2020

Adults' Use of Mobile Learning Environments While Enrolled in General Educational Development Classes

Tia Wilkinson
Walden University

Walden University

College of Education

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Tia Wilkinson

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Dr. Michael Marrapodi, Committee Chairperson, Education Faculty
Dr. Debra Tyrrell, Committee Member, Education Faculty
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Chief Academic Officer and Provost
Sue Subocz, Ph.D.

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MLD, Saint-Mary-of-the-Woods College, 2013

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education

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February 2020

Abstract

Mobile learning environments (MLEs) offer ubiquitous learning opportunities for adults in General Educational Development (GED) programs. However, MLEs have not been integrated into most adult GED programs; therefore, little is known about the experiences of adult learners who use MLEs as part of their education. The purpose of this basic qualitative study was to explore how adult learners described making connections within MLEs, how they perceived learning with MLEs, and how they expanded their use of MLEs. The principles of connectivism provided the conceptual framework for the study. Participants were 11 adult learners in GED programs in a Southern urban area of the United States. Data sources were semistructured interviews and observations of learners using MLEs in their classrooms. Data were coded using open, axial, and selective coding with LaPelle's analysis plan. Results indicated that students moved from using MLEs as communication devices to experiencing them as necessary learning tools. Findings also indicated that students experienced MLEs in positive ways when educational applications on the MLEs met their learning needs. Findings may be used to inform GED administrators about learner perceptions of mobile educational content that can be acquired at little to no cost to benefit adult learners using MLEs.

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Dedication

This dissertation is dedicated to three women who made it clear to me the value of education and my responsibility to teach and mentor others. They are Margaret Partain, Mae Luster Stephens, and Kathryn Temple. I hold these women and the examples they set for me in ethics, excellence, and perseverance in the highest esteem.

Acknowledgments

I would like to acknowledge the overwhelming encouragement and support of my children during my doctoral studies. They are Hobson Wilkinson, Kimberly Garcia, Evan Wilkinson, Ian Wilkinson, and Benjamin Wilkinson. I would also like to acknowledge my sister, Amy Holland, who cheers me on in my endeavors. She keeps me motivated and strong. My mother, Margaret Partain, was the first person in our family to receive a college degree; she holds a Master of Education. Finally, I would like to mention Dr. Michael Marrapodi. He is always knowledgeable, positive, and motivating.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Mobile learning environments (MLEs) offer learners opportunities for ubiquitous learning, for synchronous collaboration, and for free instruction and practice (Brown & Mbati, 2015). Learning applications and educational programs are easily accessible via laptops, tablets, and smartphones. Smartphones are the most likely MLE to be chosen by young adult learners and by Black and Hispanic adult learners (M. Anderson, 2015). According to research from the Pew Research Center (as cited in M. Anderson, 2015; Smith, 2015), 30% of smartphone users take classes or access educational information via their phones; 45% of those users are Hispanic, 32% are Black, and 26% are White. The number of smartphone dependent adults who use smartphones to digitally connect is increasing (Smith, 2015, 2017). MLEs have become important pedagogical and andragogical tools in and out of the classroom that provide information-rich, easily accessible academic content (Mahdi, 2018).

The ways adult learners access academic opportunities via mobile learning devices are increasing, including mobile game-based learning instruction (Wardaszko & Podgorski, 2017). Smartphones, tablets, and laptops offer numerous educational choices. Smartphones and tablets have free or affordable learning applications that teach languages, offer vocabulary lessons, provide mathematical tutorials, and teach practical subjects such as how to cook roast duck, how to repair a broken faucet, or how to find the surface area of rectangular prisms (Hariadi, Dewiyani, & Sudarmaningtyas, 2016; Hashim, Tan, & Rashid, 2015). For adult learners who did not complete high school and for those with limited Internet access, smartphones can become a new type of classroom

that offers students the ability to study and learn anytime and anywhere (Hariadi et al., 2016; Stevenson, Hedberg, Highfield, & Diao, 2015).

The need for technology in adult education programs has not gone unnoticed. College and career success is linked to proficiencies in technology use as well as competencies in literacy and numeracy (Hector-Mason, Narlock, Mushisani, & Bhatt, 2017). Learning via MLEs provides a dual technological experience. As students use technology to access coursework, research information, and collaborative venues, they learn how to maneuver in a technological landscape; self-directed, incidental, and socialized learning takes place almost simultaneously (Gu, 2014). Brown and Mbati (2015) pointed out that "the primary purpose of integrating technology into teaching and learning contexts is to enhance the learning experience" (p. 117). This premise is realized when adult learners use MLEs to advance their education and connect with multiple learning opportunities (Goldie, 2016; Siemens, 2005).

The need for reaching adult learners, especially those who are underprepared for the job market, is great. "While there are roughly 36 million U.S. adults struggling with the consequences of low skills, the adult education system today serves only 4.1 million adults, or roughly 11% of those in need" (Newman, 2015, p. 4). For adults who did not complete high school, the situation is especially dire. Dropouts are more likely than adults who finished high school to have low-paying jobs or no jobs at all (McFarland, Stark, & Cui, 2016). Dropouts have more health issues, are more likely to be incarcerated, and are more likely to depend on government services than their peers who

hold high school credentials (McFarland et al., 2016). Obtaining a high school diploma or equivalent certification could influence the lifestyle of an adult learner.

For adult learners who did not complete high school, earning their high school credentials is difficult. Previous educational experiences, learning disabilities, or personal beliefs discourage many adults from completing their education (McFarland et al., 2016; McKnight, 2015). For many young males of color, negative school experiences reinforced the notion that academic achievement was out of their reach (Schwartz, 2014). Native American learners who dropped out of school were often convinced that they were unable to learn or become successful in academic settings (Shields, 2014). Countering these negative beliefs poses a challenge. It is important to find ways to entice reluctant learners back into educational settings, whether those are brick-and-mortar establishments or MLEs.

In 2014, President Obama called for new initiatives to address the problems faced by low-skilled working adults. Prior to President Obama's address to the nation, the Organization for Economic Co-operation and Development created a survey to measure the educational skills of adults in 24 countries in the areas of literacy and numeracy and to assess their abilities in problem-solving (U.S. Department of Education, 2015). Based on this survey, additional studies of unemployed adults, incarcerated adults, adults ages 16 to 24, and adults ages 66 to 74 were conducted in the United States to create policies for low-skilled populations (U.S. Department of Education, 2015). Results of the study indicated that even though participants lived in a nation replete with technology, 36 million adults scored low in "literacy, numeracy, and problem solving" (U.S. Department

of Education, 2015, p. 1). Efforts to address this educational chasm must draw on pedagogical and technological resources (Brown & Mbati, 2015).

To address the gulf that exits between high school dropouts' academic abilities and the requirements to be successful in college and careers, an important change was made to the General Educational Development (GED) test. Beginning in 2014, it was aligned with the Common Core State Standards (CCSS) (L. Anderson, 2015; Pimentel, 2013). The CCSS address the challenges that adult students face when entering college and the workforce (Pimentel, 2013). Shifts in reading standards were meant to introduce adult students to complex texts, academic language, and informational and scientific texts (Pimentel, 2013). The new GED test is presented in an online format and is more rigorous than previous tests, and it is based on 12th grade CCSS (L. Anderson, 2015).

With the new changes to the GED, it is not surprising that many adult learners find the prospect of taking the test daunting (L. Anderson, 2015; Brinkley-Etzkorn & Ishitani, 2016). Brinkley-Etzkorn and Skolits (2014) found that young adult participants had issues with behavior and following directions, had limited familial support, and were prone to have problems in learning. On the other hand, this same population was more receptive to academic content when it was provided via computer or mobile devices (Brinkley-Etzkorn & Skolits, 2014). Studying the use of MLEs in GED classes and programs may assist in the development of new GED class models while mitigating adults' fears about testing using an online format.

Chapter 1 contains the background of the study, which includes how MLEs have become learning platforms for all ages and people. The problem statement and purpose of

the study reveal the context of this study and highlight the intent of the study, which was understanding how adults perceive MLEs. The research questions provide a guideline for the study. The chapter also includes the conceptual framework, the nature of the study, definitions, and assumptions that contributed to the study. Finally, this chapter covers the scope and delimitations of the study, the limitations of working with a population of adult learners who may lack technological skills, the significance of working with adult learners in GED classes, and a summary of the main points of the chapter.

Background

Using smartphones and tablets as MLEs is becoming more prevalent as people become more smartphone dependent; the smartphone has become an integral part of everyday life (Carter, 2017; Karnjanapun, 2015). People use smartphones to talk, text, shop, video, find directions, find answers on Google, and learn (White & Martin, 2014). Google offers a wealth of educational applications (Awuah, 2015). Learners of all ages are becoming more aware of the abundance of knowledge available on their smartphones. Ranieri and Pachler (2014) studied adult learners to create andragogical mobile learning tools and procedures and found that using MLEs allowed adult learners an elastic learning environment that supported cultural identities and was current. Ranieri and Pachler also noted that adults need more fluid ways of coping as well as the ability to create their own personal brand.

Research on how MLEs support second language acquisition is available as well as information on smart learning that focuses on how smart devices support adult learning through communication and collaboration (Hashim et al., 2015; Sung, 2015).

Munteanu et al. (2014) studied low-literacy adults and their use of an MLE that supported literacy and numeracy acquisition and found that participants' self-efficacy and self-confidence increased. How smartphones and tablets are used by adults in GED classes and what motivates them to learn experientially with them has not been adequately researched (Chan, Walker, & Gleaves, 2015). Although MLEs are being used in the United States and other countries for K-12 educational purposes, researchers have not explored how MLEs are being used with adult learners in GED classes (Parsons & Adhikari, 2016). This population of learners and their experiences with MLEs is important to understand to develop current technological andragogy that meets their educational needs (Chan et al., 2015; Sung, 2015).

Adult learners, especially those who did not complete high school, have lifestyles that are dissimilar to young adults who have completed high school (Hashim et al., 2015). The familial and social obligations of adult learners who did not complete high school are different from those who completed high school (McKnight, 2015). Adult learners often face socioeconomic challenges like financial instability that threaten their survival (McKnight, 2015). For adult learners living in poverty, an education can be perceived as a connection to social power (McKnight, 2015). At the time of the current study, the use of educational applications in GED settings had not been researched. To understand how adults in GED classes experience using MLEs and learning applications such as Khan Academy, it was necessary to explore participants' firsthand impressions and accounts.

Problem Statement

MLEs have become popular for providing access to college courses, language development courses, and business training courses (Ioannou, Vasiliou, & Zaphiris, 2016; Nickerson, Rapanta, & Goby, 2017; Mahdi, 2018). However, a review of the literature revealed that little is known about the experiences of learners in GED classes who use MLEs. Although adult education initiatives are available, most contain learning content that adult learners in GED programs perceive as barriers (Konopasky & Sheridan, 2016). Smartphones and tablets, which would allow for ubiquitous learning opportunities and which might prevent some course attrition problems, have not been integrated into most adult education programs (Laskin & Avena, 2015). This trend is changing with the release of new training technologies through the Coalition on Adult Basic Education and the Literacy Information and Communication System offered by the U.S. Department of Education (Carter, 2017). More research is needed to understand the experiences and perceptions of GED adult learners using MLEs to access educational applications and content (Ioannou et al., 2016).

This study may inform program developers and GED teachers regarding new ways of providing instruction for their students via MLEs. The opportunity to access academic content and the expansion of the classroom through discussion groups via MLEs removes boundaries and stigmas once associated with literacy education programs (Johnson-Bailey, 2016). MLEs offer new ways of learning that can facilitate GED students' prospects and empowerment (Diaz & Black, 2016).

The participants in this study were interviewed to explore how they incorporate mobile learning applications in an MLE in their GED class setting. Khan Academy, Codex: Lost Words of Atlantis, Cell-Ed, AmritaCREATE, AutoCognita, and Learning Upgrade were the mobile applications offered during the GED courses to increase literacy and numeracy proficiency. The adult learners were asked to describe the experience of learning new and critical content using smartphones or tablets as MLEs. Their perceptions and experiences contributed to the understanding of how adult learners in GED classes use MLEs.

Purpose of the Study

The purpose of this basic qualitative study was to explore the experiences and perceptions of adult learners enrolled in GED programs using educational applications in MLEs. MLEs were defined as mobile communication devices such as smartphones and tablets that allow for ubiquitous learning experiences. Findings may add to the understanding of how adults enrolled in GED classes learn in MLEs and may aid research on using mobile devices such as smartphones to reach underserved populations.

Research Questions

The following research questions were used to guide the study:

RQ1: How do adult learners use MLEs in their GED program?

RQ2: What are GED adult learners' perceptions of participating in an MLE?

RQ3: How do adult learners in a GED program at differing TABE score levels respond to the integration of educational applications in an MLE?

Conceptual Framework

The conceptual framework for this study incorporated elements of connectivism (see Siemens, 2005). Connectivism focuses on using digital devices and contends that it is more important for the learner to know how to access information than it is for the learner to possess information (Siemens, 2005). Proponents of connectivism argue that learning resides in environments outside of the classroom and is distributed throughout a network of connections (Foroughi, 2015; Garcia, Elbeltagi, Brown, & Dungay, 2015). Yumurtaci (2017) pointed out that connectivism defines the interconnectedness between today's networked society and the technology that supports it. According to Siemens (2005), content should be current, flexible, and able to evolve through connections with multiple learning sources. These concepts made Siemens's framework relevant for a study of adult learners in an MLE who are learning by accessing mobile learning applications.

Information about how MLEs can be used within the adult education field, especially the adult GED community, is limited, as are ways that MLEs can inform teaching and tutoring practices (Kizito, 2016). "In connectivism the starting point for learning occurs when knowledge is actuated by learners connecting to and participating in a learning community" (Goldie, 2016, p. 1065). For the current study, the starting point of learning occurred when the learners accessed the learning applications. This was related to Research Question 3, which addressed how the adult learners responded to the learning applications. Jirasatjanukul and Jeerungsuwan (2018) stated that as learners connect to and manage technological resources, they build knowledge connections. The

adult learners' initial and ongoing thoughts and impressions about the intervention tool were central to the current study.

