use HPDs the same, it is easier for instructors because the focus is then on the design and delivery of instruction.

Summary

This paper examined the usage of HPDs among Millennial college students and tried to identify the relationship between participants' learning styles and their adoption of HPDs. It also tried to find the differences between types of motivation orientation and hours spent on using HPDs for educational activities daily. However, results indicate that students with different learning styles did not choose their HPDs to assist learning differently. Also, participants with different motivation orientation did not spend a significant difference of amount of time using HPDs for educational purposes. Despite the lack of significant results, this study had results that indicated the current usage of HPDs without formal adoption in any of their study programs. The study also serves as a pilot test for future studies to look more into mobile learning with advanced HPDs. The expectation is that future studies will have different results with more sophisticated study design and data analysis.

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APPENDIX A: SURVEY QUESTIONS USED IN THIS STUDY

PART I: Your participation in this research is appreciated. By the end of the survey you will have a chance to enter into a drawing to win one of the 10, $50.00 gift cards. For the last question, If you choose no for entering the prize drawing, you will be directed to the end of the survey. If you choose yes, you will be asked to fill out your first and last name, and your sycamore email address. You may choose to stop and quit the survey at any time. Click on the arrow button to continue.

1 What is your gender?

❍ Male
❍ Female

2 What years are you?

❍ Junior
❍ Senior
❍ Other _____

3 In what year were you born?

1980		1990	
1981		1991	
1982		1992	
1983		1993	
1984		1994	
1985		1995	
1986		1996	
1987		1997	
1988		1998	
1989		1999	
		2000	

4 What Handheld Portable Devices do you currently own? Check all that apply.

❑ Smartphones (e.g., iPhone, Samsung Galaxy)
❑ Digital Tablets (e.g., iPad, Microsoft Surface)
❑ E-readers (e.g., Kindle, Nook)
❑ PDAs (e.g., Palm, Blackberry)
❑ Other _____

5 How often do you use your Handheld Portable Devices for the following activities?

	Never	1-3 times per week	4-6 times per week	7-9 times per week	More than 10 times per week
Receiving/Sending school e-mails	❍	❍	❍	❍	❍
Access course materials (e.g., readings, Blackboard course documents)	❍	❍	❍	❍	❍
Downloading course materials (e.g., PDF documents, PowerPoint course presentations, Tegrity videos)	❍	❍	❍	❍	❍
Participate in course forums (e.g., Blackboard discussion board, Blogs, Wikis)	❍	❍	❍	❍	❍
Working on assignment/project (e.g., Writing a paper, create a presentation PowerPoint slides)	❍	❍	❍	❍	❍
Attending virtual classes (e.g., Blackboard Collaborate, Skype in a course)	❍	❍	❍	❍	❍

6 In addition to the activities listed in question #5, what are other EDUCATIONAL activities you usually do with your Handheld Portable Devices?

7 In a typical day, about how many hours do you use all of your Handheld Portable Devices in general?

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hours																								

8 In a typical day, about how many hours do you use all of your Handheld Portable Devices for EDUCATIONAL activities?

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Hours																								

9 What are the issues you had when using Handheld Portable Devices for educational activities? Check all that apply.

- ❑ Screen size is too small
- ❑ Compatibility issues with the instructor provided content
- ❑ Visibility issues of the content
- ❑ Wi-Fi connection issues
- ❑ Battery life is too short
- ❑ Other _____

10 Have you ever accessed Blackboard using your Handheld Portable Devices?

- ❍ Yes
- ❍ No

11 If you answered YES to question #10, please select the tools in Blackboard you accessed using your Handheld Portable Devices. Check all that apply.

- ❑ Discussion Board
- ❑ Course materials
- ❑ Tegrity
- ❑ Blackboard Collaborate
- ❑ Wiki
- ❑ Blog
- ❑ Turnitin Assignment
- ❑ Regular Blackboard Assignment
- ❑ Tests
- ❑ Others _____

12 Overall, do you want your instructor to make all your course work accessible for Handheld Portable Devices

- ❍ Yes
- ❍ Maybe
- ❍ No

PART II: For each of the following questions, select either "a" or "b" to indicate your answer. Please choose only one answer for each question. If both "a" and "b" seem to apply to you, choose the one that applies more frequently. When you are finished selecting answers to each question please select the arrow button at the end of the form.

1 I understand something better after I

- ❍ (a) try it out.
- ❍ (b) think it through.

2 I would rather be considered
❍ (a) realistic.
❍ (b) innovative.

3 When I think about what I did yesterday, I am most likely to get
❍ (a) a picture.
❍ (b) words.

4 I tend to
❍ (a) understand details of a subject but may be fuzzy about its overall structure.
❍ (b) understand the overall structure but may be fuzzy about details.

5 When I am learning something new, it helps me to
❍ (a) talk about it.
❍ (b) think about it.

6 If I were a teacher, I would rather teach a course
❍ (a) that deals with facts and real life situations.
❍ (b) that deals with ideas and theories.