Within connectivism, continual learning is established by connecting sources of information and knowledge (Duke, Harper, & Johnston, 2013). The adult learners in the current study used smartphones and tablets as MLEs to connect with learning applications like Khan Academy. Viewing Research Questions 1 and 2 from a connectivist framework enabled me to explore how the GED students perceived and described their participation in the MLE.

Nature of the Study

A qualitative research approach provided for an investigation of the experiences of adult learners in GED classes when introduced and immersed in an MLE. A basic qualitative approach was appropriate for this study because it has been used in educational research (see Merriam & Tisdell, 2016). Basic or generic qualitative research is practical and applicable in educational research because it provides a straightforward approach to interviewing and is situated within everyday life (Patton, 2015). According to Merriam and Tisdell (2016), basic qualitative research is an in-depth study of how the participants, in this instance adult learners in GED classes, "interpret," "construct," and "attribute" their experiences (p. 24). A basic qualitative approach was vital for understanding how the students made meaning of their use of the MLE, whether they chose to build new learning habits using MLEs, and how they qualified their new learning experiences.

Data were collected through interviews with adult participants in two GED classes and from observations and student test results from the Test of Adult Basic Education (TABE). After the interviews were transcribed by me and reviewed by the participants, the data were coded and analyzed using LaPelle's (2004) data analysis plan and Microsoft Word. Because I used connectivism as the conceptual framework, an analysis of how the data compared to the connectivism framework was conducted. The eight primary principles of connectivism provided the basis for understanding how the adult learners responded, perceived, and described their experiences in the MLE. This information was related to the use of the mobile applications, the adult learner, and the learner's ability.

To delineate the purpose of the adult learners' integration into the MLE and the goal of the study, clear paradigms were established. According to Patton (2015), paradigms are normative ways of looking at what is important and sensible. Paradigms allowed for "perceiving, understanding, and interpreting" the data, while also keeping the research within an established boundary (see Kaufman, Oakley-Browne, Watkins, & Leigh, 2003, p. 6). Within this paradigm, the data were analyzed using open, axial, and selected coding (see Neuman, 2006).

Definitions

Adult learner: The Department of Education in Texas has determined that adult learners are ages 16 years and older (U.S. Department of Education, 2017. For the purposes of this study, adult learners included students 18 years and older who were not

enrolled in high school or alternative high school educational programs (see Tighe, Barnes, Connor, & Steadman, 2013; U.S. Department of Education, 2016).

Andragogy: A learning theory that is used to understand the complexities of adult learning (Knowles, Holton, & Swanson, 2015).

Connections: Siemens's (2005) idea of nodes of learning that were created from connecting sources of knowledge via the Internet. Connections can be formed in different ways, including social media contacts, research sites, games, videos, and online course content (Yumurtaci, 2017).

Connectivism: A theory of learning developed by Siemens (2005) based on the idea that knowledge is not self-constructed but dependent on linking sources of information.

General educational development (GED): GED classes prepare adults to take the test for a General Equivalency Diploma. This diploma covers four standards that are aligned with the U.S. Common Core State Standards in reading, math, history/social studies, and science (Panzer, Johnson, & Lewis, 2015; Pimentel, 2013).

Khan Academy: A massive open online course site that offers learning modules across a wide variety of course options, including math, science, history, government, economics, art, and computer science (Ruiperez-Valiente, Nbiz-Merino, Leon, & Kloos, 2015).

Mobile learning environments (MLEs): Learning environments that are accessed through mobile devices, such as smartphones, tablets, and laptop computers. MLEs offer

accessibility to learning opportunities anytime and anywhere that are interactive and individual (Ally, Crimus, & Ebner, 2014; Hedberg, 2014; Tutty & Martin, 2014).

Paradigm: Normative ways of looking at what is important and sensible. Paradigms offer attachment to archetypical thoughts and worldviews (Denzin & Lincoln, 2013; Patton, 2015).

Smartphone: Mobile phones (either Android or iPhone) that include features such as cameras, Internet access, text features, calling capability, audio and video content, access to applications, calculators, clocks, social media applications, and more (Hammond, Bozdin, & Stanlick, 2014; Tossell, Kortum, Shepard, Rahmati, & Zhong, 2015).

Ubiquitous learning: Learning opportunities that can occur anywhere 24 hours a day (Gilman, Milara, Cortes, & Riekki, 2015).

Assumptions

Assumptions were necessary in this basic qualitative study. The first assumption was that the adult learners in the study would participate fully in the GED program. The underlying and most important assumption was that the adult learners would respond to questions about their experiences truthfully. To understand how the adult learners experienced using MLEs, I depended on the participants giving answers that clearly represented their experiences.

Scope and Delimitations

The scope of this study was adult learners 18 years old and older who did not finish high school and who were enrolled in GED classes. The participants were learners

who interacted with the MLE. The interview process was concerned with the participants' interpretation of using the MLEs. Later, I focused on the ways that the learners constructed learning experiences via the MLEs and how they understood their experiences (see Merriam & Tisdell, 2016).

Although this study was focused on adult learners in GED classes and how they understood MLEs and the experiences they had using them, the purpose was not related to the reasons why the adults did not complete high school or the situations that brought them to the GED program. Also, I did not examine why some adult learners persisted in the program and some did not, and I did not seek to understand how adult learners feel about earning the GED certificate. I concentrated on how the adult learners perceived how MLEs allowed them to make learning connections and how they found and used the information they needed (see Kizito, 2016). Although demographic and socioeconomic factors may have contributed to whether the adults in the study completed high school, these factors were peripheral to this study.

Limitations

The participants were adult learners enrolled in GED programs who were including educational applications on smartphones and tablets as mobile learning devices. One limitation of this study was that some learners faced difficulties with accessing the Internet, which may have influenced their perception of MLEs. Conceicao and Martin (2016) stated that "digital technology access and use have evolved into one of the key basic skills (in addition to reading, writing, and math) that are necessary for full participation in our democratic society" (p. 26). Another limitation was the exclusion of

the teachers' and facilitators' perceptions about using MLEs as part of their classroom instruction and homework assignments. Their input may have provided additional insight about learner experiences, motivation, and success. Excluding the teachers' voices may limit transferability to other research sites.

Another limitation to this study may have been the church affiliations of the locations. The program sites were sponsored by local churches as well as public donations. Even though neither site excluded students based on religion, gender, race/ethnicity, or sexual orientation, their affiliation may have been perceived by some potential learners as exclusionary. The learners in my study lived in historically poor neighborhoods. Studies that are conducted at government-funded learning sites such as libraries and schools may include a more diverse cross section of socioeconomic groups.

Other limitations to the study included exclusion of data about how the learners used social media. Siemens's (2005) theory of connectivism includes all Internet connections, which means that social media can be included as a learning platform. I did not expect social media to be a part of the GED program classroom instruction, and it was not. Studies that include social media, like Facebook and Instagram, may yield different results than this study.

Significance

This research served to fill a gap in the literature concerning how adult learners enrolled in GED programs experienced learning using an MLE. Findings may be important for instructional designers and educators of adult learners because results may provide insight into how this population responds to MLEs to access and use educational

material to support their learning, especially in literacy and numeracy (see Carter, 2017). New ways of providing educational content, both inside and outside of traditional classrooms, allow adult learners to access personally relevant information (Laskin & Avena, 2015; Mahdi, 2018). Using mobile devices has proved successful for K-12 learners and for college students, so it is possible that utilizing similar methodologies to teach adults in GED classes would also yield positive results, yet there has been little research to support this area (Carter, 2017; Laskin & Avena, 2015). Offering MLEs as an instructional learning tool for adults without a high school diploma or its equivalent could enable them to complete their education. This may allow these students to meet the challenges of finding employment, overcoming impoverishing circumstances, and becoming fully integrated members of society.

Summary

MLEs offer ubiquitous learning opportunities that correspond to the needs of adult learners. Although MLEs are being integrated into the K-12 learning environment, this study focused on how MLEs can be used to augment the learning experiences of adults who did not complete high school and who are seeking high school credentials through GED programs. MLEs such as smartphones, tablets, and laptops make accessing massive open online courses (MOOCs) easy, and many adults prefer watching class videos and taking quizzes as they go about their day (Sharples, Kloos, Dimitriads, Garlatti, & Specht, 2015).

> This proliferation of mobile technologies should drive a sense of urgency to use mobile devices in education. This is the first time in history that

> citizens around the world, in all age groups, hold information and communication technologies in their own hands. (Ally et al., 2014, p. 44)

The integration of MLEs into GED programs could become a new way of connecting at-risk individuals with new learning opportunities. For the current study, Khan Academy and other mobile applications were used as instructional tools. Khan Academy is replete with videos, practice lessons, and challenges that make it interesting and effective; it is also available to use anytime and anywhere (Sharples et al., 2015). Research about how adults in GED programs use MLEs was not found at the time of this study. This basic qualitative study was important because it addressed how adult learners in GED programs respond to an MLE and to educational applications. As emerging pedagogical and andragogical tools, MLEs are changing the ways that educational material is being delivered (Brown & Mbati, 2015; Sharples et al., 2015; Vazquez-Cano, 2014).

Chapter 2 provides the literature review for this study and includes research on MLEs, the use of smartphones as a pedagogical tool, and how adult learners are being impacted by the new GED test. Chapter 2 also introduces the conceptual framework and nature of the study. A gap in the literature regarding how MLEs were being used with adult learners in GED programs formed the basis of this study.

Chapter 2: Literature Review

MLEs have become popular for providing access to college courses, language development courses, and government/corporate training courses (Mao, 2014; Sammel, Weir, & Klopper, 2014). However, a review of the literature revealed that little was known about the effects MLEs have on adult learners enrolled in GED classes. The purpose of this basic qualitative study was to explore the perceptions and experiences of adult learners of MLEs for adults enrolled in GED programs. MLEs were defined as mobile communication devices such as smartphones and tablets that allowed for ubiquitous learning experiences. This study had the potential to add to the understanding of how adults enrolled in GED classes learned in MLEs and to aid research on using mobile devices such as smartphones to reach underserved populations. The literature review addressed the use of MLEs in the education of adult learners enrolled in GED classes and revealed five areas for consideration.

The first area concerned the population studied: adult learners in GED classes. Information about their learning beliefs, literacy and math levels, and perceptions about education were identified. In the second area, information about smartphone and tablet use with adult learners in GED classes and with underserved populations was investigated (see Chan et al., 2015; Karnjanapun, 2015). An initial search of the literature revealed no information about how adult learners in GED classes used MLEs. The third area of inquiry, smartphones as MLEs, concentrated on the use of smartphones in GED classes/programs, smartphone use by underserved populations, and how adult learners in general used smartphones as MLEs. The fourth area addressed mobile applications and

highlighted Khan Academy, an instructional intervention used within an MLE, to see how it affected adult learners in GED classes/programs. Little information was available about this particular population, so the literature review was expanded to include the use of Khan Academy in high school and middle school settings. The fifth area of literature reviewed was an exploration of basic qualitative studies and connectivism for adult learners, especially those enrolled in GED courses. This exploration revealed research on how adult learners reacted to the new 2014 GED test, but there was a paucity of information about how GED learners used MLEs to access assistance with the new test curriculum or how connectivism was used as a conceptual framework to study adult learners within GED populations (see Brown & Mbati, 2015; Hart, 2015; Panzer et al., 2015).

Literature Search Strategy

The databases used to conduct this literature review included Academic Search Complete, Computers and Applied Sciences, EBSCO Open Access, EBSCO Science and Technology, Education Source, ERIC, Google Scholar, Psyc INFO, Science Direct Subject Collections, and Walden University Library databases using the Thoreau Multiple Databases search engine. Searches were limited to peer-reviewed articles from the past 5 years. Journals from Sage Publications, such as *Adult Education Quarterly,* were reviewed for information on adults in GED courses and research on adult learners who did not complete high school. Internet sources included journals, publications, and reports from agencies such as American Council on Education, American Institute for

Research, Houston Independent School District, Literacy Advance of Houston, and U.S. Department of Education.

During the initial phase of the literature review, a meta-analysis by Hsu, Ching, and Snelson (2014) revealed a list of 14 mobile learning experts. This list included Mohamed Ally, Hui-Chun Chu, Matt Dunleavy, Xun Ge, Yueh-Min Huang, Gwo-Jen Hwagn, Yong, Liu, David Parsons, Mike Sharples, M. Mahruf C. Shohel, Philip Uys, and Tami H. Wyatt. Articles from this list were reviewed to understand the background and new research on MLEs. During the search process, Academic Search complete and EBSCO were the primary databases used to review mobile learning environments, mobile learning, and mobile learning environments in GED programs. There was little research about adults in GED classes and MLEs. The research base was expanded to include MLEs in other adult education settings, such as literacy classes, colleges, and intermediate and high schools.

Key words, phrases, and acronyms used in this review of the literature included *adult learners*, *adult learners beliefs about education*, *adult learners in GED classes*, *adults in remedial education programs*, *adults who did not finish high school*, *adult education*, *adult basic education*, *adult secondary education*, *ASE*, *assistive technology*, *basic qualitative studies of adults in GED programs*, *connectivism*, *electronic learning*, *General Educational Development*, *GED*, *GED literacy levels*, *GED and Common Core Standards*, *the new GED*, *educational interfaces*, *Here and Now learning*, *Khan Academy*, *Khan Academy and the new GED*, *literacy levels of adult learners*, *Mobile Learning Environments*, *MLEs*, *Mobile Learning Environments in GED programs*,

mLearning, *MOOCs*, *Practice*, *Tests of Adult Basic Education*, *TABE*, *tutoring for adult learners*, and *ubiquitous learning*.

Conceptual Foundation

The conceptual framework for this study was connectivism. Connectivism is learning that is distributed via technological networks and depends on social interaction and developing nodes (connections of knowledge bases) to locate and participate in learning experiences (Duke et al., 2013; Goldie, 2016; Siemens, 2005; Yumurtaci, 2017). According to Siemens (2005), connectivism includes principles gleaned from four theories: chaos theory, network theory, complexity theory, and self-organization theory. From this collection of principles, connectivism emerges as a flexible theory that adapts to new technological models of transferring knowledge. Learning is not static, nor is it bound by institutional constraints; rather, it is actionable and lies beyond the boundary of an internal locus (Duke et al., 2013). Within the connectivist viewpoint, knowledge is ever growing and changing, and learning depends on accessing knowledge and not merely memorizing facts or learning through conventional means (Jirasatjanukul & Jeerungsuwan, 2018; Yumurtaci, 2017). Learning skills change to core skills that are predicated on recognizing and capturing informational connections and utilizing those connections to learn and to build further learning nodes (Duke et al., 2013).

Siemens's (2005) eight principles of connectivism are the following:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in nonhuman appliances.

- Capacity to know more is more critical than what is currently known.
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. Although there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

The principles of connectivism were relevant to this literature review and study. The first principle is the idea that what must be known is more important than what is already known (Siemens, 2005). The adult learners in my study were individuals who did not finish high school and who were engaged in GED classes. Their need to acquire and assimilate knowledge to pass the GED test was crucial (see L. Anderson, 2015). By using smartphones to access online mobile learning applications, the adult learners were able to connect with learning content (videos, activities, and quizzes) that fit their learning needs. They were able to select and practice the skills they felt best fit their needs.

Two other principles of connectivism that were relevant to this study were that technological appliances, such as smartphones and tablets, can be learning repositories, and that connectivist learning should be pertinent and timely (see Siemens, 2005). Smartphones and tablets were the mobile learning environments chosen for this study

because of their portability and because most adults have access to them. Google Play Store, available on most smartphones, offered a plethora of learning applications. Among those applications was Khan Academy, which offers free access to its learning videos and activities. Both smartphones and Khan Academy offered ubiquitous learning opportunities.

Technological appliances like smartphones do not become the teacher; they are the vehicles through which learning can occur. Accessing technology necessitates that users try new applications, access new content, and vet new programs. Within Siemens's (2005) view, the rapid growth of technology has truncated knowledge, creating the half-life of knowledge, a shortened time span between what is relevant knowledge and what is obsolete. To further expand on that idea and to offer a criticism of connectivism, Goldie (2016) provided a perspective of connectivism that was situated within medical education and highlighted the neurological aspects of making connections via technology. Goldie pointed out the relationship between creating neural networks and creating meaning through subsymbolic Internet connections of learning. Goldie also pointed out some of the criticisms leveled at connectivism, such as conflicting results from studies of massive open online courses (MOOCs), yet his viewpoint was that connectivism provided a means of understanding the learning process.

Ping, Lok, Yeat, Cheryn, and Tan (2018) posited that using mobile applications in a connectivist framework would facilitate successful blended learning. Ping et al. hypothesized that undergraduate students who used MLEs to access chemistry applications would score higher on posttests than students who used the apps

sporadically. Results of tests of three different chemistry applications supported their hypothesis: When students were able to recognize the nuances and differences amid the abundance of connections, they learned (Ping et al., 2018). Ping et al. showed that using chemistry applications enabled students to increase their learning by working in small groups and alone. Wang, Anderson, and Chen (2018) also used connectivism as a theoretical framework in their interactive study of approximately 2,000 participants in Change 11 MOOC, an extremely large MOOC containing at least 30 new innovative reports on education. Wang et al. focused on how people built networks to learn, which stimulated interaction and creativity. The study was designed to show the social media and knowledge networks the students established to foster their learning opportunities (Wang et al, 2018). Ping et al.'s (2018) and Wang et al.'s (2018) studies revealed how students interact in connectivist learning networks.

Connectivist learning calls for changing the current paradigm of teaching. Instead of being taught, learners interact through facilitation from instructors, peers, social networks, and "non-human mechanisms" (Kizito, 2016, p. 23). When learning is situated within technology, it allows for the transference and assimilation of knowledge that could not be realized in other ways (Goldie, 2016). Using a qualitative review approach to study teacher assistants, Kizito (2016) described a shift from classroom-centric learning to technological-oriented connectivist learning to improve educational processes in African higher education programs. Kizito concluded that connectivism was the most appropriate learning perspective for digital learning platforms.

New knowledge via the Internet surpasses and enhances what was deemed common knowledge almost daily (Yumurtaci, 2017). Using the theory of acceptance model combined with the media naturalness theory, Yumurtaci (2017) evaluated Siemen's theory of connectivism by examining peoples' perceptions of the usefulness and ease of use of mobile technologies within their sensory capacity for communication. Yumurtaci wanted to understand how users perceived mobile technologies to understand how they learned from them. Yumurtaci found that constant access and portability had created digital nomads, or emerging societies that stay connected via mobile technologies. The ease of forming continuous connections to other people and to information sources through mobile technologies depends on the learner's ability to identify valid and current sources of information (Siemens, 2005).

The beliefs of the adult learners in my study either hampered or enriched their learning experiences. The theory of connectivism includes the need for learners to have a positive belief system that depends on social interaction and sense making. The adults in my study who were learning the information that was mandatory to pass the 2014 GED were also being exposed to new learning applications at their learning centers in an effort to expedite the accumulation of knowledge but also to facilitate the students' learning of new technology. Participants faced the challenges of connecting with new academic information via smartphones and tablets. Within a connectivist framework, learning was expedited and facilitated by building nodes and using them to acquire new information, to practice new skills, and to forge social learning connections (see Goldie, 2016; Siemens, 2005).

Adults in General Educational Development Classes

Adults in GED programs come from a wide spectrum of ethnicities, educational backgrounds, socioeconomic statuses, and experiences (McKnight, 2015; Mellard, Woods, & Lee, 2016). To better understand adult learners in GED programs, it is important to study their learning beliefs, their math and reading literacy levels, and their perceptions of education because these areas encompass how and what the adults learn, where to begin their remediation and instruction, and why the students have chosen to return to an academic setting (Diaz & Black, 2016). The age range for the adults in my study was 18 years and older. Participants were adult learners who were not enrolled in high school or alternative high school educational programs.

Leaving high school and/or not attaining high school equivalency credentials not only impacts the adult learners, it negatively affects their families, the labor force, and the economy (Ecker-Lyster & Niileksela, 2016). According to Zaff and Malone (2017), when young people leave school, they are likely to become impoverished, unemployed, incarcerated, and unhealthy. This impacts most of society's key systems: education, social services, law enforcement, and health care (Zaff & Malone, 2017).

Diaz and Black's (2016) case study of five second-generation Latino adult learners who opted out of the public-school setting to attend GED classes addressed the students' perspectives about high school and the reasons they decided to take the GED. During interviews and from personal notes, the students reported feelings of isolation and boredom (Diaz & Black, 2016). They mentioned how they felt victimized and disregarded because of racism (Diaz & Black, 2016). These young adults ages 18 to 25

showed great resiliency and persistence in working toward a GED certificate (Diaz & Black, 2016).

Understanding what adult learners believe about learning is important. An ethnodrama created by Davis (2014) from narratives derived from semistructured interviews, field notes, journal entries, and demographic information of 12 GED students whose ages ranged from 18 years old to 25 years old presented a way for adult learners to be heard. Davis' goal was for the adult learners to be re-represented through drama. Throughout the ethnodrama, the students told their struggles with completing high school. They discussed the reasons they left school: unfinished coursework, unplanned pregnancies, deficient credits, family needs, and discipline issues. Some students were told to leave school prior to graduation. Some of the adult learners studied by Davis voiced regret that they had not finished high school, but most were determined to obtain their high school equivalency diploma.

For many adult learners in GED programs, learning beliefs have already been established and often make integration into adult learning venues difficult to achieve (Jameson & Fusco, 2014). Jameson and Fusco's (2014) quantitative study of adult learners' mathematics anxiety and mathematics self-efficacy study used 9-item Likert-type questions to understand whether adult learners were more apt to have lower math self-concepts, higher levels of anxiety, and lower self-efficacy than traditional college students. Of the adult learners chosen as participants for this study, a significant number were from a developmental math class designed for adults not prepared for college-level courses.

Being proficient in math allows individuals access to lucrative and technology-related jobs, but often adult learners who did not complete high school math courses do perceive life experiences or on-the-job training as sources for math instruction (see Jameson & Fusco, 2014). Instead, they see their age or time away from the classroom as impediments. They feel inadequate in mathematical literacy because of negative stereotypes relating to age and sometimes gender (Jameson & Fusco, 2014). Shields (2014) explored how negative learning beliefs and past experiences influenced First Nation (American Indian) adult learners in a GED program. Like Jameson and Fusco's study, Shields's research data, gleaned from semistructured interviews with students and observations as staff support to students, showed that negative self-beliefs and lack of academic efficacy were difficult to overcome.

Many of the adult learners in Shields' (2014) ethnographic study were years behind in mathematics courses. Being successful on the GED mathematics portion of the test was an extremely difficult task for them given that budget for the First Nations GED program only allowed for three and a half months to master the content. Most students were at the fourth or fifth grade level in math. Shields also felt that teaching to the test set up GED learners to fail, and failure on the test reinforced negative self-beliefs. In contrast to Shields' study, Tighe, Barnes, Connor, and Steadman (2013) used a two phase approach to gather data: the first phase used state-provided data that measured teacher effectiveness, and the second phase consisted of student interviews and observations. Tighe et al. found that adult learners in one group study appreciated targeting their weaknesses on GED practice tests and studying specifically to correct those weaknesses.

Tighe et al. also found that most students chose to work independently and relied on small groups or individualized mentoring to concentrate on areas they found challenging. Their study has implications for other GED formats because it showed that stakeholders including teachers, students, and state agencies, have different definitions of success. Most stakeholders agreed that motivational factors along with student/teacher relationships and ideas about the importance of tests contributed to students' perceptions of success (see Tighe et al., 2013).

One study conducted by Shaw, Tham, Hogle, and Koch (2015) used Vroom's expectancy-valence model for their theoretical framework. By using this framework, the researchers allowed the adult learners to voice their expectations of the GED program, and they measured how the students perceived the value of the experience. The 12 participants in the study were enrolled in an online GED class. The online classes contained curriculum in mathematics, reading, language arts, writing, science, and social studies. An online interactive tutorial program, Skills Tutor, was provided for students who needed remedial work in language arts and/or math. From their analysis of the data, Shaw et al. concluded that students appreciated the opportunities that Skills Tutor and Blackboard afforded for practice, for remediation, and for constructive learning experiences. Results from surveys and interviews showed that most of the students felt the online program was a positive experience and contributed to their learning (Shaw, Tham, Hogle, & Koch, 2015). From student reports, the researchers concluded that the flexibility of the online format was the main reason many students began their GED programs and the reason they continued in the programs. The online format provided

ubiquitous learning experiences. Unlike Tighe et al.'s (2013) study in which the students valued collaboration with other students and peer and family support, the students in Shaw et al.'s (2015) study were uninterested in peer interaction; instead they valued individual work during times conducive to their schedules.

The aim of adult learners in GED classes is to pass the GED certification tests and obtain their high school equivalency diplomas. Prins and Kassab (2015) used a quantitative approach to analyze a subset of data collected from the Free Application for Federal Student Aid (FAFSA) of students in Pennsylvania to provide a realistic picture of the differences in GED graduates and high school or alternative school graduates. Prins and Kassab wanted to show differences in rural and urban GED graduates, and they wanted to describe the demographics of GED graduates. Their analysis revealed that GED graduates were likely: susceptible to economic hardships, non-single, women, older than traditional graduates, parents, and not usually able to pursue a four-year degree. GED graduates were also more likely to enroll in two year technical degrees.

When adult learners enter GED programs, they are often deficient in math and reading literacy skills. The TABE is used to assess students' initial skills levels and as a means of tracking progress in Adult Basic Education (ABE) programs (Tighe et al., 2013). Other tests are also used to determine adult literacy and numeracy levels, and not all the testing material used for adults is appropriate for the way that adults who did not complete high school think and learn (Nightingale, Greenburg, Branum-Martin, & Bakhtiari, 2016). Some of these tests are: the Woodcock-Johnson III Tests of Achievement, the Test of Silent Word Reading Fluency, the Test of Work Reading

Efficiency, the Woodcock-Johnson III Tests of Cognitive Abilities, the Wechsler Adult Intelligence Scale, Woodcock-Johnson III Passage Comprehension, the Peabody Picture Vocabulary Test, and the Qualitative Reading Inventory (Mellard, et al., 2016; Nightingale et al., 2016). Pre-enrollment test results are used to place students in classes that provide suitable instructional materials and offer differentiated instructional strategies (Mellard et al., 2016).

Adult learners entering GED programs may not have been accurately assessed when initiating their programs (Mellard et al., 2016; Nightingale et al., 2016). Inaccurate assessments could prove problematic for adult learners who struggle with reading and mathematics (Schwartz, 2014; Shields, 2014). The 2014 GED test is considered a rigorous test of reading, writing, math, science, and social studies skills (Brinkley-Etzkorn & Skolits, 2014; Shaw et al., 2015). The content of the reading and mathematics portions of the test includes selections and questions that are meant to assess college readiness (Brinkley-Etzkorn & Skolitis, 2014). Struggling readers and adult learners behind in basic numeracy skills need coaching and practice to master the math and reading sections of the GED test (Brinkley-Etzkorn & Skolitis, 2014; Shaw et al., 2015).

Tests created to measure K-12 children's reading abilities are sometimes used to assess adult learners who have not completed high school. Nightingale et al. (2016) conducted research in conjunction with the U.S. Department of Education (USDE) to analyze various literacy tests used to assess struggling adult readers and "to investigate what the correlations among the fluency measures and other literary measures suggest about their convergent and discriminant validity and the potential influence of

measurement methods" (pp. 19-20). The participants were adults with reading levels between third and eighth grade; they had been categorized as struggling readers. Nightingale et al.'s research served to fill a gap in the literature about how fluency should be tested for adult learners. The results of this research found that although some tests like the Woodcock-Johnson III Reading Fluency subtest and the Test of Word Reading Efficiency Sight Word Reading seemed to accurately measure adult reading levels, most of the tests given to the adults were not accurate. Furthermore, giving tests meant to measure K-12 children's reading abilities were not appropriate for struggling adult learners (Nightingale et al., 2016).

Because tests such as the Woodcock Johnson III Tests of Achievement are used to test struggling adult learners and young adults who have left high school, it is important that they be viable and their results valid. Mellard, Woods, and Lee (2016) studied young adults who had left public high schools either by dropping out or for other reasons. The students were enrolled in Job Corps and were assessed in reading and math using the Comprehensive Adult Student Assessment Systems (CASAS). The mean reading score was within the eighth grade reading level, while the average math score was in the sixth grade level. Course placement was dependent on scores from the Woodcock-Johnson III Tests of Achievement, the Wide Range Achievement Test 4, the Wechsler Adult Intelligence Scale, and other written and oral assessments, including the TABE. (Mellard et al., 2016).