7 I prefer to get new information in
❍ (a) pictures, diagrams, graphs, or maps.
❍ (b) written directions or verbal information.

8 Once I understand
❍ (a) all the parts, I understand the whole thing.
❍ (b) the whole thing, I see how the parts fit.

9 In a study group working on difficult material, I am more likely to
❍ (a) jump in and contribute ideas.
❍ (b) sit back and listen.

10 I find it easier
❍ (a) to learn facts.
❍ (b) to learn concepts.

11 In a book with lots of pictures and charts, I am likely to
❍ (a) look over the pictures and charts carefully.
❍ (b) focus on the written text.

12 When I solve math problems
❍ (a) I usually work my way to the solutions one step at a time.
❍ (b) I often just see the solutions but then have to struggle to figure out the steps to get to them.

13 In classes I have taken
❍ (a) I have usually gotten to know many of the students.
❍ (b) I have rarely gotten to know many of the students.

14 In reading nonfiction, I prefer
❍ (a) something that teaches me new facts or tells me how to do something.
❍ (b) something that gives me new ideas to think about.

15 I like teachers
❍ (a) who put a lot of diagrams on the board.
❍ (b) who spend a lot of time explaining.

16 When I'm analyzing a story or a novel
❍ (a) I think of the incidents and try to put them together to figure out the themes.
❍ (b) I just know what the themes are when I finish reading and then I have to go back and find the incidents that demonstrate them.

17 When I start a homework problem, I am more likely to
❍ (a) start working on the solution immediately.
❍ (b) try to fully understand the problem first.

18 I prefer the idea of
❍ (a) certainty.
❍ (b) theory.

19 I remember best
❍ (a) what I see.
❍ (b) what I hear.

20 It is more important to me that an instructor
❍ (a) lay out the material in clear sequential steps.
❍ (b) give me an overall picture and relate the material to other subjects.

21 I prefer to study
❍ (a) in a study group.
❍ (b) alone.

22 I am more likely to be considered
❍ (a) careful about the details of my work.
❍ (b) creative about how to do my work.

23 When I get directions to a new place, I prefer
❍ (a) a map.
❍ (b) written instructions.

24 I learn
❍ (a) at a fairly regular pace. If I study hard, I'll "get it."
❍ (b) in fits and starts. I'll be totally confused and then suddenly it all "clicks."

25 I would rather first
❍ (a) try things out.
❍ (b) think about how I'm going to do it.

26 When I am reading for enjoyment, I like writers to
- ❍ (a) clearly say what they mean.
- ❍ (b) say things in creative, interesting ways.

27 When I see a diagram or sketch in class, I am most likely to remember
- ❍ (a) the picture.
- ❍ (b) what the instructor said about it.

28 When considering a body of information, I am more likely to
- ❍ (a) focus on details and miss the big picture.
- ❍ (b) try to understand the big picture before getting into the details.

29 I more easily remember
- ❍ (a) something I have done.
- ❍ (b) something I have thought a lot about.

30 When I have to perform a task, I prefer to
- ❍ (a) master one way of doing it.
- ❍ (b) come up with new ways of doing it.

31 When someone is showing me data, I prefer
- ❍ (a) charts or graphs.
- ❍ (b) text summarizing the results.

32 When writing a paper, I am more likely to
- ❍ (a) work on (think about or write) the beginning of the paper and progress forward.
- ❍ (b) work on (think about or write) different parts of the paper and then order them.

33 When I have to work on a group project, I first want to
- ❍ (a) have "group brainstorming" where everyone contributes ideas.
- ❍ (b) brainstorm individually and then come together as a group to compare ideas.

34 I consider it higher praise to call someone
- ❍ (a) sensible.
- ❍ (b) imaginative.

35 When I meet people at a party, I am more likely to remember
- ❍ (a) what they looked like.
- ❍ (b) what they said about themselves.

36 When I am learning a new subject, I prefer to
- ❍ (a) stay focused on that subject, learning as much about it as I can.
- ❍ (b) try to make connections between that subject and related subjects.

37 I am more likely to be considered
- ❍ (a) outgoing.
- ❍ (b) reserved.

38 I prefer courses that emphasize
❍ (a) concrete material (facts, data).
❍ (b) abstract material (concepts, theories).

39 For entertainment, I would rather
❍ (a) watch television.
❍ (b) read a book.

40 Some teachers start their lectures with an outline of what they will cover. Such outlines are
❍ (a) somewhat helpful to me.
❍ (b) very helpful to me.

41 The idea of doing homework in groups, with one grade for the entire group,
❍ a) appeals to me.
❍ (b) does not appeal to me.

42 When I am doing long calculations,
❍ (a) I tend to repeat all my steps and check my work carefully.
❍ (b) I find checking my work tiresome and have to force myself to do it.

43 I tend to picture places I have been
❍ (a) easily and fairly accurately
❍ (b) with difficulty and without much detail.

44 When solving problems in a group, I would be more likely to
❍ (a) think of the steps in the solution process.
❍ (b) think of possible consequences or applications of the solution in a wide range of areas.