Nightingale et al. (2016) and Mellard et al.'s studies (2016) emphasized the importance of using the correct assessment and evaluation methods for adult learners who

struggle in math and reading. Mellard et al.'s study also showed the importance of using the right intervention tools for this group of adult learners. Some students self-identified as having learning disabilities. Accurately assessing what adult learners know and how they learn informs curricula development, classroom instruction, and differentiation methods for special needs (Mellard et al., 2016).

Adult learners do not enter secondary educational programs from a void. They come with previous educational experiences; some have endured schools riddled by violence, injustice, bigotry, bullying, and low expectations (Lange, Chovanec, Cardinal, Kajner, & Acuna, 2015; McKnight, 2015; Shields, 2014). Shields' (2014) account of adult First Nations learners painted a picture of students exposed to cultural indifferences and negation of ontological beliefs, while enduring removal from tribal and familial bonds, bullying, and homesickness. When the adults for this study entered GED preparation classes, they did so from an educational background that had ignored their indigenous modes of learning, so their negative beliefs about education were difficult to overcome. Overlooking cultural and racial backgrounds is common in other educational arenas, as well. McKnight (2015) found that urban youth also suffered from educational systems that ignored their racial identities and their cultural modes of learning. The 22 participants in McKnight's research recounted their negative public-school experiences. Several students either were or had been incarcerated. Survival was a recurring theme, and students understood that gaining knowledge was crucial.

For African American young men dropping out of school is not always an accurate reason for why they stop attending school. "*Pushout,* with the implication that

leaving school was at the hand of others" may be a truer definition of why they leave school (see Schwartz, 2014, p. 110, emphasis in original). To counteract such negative experiences, Schwartz (2014) found that GED programs needed to oppose or resist the ways that urban schools operated; they needed to be safe spaces that allowed for "healing, creativity, and voice" (p. 113). Like McKnight's (2015) study of urban youth, Lange, Chovanec, Cardinal, Kajner, and Acuna's (2015) work with wounded learners, and Shields' (2014) experiences with First Nations' students, Schwartz found that perceptions about education colored how GED students reacted to their current educational situations, their self-efficacy, and their ability to learn in formal and informal settings.

Factors other than self and academic efficacy may better explain why adult learners continue to pursue their education. Reasons like wanting to help their children with homework, getting a job, pursuing career advancement, obtaining social power, or desiring continual learning were the motivators for many of the adults surveyed in the studies cited in this literature review (Lange et al., 2015; Schwartz, 2014; Shaw et al., 2015). Technological advances in adult programs using MLEs providing adult emerging literacy and numeracy programs may also contribute to increased participation in learning activities and the pursuit of personalized learning opportunities (Ranieri & Pachler, 2014; Windisch, 2016).

Mobile Learning Environments

MLEs such as tablets, laptops, and smartphones are changing the way that education is being delivered. Whether transmitted through massive open online courses

(MOOCs) like Coursea or practice applications like Khan Academy, educational opportunities are becoming free and ubiquitous (Gilman et al., 2015). By using MLEs through smartphones, tablets, and other portable devices, learners can access academic content any place and anytime, breaking through barriers of time and space by informal and formal means of acquiring knowledge (see Ally & Prieto-Blazquez, 2014; Schmid, Manturuk, Simpkins, Goldwasser, & Whitfield, 2015; Tutty & Martin, 2014).

MLEs are mobile*;* they are accessed via handheld communication devices. Learning may occur wherever and whenever the learner activates an educational app on his device. According to Ally, Grimus, and Ebner (2014), mobile learning is interactive, individualized, offers a multiplicity of learning opportunities, and includes the chance for knowledge to be built and assimilated (pp. 45-46). Tutty and Martin (2014) stated, "The anytime, anywhere availability of mobile devices has potential to promote a seamless 360-degree learning experience, that breaks down the barriers between formal and informal educational environments" (p. 17). Because MLEs are portable, learners may seek and obtain knowledge they want and need through learning applications, online classrooms, and social platforms (Ally & Prieto-Balzquez, 2014). MLEs are useful for learning everything from math problems to new languages; they are the new classrooms of the future (Schmid et al., 2015).

Online platforms are now pervasive means of delivering higher academic content, informal learning opportunities, and professional development courses. Most colleges and university classes use some online features such as drop boxes, discussion boards, interactive syllabi, Google docs, and YouTube videos (Karbjanapun, 2015; Underdown

& Matin, 2016). Course delivery systems have been structured for ubiquitous availability, and researchers seek answers to what motivates learners, particularly adult learners. Hashim, Tan, and Rashid's (2015) study of 255 adult students sought to uncover what adult learners wanted from mobile learning opportunities. Using a web survey, they looked at differences in adult learners, working adults over the age of 21, as compared to traditional learners, college students with ages ranging from 18 to 21. Basing their research on the uses and gratification theory, which has been used in adult education to measure how learners are motivated to use technology, Hashim et al. (2015) discovered that adult learners were not initially as attracted to online platforms as traditional learners. However, when m-learning platforms met the adult learners' affective, social, and cognitive needs, the adults were more likely to be motivated to use and engage in them (Hashim et al., 2015).

Massive open online courses (MOOCs) offer admittance to college courses, certifications, and tutorials. Schmid, Manturuk, Simpkins, Goldwasser, & Whitfield (2015) distributed 414,000 surveys to understand whether MOOCs could reach underserved adult populations. Their study's population included learners under 18 years old, learners over 65, and learners with limited access to traditional learning. Thirty-one thousand people responded to the surveys. Of those responding, they found that 25,918 learners were interested in MOOCs as a supplement to learning: the courses were seen as a means of gaining information needed for careers, for recreational purposes, to augment classes taken in traditional settings, and for the experience of studying from prestigious colleges and universities which were otherwise unattainable (Schmid et al., 2015, p. 126).

Findings from Schmid et al.'s study complement those of Hashim et al. (2015) because they show that adults are motivated to seek online learning opportunities that meet their affective, social, and cognitive needs.

Mobile learning is effective (see Mahdi, 2018; Nickerson et al., 2017; Wardaszko & Podgorski, 2017). Mahid's (2018) meta-analysis of 16 studies which included 986 participants compared traditional vocabulary-building programs with MLEs that provided English vocabulary tools. Findings from this study were significant because they showed that MLEs could be effective means of teaching vocabulary skills. Like Mahdi's (2018) analysis, Wardaszko and Podgorski's (2017) research found positive effects for mobile learning. Their investigation of game-based mobile applications used with 160 Polish and Ukrainian students found that students using game-based MLEs had immediate short term benefits and showed improvement on assessments delivered long term. Acquisition, comprehension, and applications of knowledge must be assessed and interpreted in different ways (Nickerson et al., 2017). Nickerson et al.'s, 2017 quantitative study of 132 business students showed that mobile learning that occurred outside of traditional classrooms was an important component of the students' overall learning experience. This study highlighted the positive ways that MLEs influence current marketplace skills (Nickerson et al., 2017).

MLEs and classrooms offer complementary learning experiences: Internet learning connections, data-collection services, and a continuous learning experience (Hedberg, 2014). Traditional means of delivering educational content are challenged when handheld mobile technologies flip the classroom and make learning a continuous

experience. Students have access to videos and practice materials that encourage learning outside the walls of school (Hwang, Lai, & Wang, 2015).

With the advent of MLEs, pedagogy for mobile learning must also be extended (Hedberg, 2014). Teachers' roles change because mobile learning interactions blend informal and formal ways of teaching and learning. Students interact with content through academic sources as well as social media on the Internet. To facilitate MLEs successfully, teachers must be able to access and use MLEs and be familiar with current and emerging technologies (Ally, Crimus, & Ebner, 2014). In their study of 132 pre-service teachers, Tutty and Martin (2014) found that MLEs are most effective when they allow for reflective practice. Students who received in-time feedback were more motivated to practice and to enjoy their learning experiences. When feedback was tied to a mastery objective, the instructional design was more aligned to the outcome. When learning designs are not planned effectively, pedagogical goals are not met (Kizito, 2016). Kizito's (2016) study of a teacher assistant training program highlighted the experiences of African students' interaction with technology. Lack of clear learning goals and scaffolding deficiencies contributed to the failure of the technology program. Important lessons were learned from this study. Most relevant to research about MLEs was the need for the learning environment to be able to support the MLE and for the learning activities to be meaningful and interactive (Kizito, 2016).

Mobile learning applications are providing new media-enhanced lessons across multiple genres. Mathematics and literacy applications abound, as do apps for history, science, geography, and foreign languages (Hariadi et al., 2016; Stevenson, Hedberg et

al., 2015). Mobile devices, like smartphones and tablets, contain the Google store replete with everything from learning apps to games and social sites. Knowledge is transferred easily, and the learner has almost unlimited learning opportunities available through applications contained within a handheld MLE (Stevenson et al., 2015). For struggling students, applications allow for revisiting misunderstood content and for practicing concepts outside of the pressures of the classroom (see Zhang, Trussell, Gallegos, & Asam, 2015).

Generation Z students, who have grown up during the mid-90s and into the 2000s in the midst of technology and who count on social and informational connections, seem most comfortable using mobile applications and digital learning platforms (Hariadi et al., 2016. For them, applications like Google Apps for Education (GAfE) seem natural and augment traditional classroom practices without wasting time (Bryne-Davis et al., 2015; Hariadi et al., 2016). Stevenson et al. (2015) pointed out that mobile learning applications provide more options than traditional schooling. They promote learning a broader spectrum of literacies that correspond to the current trends of making meaning digitally (Stevenson et al., 2015). Literacy tools and educational opportunities are available by keyboard and graphic interfaces, social media sites, wikis, geocities, cloud-based interactions, blogs, windows, desktop publishing, and more (Stevenson et al., 2015).

The mobile and ubiquitous nature of smartphones and tablets are appreciated by male and female adult students. Liaw and Huang's (2015) study of 159 university students found that no gender differences existed in how students used app-based learning. The results of their study highlighted gender differences in social anxiety self-

efficacy, and self-regulation. Females were more likely to experience social anxiety while using social media, if it was introduced as part of the mobile learning component. Males were apt to respond negatively when faced with mobile learning situations demanding self-efficacy but positively on those requiring self-regulation (Liaw & Huang, 2015). Applications are also being used as transactive memory stores; learners do not try to learn or remember the details of Internet content; rather, they remember where they found their answers (Bryne-Davis et al., 2015). These memory stores accessed through applications become a part of a learner's cache of connections that are then drawn from and shared with others, creating continual learning networks (Bryne-Davis et al., 2015; Kizito, 2016).

One population of learners that cannot be ignored, especially in the United States, is immigrants. The GED test is one of the primary ways that immigrants enter the workforce and integrate into society (L. Anderson, 2015). For non-English speaking adult learners, applications to help navigate a new country and to learn the English language or other languages provide informal and incidental learning opportunities—learning that takes place unconsciously and on the go (Demouy, Jones, Kan, Kukulska-Hulme, & Eardley, 2015). Smartphones, which have applications available such as Duolingo, Anki, Memrise, and Yabla, are MLEs that facilitate the transfer of language knowledge (Demouy et al., 2015; Jones et al., 2014). Demouy et al.'s (2015) study of 143 adult language learners found that 74% of the students used MLEs almost daily to study new languages, and 86.5% reported studying at times and places that they would not have considered in the past. The adults mentioned using their mobile devices to study during

work breaks, on the bus, and in other informal contexts. The learners also enjoyed learning in a variety of ways provided by choosing different applications, and they used different applications to address self-perceived gaps in their language acquisition process (Demouy et al., 2015).

Even though some immigrant students readily used their smartphone applications for learning, they were most likely to engage in applications that gave immediate feedback and that allowed for using that feedback to create new information connections (Jones et al., 2014). MApp is an interactive language teaching tool that provides in-time feedback to users and helps build informal and incidental learning experiences (Jones et al., 2014). MApp uses GPS to show users where to go, provides vocabulary and conversation tools, translates, and provides city and social information. Demouy et al. (2015) found that adult learners were more engaged in learning with MLEs when they used a variety of learning applications to meet their needs; therefore, using multiple learning applications may facilitate adult learner engagement and retention in programs using MLEs.

Whether learners are aware they are learning in MLEs, or if they are learning in incidental ways, MLEs offer ways to build literacy and math skills, to instruct students in new languages, and to offer learning opportunities through MOOCs that might be beyond the financial reach of some learners (Jones et al., 2014; Munteau et al., 2014; Sharples et al., 2015). MLEs provide the chance for experiential learning and for repetitive learning (Munteau et al., 2014). In a literacy study by Munteau et al. (2014), 11 nonliterate adult learners incorporated the ALEX mobile learning devices into their school, work, and

home experiences. Using ALEX as a homework tutor and language translator, the learners formed attachments to their mobile devices, calling them by name and introducing them to classmates, friends, and family. The learners relied on the devices for reading, spelling, and socialization in studying. One student outside of Munteau et al.'s (2014) study used ALEX to feel more confident in studying for the GED. Munteau et al.'s (2014) study showed how MLEs can support adults in learning and in going about their everyday jobs.

Mobile learning applications provide new teaching and learning methods through MLEs like smartphones and tablets. Hsu et al.'s, (2014) research data on MLEs was collected using the Delphi method, a consensus technique, from 14 international experts on mobile learning. Their study indicated that MLEs in the future will offer even more affordances for learning: "high device-portability," strong computing functions, constant Internet access, the ability to communicate anywhere and anytime (Hsu, Ching, & Snelson, 2014, p. 2). As MLEs become more prevalent, using applications might become a norm in formal and informal learning environments.

Smartphones as Mobile Learning Environments

Smartphones, as MLEs, offer a plethora of learning capabilities and opportunities. Smartphones' features include cameras, text features, audio and video content, access to learning applications, recording capabilities, global positioning systems (GPS), Internet access, email, word processing, readers, calculators, and much more (Hammond et al., 2014; Tossell et al., 2015). They can be used as delivery systems for formal and informal learning, and they can help social agencies and academic institutions deliver user-specific

knowledge (Chan et al., 2014; Geckle, 2016; Munteanu et al., 2014; Shraim & Crompton, 2015). Young adults responded positively to physical and mental health information delivered via texts; they showed decreases in risky sexual behavior, increases in smoking cessation, decreases in drug relapses, and positive reactions to mental health information (Geckle, 2016). The affordability and portability of smartphones has led to increased learning capabilities for consumers; the smartphone offers ubiquitous access to networks in business, academia, services, and recreation (Ranieri & Pachler, 2014).

While smartphone usage in schools, college, and universities is growing, one area of smartphone use in education has been noticeably under-researched: smartphone use with GED populations. The examination of peer-reviewed literature found GED populations and smartphone use was limited to a few studies about GED students who were incarcerated, students who felt betrayed by perceived racial barriers, or students using technological affordances to study for the new 2014 version of the GED test (Brinkley-Etzkorn & Skolits, 2014; Crabtree, Ohm, Wall, & Ray, 2016; Simone, Conceicao, & Martin, 2016). Information about educational opportunities for using smartphones with underserved populations was also scant; however, there were research studies that covered smartphone introduction and use in adult populations.

The 2014 GED test is delivered in an online format. The new test's alignment with common core standards is daunting for students who did not receive their education based on Common Core requirements (L. Anderson, 2015; Brinkley-Etzkorn & Skolits, 2014). Using computers, smartphones, or other devices to study for the GED has been found to have positive effects among GED students (Brinkley-Etzkorn & Skolits, 2014).

Perceptions about using smartphones or other MLEs varied among student populations. Using data from surveys, investigations, and literature, Conceicoa and Martin (2016) found that people choose to embrace mobile technologies or to eschew them. From their efforts to understand the digital divide between different socioeconomic groups, they noticed that black men responded to MLEs in three different ways: they saw them as politically enslaving; they perceived them as entrance vehicles into society; or they used them as tools to wrestle power away from dominating culture groups (Conceicoa & Martin, 2016). Conceicoa and Martin's (2016) aim was to inform society about the need for Internet access for people of color and to provide ideas about how to create programs that are accessible via digital technologies.

Smartphones can provide unique learning opportunities for underserved populations. "Furthermore, as smartphones run on mobile operating systems such as Google Android, Apple IOS, and Nokia Symbian, they have the capacity to run numerous free and paid applications, transforming the once dedicated mobile phones into powerful, mobile personal computers" (Chan et al., 2015, p. 96). Smartphones have been beneficial for creating educational spaces for people considered low-literacy or illiterate. Smartphones offer reading and math literacy supports from applications like Khan Academy and Virtual Reality Trainers (Munteau et al., 2014; ur-Rehman, Shamin, Khan, Elahi, & Mohsin, 2016). They also reinforce literacy skills by providing dictionary services.

In Munteanu et al.'s (2014) and ur-Rehman et al.'s (2016) studies of low-literacy adults, using mobile devices gave students confidence and motivated them to learn more.

Because smartphone use is so prevalent today, students did not feel stigmatized when accessing their learning content from their phones (Munteanu et al., 2014; ur-Rehman et al., 2016). The 120 farmers and women in ur-Rehman et al.'s study were exposed to a 3D learning environment that was designed to mirror the objects in their daily lives and teach basic literacy skills. Using MLEs proved beneficial to adults in the study because an avatar used Urdu, the local dialect, to name objects; the phones were easy to operate; and the adults could use the devices ubiquitously. Learning via smartphones also had a positive effect on Munteanu et al.'s (2014) 11 student participants; the smartphone made accessing applications for math and literacy support easy.

While smartphone use in K-12 schools is still under debate, most colleges and universities are experimenting and embracing the ubiquitous learning prospects smartphones offer (Chuang, 2015). Hannon (2017) studied whether animal anatomy applications would be useful in stimulating pre-class preparation and in-class engagement for veterinary classes. Students learning with anatomy applications scored higher on tests than their peers who used only textbooks. Chuang's (2015) quantitative study of a university-level, smartphone-collaborative technology class found that almost 75% of students using the mobile applications were pleased with the ease with which the system operated, and over 60% reported the app helped them with concentration and comprehending course materials.

College students tend to spend additional time on their work when they connect with compulsory coursework that offers supplemental learning resources via smartphone-supported learning systems (see Fuller & Joynes, 2015). In a case study by Fuller and

Joynes (2015), fourth- and fifth-year medical students were more apt to take formative assessments and make in-time adjustments to learning outcomes, and they were more likely to use their smartphones to connect with informal Internet sources to augment content taught in classes (Chuang, 2015; Fuller & Joynes, 2015; Sykes, 2014). Using a mixed methods approach to determine the effectiveness of implementing iPhones in university classes, Sykes (2014) found that students were excited to use their phones, and they out-studied and out-performed their comparison group. Smartphones are becoming important learning environments in college-level courses. Like the college students mentioned above, the adult learners in the GED classes that are part of my study will be using smartphones and tablets to access educational material and resources. Understanding how adult learners use MLEs in college settings has implications for how adult learners in other settings might use smartphones and tablets to learn.

Educators are becoming more interested in bringing smartphones and tablets into the classroom. In Shraim and Crompton's (2014) study, educators were given questionnaires to discover their perceptions about using smartphones in the classroom. Survey data were measured using a quantitative description method, revealing that the more faculty felt at home using smartphones to learn, the more likely they were to be comfortable using the smartphones as learning environments in their courses. This study also highlighted that educators are interested in utilizing technology that connects with struggling and disabled students through applications and downloads that aid in differentiation (Shraim & Crompton, 2015). The study by Shraim and Crompton (2015)

has implications for how teachers in GED classrooms could use mobile applications to aid students who need remediation or language assistance.

Smartphones as mobile learning devices have some limitations that must be considered. Some adult learners may lack experience in using smartphones and be unwilling or unable to use them effectively (Sung, 2015). Smartphones offer an array of learning opportunities; but for adults with limited literacy skills and inadequate training in technology, the choices may be overwhelming. Also, the abundance of technological features, social media abilities, and entertainment features can prove distracting for adult learners (Tossell et al., 2015). Social media can prove to be a powerful distraction, as can the lure of games and musical features. Scaffolded and structured learning environments could alleviate some distracting elements and prove motivating for students when integrating technologies, like GPS or YouTube, as MLEs (Hammond et al., 2014; Tossell et al., 2015).

Mobile Applications

Khan Academy is one of the most accessed open online courses available that offers ubiquitous learning modules across a wide variety of curriculum options (Ruiperez-Valiente et al., 2015). Math, science, history, government, economics, art, and computer science are among the content areas covered in Khan Academy. Purported to be one of educations' best and newest innovative tools, Khan Academy is becoming widely used in blended classrooms, to flip classes, and as an intervention tool (Cargile & Harkness, 2015; Light & Pierson, 2014; Pinkus, 2015).

Two of the most important aspects of Khan Academy are mastering of core skills is considered critical and individual learning pace is respected (Cargile & Harkness, 2015; Light & Pierson, 2014; Smith & Harvey, 2014; Zhang et al., 2015). Many GED students left high school because of failing grades, lack of credits, and skipping school (Davis, 2014). Remediation of skills using Khan Academy which offers video tutorials and numerous practice questions allows GED students to make up classroom time and to hone their basic skills.

During the review of the literature, no peer-reviewed research studies were found about the use of Khan Academy with adults in GED classes or programs. The scope of the review was broadened to include the use of Khan Academy with high school and middle school students. There were several studies that met this search criteria. Two other studies were reviewed: one by Ruiperez-Valiente, Munoz-Merino, Leon, & Kloos (2015) that extended the analytical model used by Khan Academy and another by Chen and Wu (2015) that researched using video models for instruction, which is Khan Academy's primary means of delivering course contents.

Two ways Khan Academy was being used in high schools and middle schools were as math interventions and practice tools. Students used Khan Academy to learn new content, practice problems, and for enrichment (Kelly & Rutherford, 2017). For students struggling with core math skills, Khan Academy allowed students to work at the pace they needed to master skills, become proficient, and to move on to more advanced concepts (Light & Pierson, 2014). Khan Academy's math curriculum's design established sound practices in cognitive development, strengthened content knowledge, and

developed opportunities for learning academic content and critical thinking skills. Khan Academy has also been used to flip classrooms (Cargile and Harkness, 2015). Teachers used Khan Academy as a homework piece that enabled students to view videos about math and science skills prior to their introduction in the classroom. The exercises included Khan Academy's website augmented problems taught in the classroom. The exercises allowed students to practice problems until they mastered the learning objective (Hwang et al., 2015; Russ et al., 2014).

Khan Academy was introduced to Chilean schools as a practice tool and for test preparation for standardized tests (Light & Pierson, 2014). In comparison to studies showing Khan Academy as an intervention, the Chilean study found that Khan Academy benefited student interactions, enabled teachers to work more closely with students, and served as an aid to struggling students to gain mastery. Using Vygotsky's socio-cultural theory, Light and Pierson's (2014) 3-year study observed 4 impoverished Chilean schools and collected data through observations, interviews, and data collected from Khan Academy's website. The use of Khan Academy changed the ways that Chilean teachers taught, and students learned (Light & Pierson, 2014). Kelly's (2018) dissertation study of 131 9th graders relied on Light and Pierson's (2014) study as a model to determine whether students from rural schools would improve their math scores after using Khan Academy. Unlike Light and Pierson's (2014) study, Kelly's (2018) research did not find any difference between students who used Khan Academy and those who did not. The integration of Khan Academy and other mobile learning applications will be a new experience for the adults in the GED programs in my study. While my study did not

measure student assessments on Khan Academy, it focused on how the adult learners perceived using MLEs with Khan Academy and other mobile applications.

By using Khan Academy as a means of delivering pre-lessons, teachers increase time for collaboration in the classroom and provide for more opportunities for discussion and reflection about core content. "One of the objectives of flipped learning is to promote self-directed learning" (Hwang et al., 2015). Khan Academy, with its video banks, practice problems, and discussion board, allows for self-directed learning to occur (Light & Pierson, 2014). One important outcome of Light and Pierson's (2014) exploratory qualitative study was that fourth through twelfth grade students grew in self-confidence about their math skills; they could witness their progress in learning math through the applications' award system of badges and from progress charts. Students may view and study any course on the Khan Academy website; they are not limited by age, grade, or ability from perusing and trying any of the course contents. As an intervention tool for students with behavioral or social disorders, Khan Academy may not be successful. It does not align with guidelines set forth by the Universal Design for Learning (UDL) (Smith & Harvey, 2014). The UDL proposes strategies that support the interaction between instructional and technological products and skills and the learning environment (Smith & Harvey, 2014).

Two studies were found that explored Khan Academy in middle school settings. Within these settings, Khan Academy was used as an introduction to blended learning, an educational resource, and as a program to fill-in time after standardized testing (Cargile & Harkness, 2015; Kelly & Rutherford, 2017). Kelly and Rutherford's (2017) study of

seventh graders used Khan Academy in math enrichment classes. The students in the study had comparative scores with those in a supplemental math class; however, the Khan Academy metrics showed a positive correlation between the amount of time students spent using the math topics and the topics the students mastered.

The chief form of content delivery for math and science courses by Khan Academy is videos, which use a whiteboard with a voice-over describing how to work problems (Cargile & Harkness, 2015; Hwang et al., 2015). While the usefulness of the video presentation has been lauded by Khan and embraced by students and educators, a study by Chen and Wu (2015) found that lecture capture videos which contain teacher lectures, inserts of PowerPoint presentations, and whiteboard use superior to Khan's videos. The same study found that voice-over presentations, like those used by Khan Academy, generated a split-attention effect, where the student's attention is divided between a PowerPoint slide, the voice-over of the instructor, and other information. Because of the split-attention effect, students' attention was more sustained using this model (Chen & Wu, 2015).

A key feature of Khan Academy is the ability for students and teachers to see progress easily. Progress indicators are available on the Khan Academy dashboard, showing modules started and completed, time spent on the website, and badges awarded for watching videos and working problems (Ruiperez-Valiente et al., 2015). The progress report shows what students master and where they need help. "The learning analytics module has individual visualizations so that students can access their own information. There are also some global class visualizations that can only be accessed by teachers"

(Ruiperez-Valinete et al., 2015, p. 140). This feature allows students to monitor their own progress, and it also allows teachers to know which students are actively practicing the content and which are not. Teachers may respond in several ways: small group teaching, one-on-one teaching, request parental involvement, and whole group classroom instruction.

Other mobile educational applications were offered by the sites studied during this research. They were Learning UpGrade and Cell-Ed. These new applications were created for adult literacy programs, and test data for the applications was collected but not released.

Basic Qualitative Study

Basic qualitative research was the methodology chosen for this study. Merriam and Tisdell (2016) defined a basic qualitative study as one that investigates: the interpretations that people give to their experiences, how they construct the framework of the experiences, and what meaning they ascribe to those experiences (p, 24). Five qualitative studies of students using MLEs were examined during this research (Aluko, 2017; Cochrane, Cook, Aiello et al., 2017; Laskin & Avena, 2015; Montrieuz, Vanderlinde, Schellens, & Marez, 2015; Pertovic, Babcicky, & Puchleitner, 2014). Three of the studies explored the experiential nature of MLEs (Cochrane et al., 2017; Montrieux et al., 2015; Petrovic et al., 2014), and all five of the studies reported how the MLEs affected the learning environment. One study was interested in exploring the likelihood of government support for an MLE in South Africa (Aluko, 2017). Each study focused on the participants; some were students (Laskin & Avena, 2015; Montrieux et al., 2015;

Petrovic et al., 2014) and others were educators (Aluko, 2017; Cochrane et al., 2017; Montrieuz, et al., 2015)

Three of the qualitative studies were conducted within formal classrooms. Laskin and Avena's (2015) study revealed that students are likely to follow the ideas of their teachers concerning MLEs. If their teacher does not support the integration of MLEs in the classroom, students may not utilize MLEs for their classwork. Pertovic, Babcicky, and Puchleitner (2014) used an ethnographic approach to understand how experiential use of MLEs "support learning by experience and observation" (p. 271). Their study differed from Laskin and Avena's because it combined learning with MLEs with experiential activities and with observations. The third study by Montrieuz, Vanderlinde, Schellens, and Marez's (2015) explored the impressions of students and teachers about the interjection of iPads in formal classrooms. Their study found that two teacher types emerged during the study, instrumental teachers and innovative teachers. The instrumental teachers did not change their teaching styles to accommodate the new technology; rather, they substituted the iPads for textbooks and continued to teach as they always had. The innovative teachers used the iPads to modernize their classrooms, utilizing the iPads to create new activities. The innovative teachers "reported that they realize that learning through the didactical use of tablets has meant a shift from traditional, teacher-centered education to the individual use of tablet devices by the students" (p. 9).