PART III. These following items pertain to a series of hypothetical sketches. Each sketch describes an incident and lists three ways of responding to it. Please read each sketch, imagine yourself in that situation, and then consider each of the possible responses. Think of each response option in terms of how likely it is that you would respond that way. (We all respond in a variety of ways to situations, and probably most or all responses are at least slightly likely for you.) If it is very unlikely that you would respond the way described in a given response, you should choose answer 1 or 2. If it is moderately likely, you would select a number in the mid-range, and if it is very likely that you would respond as described, you would circle answer 6 or 7.

1 You have been offered a new position in a company where you have worked for some time. The first question that is likely to come to mind is:

	1	2	3	4	5	6	7
What if I can't live up to the new responsibility?	❍	❍	❍	❍	❍	❍	❍
Will I make more at this position?	❍	❍	❍	❍	❍	❍	❍
I wonder if the new work will be interesting.	❍	❍	❍	❍	❍	❍	❍

2 You have a school-age daughter. On parents' night the teacher tells you that your daughter is doing poorly and doesn't seem involved in the work. You are likely to:

	1	2	3	4	5	6	7
Talk it over with your daughter to understand further what the problem is.	❍	❍	❍	❍	❍	❍	❍
Scold her and hope she does better.	❍	❍	❍	❍	❍	❍	❍
Make sure she does the assignments, because she should be working harder.	❍	❍	❍	❍	❍	❍	❍

3 You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It likely that you might think:

	1	2	3	4	5	6	7
It's not what you know, but who you know.	❍	❍	❍	❍	❍	❍	❍
I'm probably not good enough for the job.	❍	❍	❍	❍	❍	❍	❍
Somehow they didn't see my qualifications as matching their needs.	❍	❍	❍	❍	❍	❍	❍

4 You are a plant supervisor and have been charged with the task of allotting coffee breaks to three workers who cannot all break at once. You would likely handle this by:

	1	2	3	4	5	6	7
Telling the three workers the situation and having them work with you on the schedule.	❍	❍	❍	❍	❍	❍	❍
Simply assigning times that each can break to avoid any problems.	❍	❍	❍	❍	❍	❍	❍

Find out from someone in authority what to do or do what was done in the past.	❍	❍	❍	❍	❍	❍	❍

5 A close (same-sex) friend of yours has been moody lately, and a couple of times has become very angry with you over "nothing." You might:

	1	2	3	4	5	6	7
Share your observations with him/her and try to find out what is going on for him/her.	❍	❍	❍	❍	❍	❍	❍
Ignore it because there's not much you can do about it anyway.	❍	❍	❍	❍	❍	❍	❍
Tell him/her that you're willing to spend time together if and only if he/she makes more effort to control him/herself.	❍	❍	❍	❍	❍	❍	❍

6 You have just received the results of a test you took, and you discovered that you did very poorly. Your initial reaction is likely to be:

	1	2	3	4	5	6	7
"I can't do anything right," and feel sad.	❍	❍	❍	❍	❍	❍	❍
"I wonder how it is I did so poorly," and feel disappointed.	❍	❍	❍	❍	❍	❍	❍
"That stupid test doesn't show anything," and feel angry.	❍	❍	❍	❍	❍	❍	❍

7 You have been invited to a large party where you know very few people. As you look forward to the evening, you would likely expect that:

	1	2	3	4	5	6	7
You'll try to fit in with whatever is happening in order to have a good time and not look bad.	❍	❍	❍	❍	❍	❍	❍
You'll find some people with whom you can relate.	❍	❍	❍	❍	❍	❍	❍
You'll probably feel somewhat isolated and unnoticed.	❍	❍	❍	❍	❍	❍	❍

8 You are asked to plan a picnic for yourself and your fellow employees. Your style for approaching this project could most likely be characterized as:

	1	2	3	4	5	6	7
Take charge: that is, you would make most of the major decisions yourself.	❍	❍	❍	❍	❍	❍	❍
Follow precedent: you're not really up to the task so you'd do it the way it's been done before.	❍	❍	❍	❍	❍	❍	❍
Seek participation: get inputs from others who want to make them before you make the final plans.	❍	❍	❍	❍	❍	❍	❍

9 Recently a position opened up at your place of work that could have meant a promotion for you. However, a person you work with was offered the job rather than you. In evaluating the situation, you're likely to think:

	1	2	3	4	5	6	7
You didn't really expect the job; you frequently get passed over.	❍	❍	❍	❍	❍	❍	❍
The other person probably "did the right things" politically to get the job.	❍	❍	❍	❍	❍	❍	❍
You would probably take a look at factors in your own performance that led you to be passed over.	❍	❍	❍	❍	❍	❍	❍

10 You are embarking on a new career. The most important consideration is likely to be:

	1	2	3	4	5	6	7
Whether you can do the work without getting in over your head.	❍	❍	❍	❍	❍	❍	❍
How interested you are in that kind of work.	❍	❍	❍	❍	❍	❍	❍
Whether there are good possibilities for advancement.	❍	❍	❍	❍	❍	❍	❍