Unlike the studies mentioned above, Aluko's (2017) study was conducted primarily to understand how or if government policies were in place to support mobile

learning in South Africa. The MLEs used in this study were tablets loaded with educational material and cell phones that offered math applications and an online library. The key concerns of this study were educational policy and student safety. Similar to Petrovic, Babcicky, & Pucleitner's (2014) study, Aluko was interested in the experiential aspects of using MLEs. According to Pertovic et al., "with a steadily growing number of features and an increased availability of mobile devices, the greatest potential of mobile technology may be found in supporting learning activities that are taking place outside of the classroom" (p. 272). Both studies acknowledged the potential for taking MLEs into classrooms and beyond into the students' worlds.

Cochrane, Cook, Aiello, et al.'s (2017) study extended research on MLEs beyond brick and mortar classrooms into the virtual realm. Using McKenney and Reeves (2012) "generic model of educational design research" to study augmented reality (AR) and virtual reality (VR) MLEs, Cochrane et al. focused on genuine "learner-designed authentic learning" (pp. 54, 58). Their study meshed with Siemens' (2005) work on connectivism, which is the conceptual framework for this dissertation.

Summary

This review of the literature included five areas that must be considered when exploring how MLEs are used in the education of adult learners enrolled in GED classes. The areas were: adult learners in GED classes, the definition of MLEs, smartphones as MLEs, Khan Academy as an MLE, and connectivism and basic qualitative studies of adult GED learners. Based on a review of these areas there were gaps in the literature concerning learners using MLEs in GED classes and about adults using Khan Academy

as an instructional tool when studying for the GED test. No research studies were found about adult learners in GED programs using smartphones as MLEs, nor were any studies found that used connectivism as a learning theory with GED class populations.

Two definitions emerged during this review of the literature. To specify the learning population for this study, adult learners in GED classes were defined as those adults age 18 years and older who were not enrolled in high school or alternative high school educational programs (Tighe et al., 2013; U.S. Dept. of Education, 2016). The second definition for MLEs also needed to be clarified as numerous examples were used to define this ubiquitous learning environment. Therefore, the definition for MLEs was: Mobile learning environments (MLEs) are *mobile* and may be accessed via handheld communication devices, allowing for learning anytime and anywhere that is interactive, individualized, and includes the opportunity for making connections to other learning sites (Ally et al., 2014; Ally & Prieto-Balzquez, 2014; Tutty & Martin, 2014).

From the literature, evidence pointed to the traumatic effect that failure in mathematics, real or perceived, had on adults who did not finish high school. Adult GED students reported high levels of math anxiety and low self-efficacy about their ability to be successful in math courses (Jameson & Fusco, 2014). Negative past experiences coupled with diminished self-beliefs about academic success reinforced a pattern of failure in math, especially for adult learners who were years behind their peers in math proficiency (Jameson & Fusco, 2014; Shields, 2014).

To overcome obstacles in math and reading literacies, adult learners need instruments of empowerment that meet their ubiquitous learning needs (Conceicoa &

Martin, 2016). Smartphones offer that opportunity, as they are used by almost every adult and their use is seen as normal. In other words, learning via an MLE on a smartphone holds no visual social stigma (Munteanu et al., 2014; ur-Rehman et al., 2016). For adult learners, educational applications on smartphones offer gateways to MOOCs and other learning environments. Khan Academy, as one of the largest free instructional websites, offers tutoring and practice problems geared toward a learner's pace and individual learning level. It is designed to encourage mastery of coursework, especially in mathematics (Cargile & Harkness, 2015; Light & Pierson, 2014; Pinkus, 2015).

Chapter 3 presents basic qualitative research as an appropriate methodology for this study and explains the research design and rationale for the study. The next chapter begins with an explanation of the research method and continues with a description of the role of the researcher, how bias was avoided during the study, and the instrumentation for collecting data. The data analysis plan is presented, along with a plan to compare the data to connectivism (Siemens, 2005).Viewing MLEs through a connectivist perspective which highlights learning that depends on a continuous assimilation of knowledge through social and intellectual connections, is important for understanding how MLEs bring learning opportunities that are current (Duke et al., 2013; Siemens, 2005).

Chapter 3: Research Method

The purpose of this basic qualitative study was to explore the described experiences and perceptions of adult learners enrolled in GED programs using educational applications in MLEs. MLEs were defined as mobile communication devices such as smartphones and tablets that allowed for ubiquitous learning experiences. This study has the potential to add to the understanding of how adults enrolled in GED classes learn in MLEs and to aid in research on using mobile devices such as smartphones to reach underserved populations.

The contents of Chapter 3 include the research design and the rationale for using it, the role of the researcher, a strategy for avoiding bias, the methodology, participant selection, and instrumentation. Data collection plans as well as data analysis plans are also included in this chapter. Finally, Chapter 3 contains procedures for transcribing and coding data and issues of trustworthiness for working with the data and the participants. The chapter concludes with a summary.

Research Design and Rationale

Basic qualitative research was the design for this study because it allowed me the freedom to search for the answer to questions (see Denzin & Lincoln, 2013). The research questions concerned real people in real-life situations, in this case adult learners in GED classes (see Percy, Kostere, & Kostere, 2015). These research questions guided the study:

1. How do adult learners use MLEs in their GED program?
2. What are the GED adult learners' perceptions of participating in an MLE?

3. How do adult learners in a GED program at differing TABE score levels respond to the integration of educational applications in an MLE?

Studying GED adult learners immersed in a program that has not utilized MLEs before and that has not positioned smartphones as andragogical tools provided important information about how the learners interpreted their new learning experiences. Merriam and Tisdell (2016) pointed out that basic qualitative methodology is often used in educational research. This approach enables researchers to understand the ways that people interpret, construct, and attribute meaning to their educational experiences (Merriam & Tisdell, 2016).

In basic qualitative research, field research is the most common way of collecting data (Frankfort-Nachmias & Nachmias, 2008). According to Merriam and Tisdell (2016), observations are one of the key components of fieldwork. Observing GED students in their natural setting allowed me to collect data that were realistic and pertinent to understanding how adults use MLEs, when and where they study via the MLEs, and whether they access educational applications for assistance (see Janesick, 2011; Merriam & Tisdell, 2016; Patton, 2015). Because qualitative research is holistic, the design permitted me to look at the social system and the culture within the GED program as well as the experiences of the adult learners using the MLEs (see Denzin & Lincoln, 2013).

Other methods of qualitative research were considered for this study. Initially, an instrumental case study seemed best suited to researching how adult learners would be affected by using MLEs. An instrumental case study positions the case as a support to understanding the main issue (Baxter & Jack, 2008; Denzin & Lincoln, 2013; Stake,

1995). For this study, the main issue was already known: Adult learners in GED classes struggle to pass the new GED test. What was not known was how they would respond when introduced to digital learning devices in their GED classes (see M. Anderson, 2015; Conceicao & Martin, 2016). An instrumental case study was not appropriate because the research needed to focus on how the adult learners understood the MLEs. In this study, the adult learners' perceptions were the primary interest of study.

Ethnography was also considered as a method. According to Singh, Strating, Herrera, van Dijk, and Keyson (2017), ethnography is iterative as well as inductive and creates a sustained engagement with the participants. Ethnography is used to investigate social groups and practices (Percy et al., 2015). Ethnography was not chosen for this research because ethnographic researchers primarily act as participant observers, which was not appropriate for this study (see Merriam & Tisdell, 2016).

Quantitative research was also not appropriate for the study. The goal of this study was far removed from controlled experiments that have rigid and specific treatments, such as those used in quantitative research (see Patton, 2015). Rather than using an experimental approach to generate user statistics or quantifiable gains in learning, this study focused on the perceptions of the adults (see Merriam & Tisdell, 2016).

Basic qualitative research was the best fit for this study because "the primary goal of a basic qualitative study is to uncover and interpret" (Merriam & Tisdell, 2016, p. 25) how the participants create meaning of their experiences. Basic qualitative research allowed the natural data to emerge as the participants described how they interpreted the

MLEs, how they experienced learning with educational applications, and how they were situated within their ordinary settings (see Miles, Huberman, & Saldana, 2014). Using basic qualitative research as the method of inquiry was pragmatic because the study was aimed at exploring how adults were affected by MLEs in an effort to better understand adult learners and their needs (see Patton, 2015).

Role of the Researcher

The role of a qualitative researcher is to begin with a how or what question and then expand that question to understand a person, experience, or phenomenon (Denzin & Lincoln, 2018; Merriam & Tisdell, 2016). Miles et al. (2014) pointed out that the researcher's skills in interviewing, observing, recording, decision-making, modifying, and exploring generate a research instrument, the researcher, who is reliable and ensures validity. Each stage of the research dictated the role of the researcher. My role as researcher for this project changed as the project developed, yet it began with a question.

My role was not intrusive; I interviewed the participants. As a researcher, I wanted to know how adult learners in GED classes used MLEs. I wanted to know whether MLEs brought advantages to learning. I wanted to understand whether GED students wanted digital assistance, and whether Siemen's (2005) theory of connectivism would prove a good fit for understanding MLEs. To gain the participants' trust, the GED instructor began by introducing me to the GED learners as a researcher. In that capacity, I used responsive interviewing techniques to build a trusting conversational relationship with the students (see Rubin & Rubin, 2012).

I did not have previous experience with the GED students whom I interviewed. I was not their teacher or mentor. I was not working with GED programs at the time of the study, so I had no direct influence over the students in this study. I knew that my desire to help adult learners in GED programs influenced me deeply; I felt a moral obligation to find ways to help adult learners who have not completed high school to become successful students and high school graduates. I understood that I must not show partiality to any result this research might reveal.

Methodology

The methodology section includes the type of participants selected and the criteria that formed the basis for their selection. I explain the instruments used for this study, which included interview guides, observations, and TABE results. The procedures for recruitment and participation as well as the data collection and data analysis plan are explained in this section.

Participant Selection Logic

This basic qualitative study included a sample of adult participants in GED programs that were designed to eliminate generational poverty, which was endemic to the neighborhoods where participants were situated. The program sites were well-known for their dedication to impoverished adults and for educational programs that offered reentry opportunities for adults wanting to change their lives. The groups were considered homogeneous because they were a subgroup of adult learners who had similar social and educational demographics, and the groups contained adults who did not complete high

school. Patton (2015) noted that homogeneous groups consist of "people of similar backgrounds and experiences" (p. 236) who share common issues.

The participants were classmates in GED programs that were part of nonprofit adult learning programs. The research sites were chosen through purposeful sampling because the leaders were accomplished educators who had indicated an eagerness to integrate technology into their GED classrooms using smartphones or tablets. Merriam and Tisdell (2016) pointed out that purposeful sampling is used when the researcher chooses research samples that generate the most understanding or insight into what is being studied. The primary site selected for the study was an accredited school that offered adult basic education (ABE), English as a second language (ESL), GED, and computer courses. This site was selected because the chief executive officer (CEO), a well-known figure in adult literacy and education, and the staff members invested in the program were introducing MLEs and educational applications from the XPrize literacy competition, which was a literacy campaign initiated by the Barbara Bush Foundation, into their GED classes.

The participants for the study consisted of GED students who volunteered and who met specific criteria. The university site accepted adults 18 years of age or older into their programs; therefore, the participants were 18 years old or older and enrolled in GED classes. Miles et al. (2014) described collecting data from within a sample that is realistic to the time and location of the research. In determining the sample size for this study, I took into account the number of students in the program, the amount of time for the study (3 months), and the likelihood of student attrition. According to the site director,

approximately 30 students were enrolled in the university program. Considering these factors and a similar study by Laskin and Avena (2015), I determined that it was reasonable to set a goal that at least 15 participants would remain enrolled in the classes and complete the study. In Laskin and Avena's study of adult university students' use of mobile learning devices in the classroom, 15 of the 28 invited students participated. Fusch and Ness (2015) noted that data saturation is the goal of qualitative research and that interviews are the best means of reaching that goal; therefore, the maximum sample size for this study was 15 adult learners and the minimum was eight learners.

The sample size was smaller than expected, so I contacted the GED director from another site. The second site was a mission that reeducated men through GED, career, and religion classes. The educational director at the mission was using technology to introduce blended learning techniques with Khan Academy and YouTube. The director was also introducing mobile applications from the XPrize competition into his classes via tablets. He indicated that he wanted to be a part of the study. Shaw et al. (2015) experienced a similar situation working with adults in a GED program. In Shaw et al.'s study, GED agency directors were asked to contact a diverse sample of students. Shaw et al. had hoped to have at least 30 participants in the study. Twenty one students volunteered for the study, and only 12 participated.

Percy et al. (2015) stated that research samples are about people's experiences within real-world contexts. Patton (2015) stated that qualitative researchers should expect that sample size will fluctuate and that flexibility in sample size is dependent on factors

such as interview times and places. According to Patton, when new information ceases to be revealed, data saturation has been reached.

Instrumentation

Interview guides (see Appendixes A, B, C), TABE reports (see Appendix D), and observation forms (see Appendix E) were the instruments for data collection for this study. The interview questions and observation form were researcher-developed instruments. Student TABE reports (archived documents) were collected by the GED sites at the beginning of each school year and were available to the students at any time. The TABE reports showed the entry-level scores of each student and indicated areas where students needed additional teaching (Mellard et al. 2016).

This basic qualitative study addressed three research questions. The interview questions designed for this study were aligned with the research questions (see Appendix F). According to Rubin and Rubin (2012), responsive interviewing is based on building positive relationships between the participant and the interviewer. My interview guides were examples of responsive interviewing. Turner (2010) noted that interview questions should be open-ended, neutral, singular, and clear. Open-ended questions and descriptive questions should evoke answers that reveal the participants' perspectives (Patton, 2015; Seidman, 2006). My objective was to understand how MLEs affected adult learners, so understanding how the participants thought about using an MLE was vital.

Researcher-Developed Instruments

The strength of qualitative data is based on the research goals and the amount and richness of the information gathered (Rubin & Rubin, 2012). For this study, I created pre-

, mid-, and post-interview guides. The semistructured interview questions were designed to be open-ended and to allow the adult learners to respond as completely as they wished (see Rubin & Rubin, 2012). Patton (2015) noted the importance of beginning interview guides with a clear statement relating the purpose of the interview and keeping questions within the parameters set by the initial statement. My interview guides began with an opening statement explaining the study, and the questions were designed to be consistent with that statement. The interview questions were also designed to align with and answer the research questions (see Appendix F). Each interview question was carefully considered alongside the research questions, so the interview questions were aimed at finding the answer to one or more research questions. Interview guides were one means of understanding the perceptions of participants in this study.

Though there were limitations to this approach, it allowed participants to address descriptions they felt were inadequate or inappropriate (see Neuman, 2006). Stake (1995) encouraged researchers to employ member checking as one way to ensure accuracy. Allowing participants to interact with the data allowed for an objective analysis of the field results (see Merriam & Tisdell, 2016; Patton, 2015).

During class periods, GED instructors reviewed using smartphones and tablets as MLEs. They also reviewed procedures for downloading educational applications and set-up and features of the applications. Hariadi, Dewiani, and Sudarmanigtyas' (2016) study of students and lecturers introduced to Google Apps for Education (GAFE) had similarities to my study because the primary data collection tool was interview guides, and the students were acclimated to learning applications during their instructional

periods. The basis for developing the research instruments was to allow interviewees the most space to tell and show their perceptions and experiences using MLEs. Denzin and Lincoln (2018) pointed out that semi-structured interviews were the type of interview most used in qualitative research because they allowed the participant to describe their world and its meanings to the researcher.

To discover different readers' philosophical beliefs and their opinions about the interview guides and their alignment to the research questions, I contacted former professors and a research methodologist from a small private Midwestern college who previewed the interview guides. Their comments included suggestions for creating more open-ended questions and for creating scales for in-depth analysis. After reading their debriefing comments, I revised the interview guides by creating questions that were more open-ended and allowed participants to elaborate on their answers. I also added two questions that allowed the participants to rate the educational applications and to give reasons for their decisions. For example, one question asked: Using a one to five scale, with one being the lowest and five the highest, how would you rate each new educational app offered by the program, and why would you assign that rating?

To ensure content validity of the interview data collected, I began by providing the participants with a clear explanation for the interviews. Then, I asked open-ended questions that generated conversation. If an answer was not fully provided, or when the participant could elaborate further about the question asked, I provided prompts for clarification. Each interview question was aligned with one or more of the research questions. Patton (2015) mentioned 4 elements to establish credibility: 1. "systemic, in-

depth fieldwork," 2. "systematic and conscientious analysis of data," 3. "credibility of the inquirer," 4. "readers' and users' philosophical belief in the value of qualitative inquiry" (p. 653).

Merriam and Tisdell (2016) pointed out that data collection involved "asking, watching, and reviewing" (p. 105). To become actively immersed in the data and to collect sufficient data, I developed forms for recording information collected from student TABE results and observations (see Appendixes D, E). These simple instruments enabled me to gather data that was information rich. I used the interview guides and observation forms to collect data that answered the research questions and I used the TABE results form to glean information about the students' abilities and reasonable expectations for future testing success (Merriam & Tisdell, 2016).

Procedures for Recruitment, Participation, and Data Collection

The participants for my study were recruited from GED programs that were part of adult literacy initiatives. I met with the chief executive officer (CEO) of the primary site and the director of the back-up program, and they were aware of the nature of the study and the voluntary participation of the students. Students at both sites met the criteria for the study: the adult learners were 18 years old or older, and they were enrolled in GED classes. Some states offer GED classes to high school students 16 and 17 years old; these students were not included, because they were not adults. According to the site directors, neither site accepted students under 18 years old. I sent invitations to participate in my study to the CEO of the university site and the educational director of the mission school (see Appendix G). After return of the letters of confirmation were

received by the university and myself, I emailed the Walden University Institutional Review Board (IRB) to apply for approval to conduct research. After receiving approval from the IRB, the GED instructors gave recruitment flyers for the study to the adult learners from their GED programs (see Appendix H). The flyers contained my Walden email address, a brief introduction to the study, and information about the time and date of the interview sessions. Participation in the study was voluntary; no participants received compensation of any kind.

I contacted participants who agreed to join the study and gave them an informed consent agreement to read, detailing the structure of the study, the types of data to be collected, their rights as participants, and my contact information. Each participant signed an informed consent form prior to their first interview. The form was copied, and they were given a copy to retain. Individual meetings were held in an empty classroom or space and at a time that was mutually agreed upon by the participant and me to ensure confidentiality. The meetings lasted approximately one hour. I explained the purpose of the study, and we discussed the types of data that were collected and the length of the sessions and the study. Each learner and I scheduled interviews and class observations. Information on consent and confidentiality was fully explained to the participants.

The data for this study were collected through three personal interview stages, two observations, and learners' TABE results. The data collection process began with one-on-one interviews with the participants. During the initial interview, the participants received information about the reasons for the study, and they were assured of confidentiality. They answered questions posed to them from the interview guide. They

reviewed information from their TABE documents, which were available through the GED program directors and provided to me. The learners described areas of the TABE test they felt were challenging. They indicated the subjects that they needed assistance in building success. This information was included as data that described the participants and their perceptions about their learning needs. The TABE results were only discussed in the first interview session. Each interview lasted for approximately one hour.

The participants were interviewed midway through their program and again at the end of the program. The interview procedure was the same for all three interviews, except for the TABE review in the first interview. The interviews consisted of semistructured open ended questions related to the students' perceptions about MLEs and the educational applications. The interviews were conducted in an empty classroom or conference room provided by the CEO of the GED program sites. Any interruptions or adverse conditions that occurred during the interview process were noted and revealed during the data analysis procedures.

I used my smartphone audio recorder to tape the interviews. The audio files were transferred to a password protected, coded file on a password protected computer and then purged from the smartphone. I replayed each interview, and the recorded interviews were typed verbatim onto a Word document on my computer. The participants' names were coded using an alpha-numeric system to preserve confidentiality. Then the transcriptions were checked and rechecked for accuracy.

Other documents that were used for data were the students' TABE results. The students were given the TABE by staff members of the GED program sites at the

beginning of the school year. The results of the tests were archived and were available to the students at any time. The names and any identifying numbers were blacked out and replaced by a coded sticker. The documents were scanned into a password word protected file. The original documents were retained by the program directors. Notes were taken during the observations and recorded on observation forms (see Appendix E). All interview recordings, transcriptions, scanned documents, and observation forms were kept in password-protected Word document folders on a password-protected computer.

To determine the validity of my transcriptions, the students were asked to read and respond to their interview transcripts and observation notes (Miles et al., 2014). Their spoken responses were noted on the transcripts and observation notes (Stake, 1995). After the study was completed, the participants were given a card thanking them for their participation and congratulating them on their contributions to an emerging field of education.

Data Analysis Plan

I used La Pelle's (2004) data analysis plan using Microsoft Word. According to La Pelle, Microsoft Word works well as a qualitative analysis tool. As I transcribed, read, and reread the interviews, I looked for emerging themes and descriptive words. Patton (2015) pointed out that many good examples of analysis frameworks are available; the framework examples provided in La Pelle's article were certainly good and easy to use.

The interviews were connected to the three research questions. The interviews gave the participants a space and time to describe their experiences (Rubin & Rubin, 2012). Observation notes taken during two class sessions provided information about the

first research question about how the adult learners used the MLEs. The observation notes were also connected to all three research questions because they reported on the setting, nuances of the interviews, and on my impressions (see Appendixes E) (Janesick, 2011). The student TABE results were related to the second and third research questions. The TABE results provided context for the study because they showed areas where the students were struggling academically, so they showed how the students' academic backgrounds related to their experiences with the MLEs and the educational applications (Patton, 2015).

For the interview transcripts, TABE results, and observation notes, I initially used open coding, highlighting terms and phrases that seemed critical to understanding how the adult learners used the MLEs and how they felt about using them (Merriam & Tisdell, 2016). Neuman (2006) pointed out, "Open coding brings themes to the surface from deep inside the data" (p. 461). Using themes and descriptors that emerged from the data, I constructed a working list of gerunds (Denzin & Lincoln, 2015, 2018).

During the second phase of coding, I employed axial coding. Throughout that part of the analysis, I focused on creating codes and determining subcategories, created general sections, and decided what sequencing or ordering system I would use (Merriam & Tisdell, 2016). Data that was contrary to the majority of codes being created was included, as it added to the richness of the data and its inclusion created validity. It was important that each participant's voice was heard, even if that voice differed from most of the learners. For instance, differences in culture made generalizing about some findings difficult (Rubin & Rubin, 2012). I looked for other connections, like educational

similarities or similarities within cultural categories (Rubin & Rubin, 2012). Finally, I used selective coding to review and reassess the coding and themes. Selective coding was the final phase of analysis, and core categories became known, and data were selected that reflected the coding categories (Merriam & Tisdell, 2016).

Using La Pelle's (2004) article on Microsoft Word as a qualitative data analysis tool, I created a coding chart that identified the major themes of the interview script and possible themes that emerged from the observations, reflexive entries and the student documents. Sublevel themes that emerged from within those categories were also included. Seven major themes included: 1. feelings about the GED program, 2. areas of study, 3. learner beliefs, 4. mobile learning environments, 5. applications, 6. adult learner needs, and 7. changing perceptions. Code numbers assigned to these Level 1 themes began with 1.00. Sublevel 2 was accompanying themes that augmented the main themes, while Sublevel 3 contained more specific areas of Sublevel 2. For example, in Level 1, the theme areas of study were broken down into five Sublevel 2 themes: reading, language arts, math, science and social studies. These Level 2 categories were defined in Sublevel 3 with specific areas, like 2.055 for vocabulary (word meanings), and 2.155 algebra. This way of coding each theme helped to identify broad and specific themes within the data (see Appendix I).

I also used Siemens' (2005*)* theory of connectivism as a lens to view the learners' responses and observed behaviors to the MLEs that corresponded to the eight connectivism principles. The themes drawn from the coding chart were compared with

the eight principles to better understand how the adult learners perceived using MLEs. Any discrepancies associated with using the MLEs were noted as well.

Issues of Trustworthiness

According to Shenton (2004), trustworthiness in qualitative research depends on four constructs: "credibility, transferability, dependability, and confirmability" (p. 64). The goal of the qualitative researcher is to collect and interpret accurate data, so the reader can understand the data and utilize it (Merriam & Tisdell, 2016; Rubin & Rubin, 2012). According to Denzin and Lincoln (2018), qualitative research is the interpretation of data. Janesick (2011) pointed out qualitative research depends on the researcher to relay a detailed narrative that shows an understanding of the setting and the relationships within an experience or culture. Keeping a reflexive journal helped me notice and account for any bias that occurred. Knowing my bias and stating it as a limitation of this study compelled me to objectively review the data and remain true to whatever results it revealed.

Credibility

For this study, credibility or internal validity was insured in four primary ways: the interview guide was open-ended and followed an established design for questioning, the participants volunteered, I was familiar with the participant population and its culture, and I relied on debriefing to establish accuracy of the interview transcription (Shenton, 2004). Other methods used to obtain credibility included: reflexive prompting for clarity, seeking out responses counter to existing supporting evidence, recorded interviews, verbatim transcriptions, imperfections in reported patterns, and member checking (Patton,

2015). Notes and questions about the data were kept in a reflexive journal, so I could reflect on the themes and consider the thoughts and ideas that emerged (Janesick, 2011).

Rubin and Rubin (2012) presented the strengths of qualitative interviewing: high credibility, evidentiary-based conclusions, and contextual analysis. These strengths lead to research that is "accurate and credible" (Rubin & Rubin, 2012, p. 64). Merriam and Tisdell (2016) pointed out that in qualitative research the participants and the interviewer are the lens through which data is interpreted. Interviews and observations interpreted through their shared reality provided internal validity to the research. My study was an exploration of adult learners' experiences with MLEs, so this research provided a way their voices were presented and heard.

Transferability

Transferability, or external validity, occurs when research results can be extended beyond the confines of a research study to be replicated in further studies or different settings (Merriam & Tisdell, 2016; Toma, 2011). As Merriam and Tisdell (2016) pointed out, generalizing qualitative research "in the statistical sense (from a random sample to the population) cannot occur in qualitative research" (p. 254). For the current study, careful consideration was given to the interview script and the target population, adult learners in GED classes. The primary means of ensuring transferability was the reflexive journal entries. Within journal entries, I noted the transcription process and the analysis process. Even though participants in my study did not share the same geographical locations or socio-economic situations as perhaps students in a future study, the research methods could be replicated (Shenton, 2004).

Dependability

According to Tomo (2011), dependability is achieved through the deliberate process of consistency and stability. Tomo's notion of dependability was consistent with my research project. My study relied on research questions that led to the use of a specific conceptual framework, connectivism. Steps to increase dependability included: a transparent report of procedures used, and reflexive journal entries about the interview, transcription, and analysis process. My goal was to provide readers with transparency (Rubin & Rubin, 2012). To show the relationship between the research questions and connectivism, I compared Siemens' (2005) eight principles of connectivism with how adult learners responded, perceived, and described their experiences in the MLE. The study was also reviewed by participants and revised in response to suggestions and comments.

Confirmability

Finally, the study should be considered trustworthy because it was conducted objectively and achieved confirmability. Confirmability occurs when the researcher is transparent about any bias he or she may hold regarding the research, when he or she is able to present a clear sequence of data collection and analysis, and when the data for the study is archived for several years and is available for review (Miles et al., 2014). For the current study, I did not know the participants personally and held no expectations or preferences about what experiences the participants revealed about using MLEs. Data were triangulated as much as possible, and interviews were recorded via smartphone, transcribed, coded, and reviewed for accuracy.

Ethical Procedures

As Merriam and Tisdell (2016) pointed out, the most important part of ethical research is not found exclusively within the procedures, as important as ethical procedures are; instead, ethical procedures are embodied in the "ethical stance" of the researcher (p. 260). "A relational ethic means being aware of one's own role and impact on relationships and treating participants as whole people rather than as just subjects from which to wrench a good story" (Tracy, 2013, p. 245). The importance of the person was not neglected during my research study. To ensure the safety and confidentiality of the participants and the trustworthiness of the data, several cautions were made with the site and the data.

In accordance with the requirements of the university's IRB, I gained permission from the IRB to conduct the study and the directors' signed and dated agreements for the sites to be used during the research process. The IRB approval number for this study was 03-27-19-0501224. As mentioned previously in this chapter, I requested permission to advertise by teacher-distributed flyers. All GED program participants were invited to participate and had an equal opportunity to be part of the study (Frankfort-Nachmias & Nachmias, 2008). GED students come from diverse populations, so the sampling represented students from different racial and ethnic backgrounds, different genders, and a variety of ages and locations.

I informed each student about the research project, about how he or she could contact me for more information, and about the confidentiality he or she could expect. The participants were asked to sign an informed consent form, and all participants in the

study were 18 years old or older. Participants had the right to refuse participation and to withdraw from the study without recriminations.

To protect the confidentiality of the participants, data were downloaded into protected computer files. The computer storing all the data, including interview transcripts, audio files, field notes, and photographs of artifacts was password protected, as were the participants' files (Patton, 2015). Participants' identities remained confidential. Three participants who ceased participating in the study were not included in the study and their data were purged. Another participant who was asked to leave his program had data related to early participation which was considered relevant by the participant and me (Janesick, 2011). His data were included in the study. There were no irregularities that occurred during the data collection process.

All data will be kept secured and confidential until five years after the dissertation has been accepted and published, and then it will be deleted from the flash drive and the flash drive will be disabled by breaking the stem of the drive (Merriam & Tisdell, 2016).

Summary

Fine attention to detail, comprehensive and rich data, and high ethical standards are the hallmarks of good research methods (Denzin & Lincoln, 2018; Merriam & Tisdell, 2016; Patton, 2015). Striving for a solid and publishable report that stays within the boundaries of truth and holds the bonds of confidentiality was the goal of this research project. To that end, the rules of confidentiality were followed, and clear and understandable protocols were followed. The research method was held dear, yet never was it idolized (Denzin & Lincoln, 2018).

This chapter revealed the research design, the roles and bias of the researcher, and the methodology followed. It presented the data analysis plan as well as the issues and procedures associated with collecting and disseminating data. Respecting the humanness of participants and the trusting relationship that must exist between researcher and participants became the most important elements discovered in this chapter (Tracy, 2013).

Chapter 4 includes the report of the exploration of the use of MLEs in GED programs. It explains the purpose of the study and the research questions that guided it. The chapter also gives detailed accounts of the setting, the participants' demographics, how the data were collected and analyzed, and any issues or problems that ensued during the research process. Finally, using each research question as a guide, Chapter 4 presents the results of each research question. It shows the entire process of my study and the ways that adults in GED programs experienced MLEs in their educational ventures.

Chapter 4: Results

The purpose of this basic qualitative study was to explore the described experiences and perceptions of adult learners enrolled in GED programs using educational applications in MLEs. The MLEs used in this study were smartphones and tablets, and the applications included Learning Upgrade, Cell-ed, Khan Academy, Math is Fun, IXL, and others selected by the GED program sites. Siemen's (2005) conceptual framework of connectivism was used as a basis for exploring the participants' described perceptions and experiences. The results of this study added to the literature about mobile learning and adult GED education.

The following research questions were used to guide the study:

RQ1: How do adult learners use MLEs in their GED program?

RQ2: What are the GED adult learners' perceptions of participating in an MLE?

RQ3: How do adult learners in a GED program at differing TABE score levels respond to the integration of educational applications in an MLE?

This chapter provides a description of the setting and the characteristics as well as the demographics of the participants of the study. The chapter provides the data collection process and the categories, codes, and subcodes for the data analysis. Four qualities (credibility, transferability, dependability, and confirmability) are described to indicate the means I used to establish trustworthiness in the study. Finally, the results of the study are linked to the three research questions, and I discuss the relationship between the data and the conceptual framework.

Setting

The primary setting for this study was a small church-affiliated university that specialized in GED, ABE, and ESL courses. The university site, which has a student population of 80 learners, was situated in one of the poorest neighborhoods in a large urban area. The population for the area near the university was approximately 13,000. The secondary site was a mission school located in another poor urban area with a population of nearly 20,000 people. The mission offered educational and career programs for men and averaged 50 learners per term. Both sites served learners from other areas of the city, including newly arrived immigrants and homeless people. Learners at the university worked in cohorts more often than the learners at the mission school. The mission school had retired professionals who served as tutors. Only adult learners ages 18 and over were enrolled in the GED programs offered at each site.

Demographics

The participants for this study were adult learners who did not finish high school. They were from neighborhoods near to their prospective school in an area known for generational poverty and violence. The learners ranged in age from 22 to 74 years; they were mostly Hispanic and African American or of mixed descent. Table 1 contains the participants' demographic information. Even though the mission school was considered the secondary site, the research began there because the primary site was in the process of retesting students followed by a 2-week break. Initially, the mission school had six participants, and the university had nine. None of the students were employed though most mentioned having had a job at one time. Several students stated that they had lived

on the streets and were continuing their education to have a better life. Some of the younger learners had small children.

Table 1

Adult Learning Demographics

Coded name	Race/ethnicity	Age	TABE grade levels (reading math, ELA)	Gender
P1	Hispanic	45	7.6, 9.5, 5.4	Male
P2	African American	74	3.3, 3.3, 1.2	Female
P3	African American	56	5.4, 4.2, 5.0	Male
P4	African American	49	2.6, 2.3, 2.1	Male
P5	Hispanic	20	6.6, 8.9, 7.4	Male
P6	Hispanic	33	4.5, 9.3, 9.3	Female
P7	African American	74	4.5, 3.5, 3.2	Female
P8	Hispanic	25	3.6, 4.9, 3.6	Male
P9	Hispanic/White	33	6.3, 4.4, 9.4	Male
P10	African American	44	6.6, 5.6, 7.0	Female
P11	African American	64	5.8, 5.7, 4.2	Male

Data Collection

Initially 15 adult learners who were enrolled in GED programs at two different sites in an urban environment participated in this study. The primary site was located in a small university setting, and the secondary site was part of the education department of a mission school. The 15 learners read and signed an informed consent form, giving permission to be interviewed and observed. Each adult was given the opportunity to ask questions about the consent form during the first interview. Participants were also

informed of the data collection methods, interviews, TABE results, and observations, and were assured of complete confidentially. The first interview was designed to last no longer than one hour (see Appendix A). Most of the interviews were completed in approximately 30 minutes. All 15 of the first interviews took place in person and were digitally recorded. The interviews were transcribed and saved on a password-protected USB drive. Each participant was assigned an alpha-numeric code that identified their recordings, transcriptions, TABE results, and observation notes using the convention P1, P2, and so on.

Following the first round of interviews, I observed classrooms twice for about 30 minutes each time to determine whether the adults used their smartphones or tablets during their regular class times and tutorials. I used the observation notes form to record my observations, describing how the learners used the MLEs when they used them, and whether they seemed to find the MLEs conducive to the learning environment (see Appendix E). I also noted comments students made about their MLEs and mobile applications.

I used the second interview guide and final interview guide to complete the data collection process (see Appendixes B and C). Four students were not present for the second and third interviews as well as the second observations. One man from the mission school had been asked to leave his GED program for lack of compliance with school rules. Two men, one from the primary site and one from the secondary site, dropped out of their programs, and a female student from the university contracted a debilitating illness and had to withdraw from her program. An ongoing unusual

circumstance encountered in the data collection process was that Internet connectivity at the secondary site during class times sometimes proved to be a problem for the students who relied on tablets. The school's protection firewall limited the use of YouTube, which was a favorite learning platform for several students.

Data Analysis

Process

The data analysis framework chosen for this study was LaPelle's (2004) plan, which included the use of Microsoft Word. After transcribing the interviews verbatim, I used open coding. Highlighting words and phrases showed how adult learners used MLEs and how that interaction made them feel (see Merriam & Tisdell, 2016). As I highlighted different interview passages, I constructed word maps as journal entries and looked for repeated phrases and words. From the data word maps, descriptive themes emerged (see Denzin & Lincoln, 2018). Figure 1 illustrates a word map used to identify emerging themes.

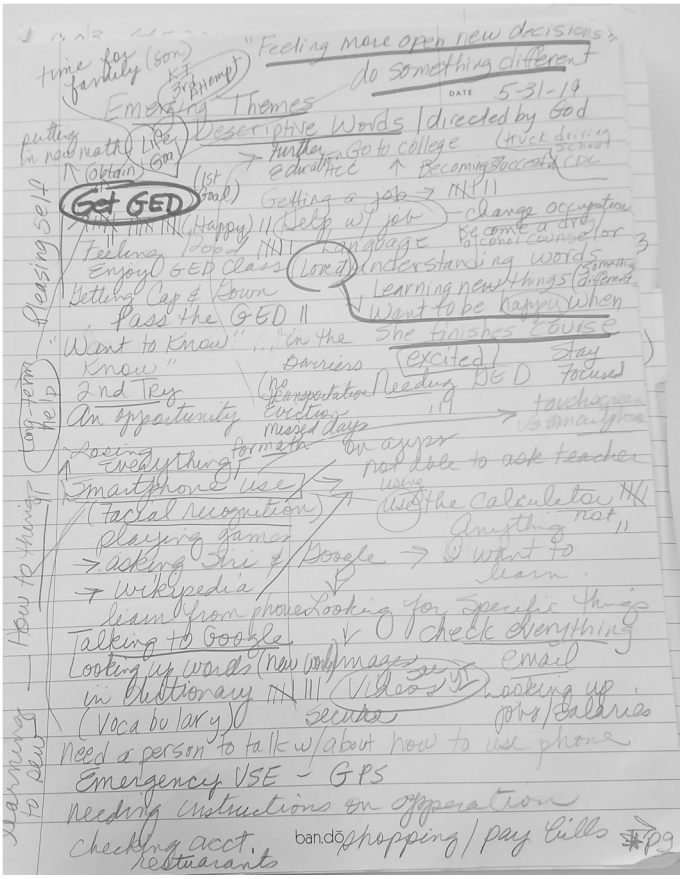

Figure 1. Example of word map of emerging themes.

Using the themes, I created a working list that contained the following gerunds and gerund phrases: *searching for information*, *asking for help*, *Googling*, *getting a GED*, *getting a job*, *needing a GED*, *needing a job*, *sharing information*, *sharing apps*, *watching YouTube videos*, *staying focused*, *downloading*, *liking the program*, *liking the apps*, *using the apps*, *finding information*, *finding the meaning*, *helping*, *breaking down*, *upgrading*, *frustrating*, *making sense*, *writing the essay*, and *learning new things*. For example, the gerund phrases *getting a GED*, *getting a job*, *needing a GED*, and *needing a job* were included under the theme heading Feelings about the GED certificate in subheadings like Enrolling, Goals, Needs, Progress, and Other Feelings (see Appendix I).

On the computer, I drew word clouds to see themes that indicated how the participants felt about the MLEs (see Figure 2). Highlighted notes from class observations and learner comments during the classes provided insight about how the adult learners perceived the MLEs.

Figure 2. Word cloud of learner feelings.

Using axial coding for the second phase of data analysis, I employed LaPelle's (2004) process using Microsoft Word. In this process, data are retrieved and coded with numeric codes that represent themes and then inserted into data tables that can be accessed and sorted within tables. For the first step of this process, I formatted the interviews into simple one-column data tables. Then I used the interview questions and the gerunds and gerund phrases that emerged during open coding to create a three-level coding table (see Appendix I). Level 1 themes were given whole numbers that represented general themes. Level 2 themes were assigned within a range of their whole

number and a decimal to represent sublevel themes. Level 3 themes were assigned whole numbers and decimals within the thousandth's decimal representing the most specific sublevels. The seven general themes were feelings about the GED program, areas of study, learner beliefs, mobile learning environments, applications, adult learner needs, and changing perceptions. As I reread the interviews focusing on the highlighted areas discovered in open coding, I added sublevel and specific emerging themes (see Appendix I).

Codes, Categories, and Themes

Once a coding table was created, I developed a themed data table to handle interview questions and participant quotations that corresponded to the general and sublevel themes (see Appendix J). Columns in the themed table included participant codes, theme codes, interview questions/participant responses, and interview number. The data table made retrieving quotations that were applicable to the theme codes easy and organized.

Examples of quotations about theme 1.00 Feelings about the GED Program were the following: P3 said, "I feel good about being enrolled in the GED program, because it's something that I feel like I've long-time needed. I had complications along the way, and now I have the opportunity that has presented itself again." P6, an immigrant woman with a seventh-grade son, said, "How do I'm feeling? I'm feeling that I'm learning new things. I'm feeling more open new decisions on your problems, so that they provide. I'm feeling that I'm learning every day. I'm learning something different."

Sublevel themes about needs and goals also emerged. P8 mentioned,

> My goals are to get my GED and get my life back. You know what I'm saying. And when I'm done with XXX School, and I get my GED, I'm trying to go up to the army. That's one of my...that's my goals.

Level 2 Areas of Study focused on courses the students were taking and comments made about them. Reading, especially vocabulary skills, emerged as the most important and challenging area of study. P7 reported, "I need to know the word. A lot of them I do know. I don't know the exact meaning for it or what you call it or how you pronounce it. Because I even talk bad, too." P1 and other students found reading distressing. P1 said, "When I start reading a lot, my head just starts just going everywhere. Trying to figure out and then going to the next story. It kind of messes me up a little bit."

As I selected quotes and sorted through data to include in the chart, Level 3 Learner Beliefs emerged. From the data, I found that learner beliefs not only shaped how the students studied but influenced their attendance in class as well. P4 was a dedicated student who rarely missed class. P4 said,

> My mother put me in a special class when I was younger, so they skipped me in each grade. So, I used to be ashamed about me reading; but over the years I learned how to read better, but I came here. I had a lot of work to do. I thought I couldn't do it, so my peers and counselor told me to take my time, and they helped me out. Give myself a chance, and that's what I did, so I'm better than I was six weeks ago.

P9 moved quickly through his program. He reported, “I loved going to school when I was younger. And, like I said due to lifestyle and my family in the past, I didn’t get to finish. I had to turn to the streets.”

Level 4 Mobile Learning Environments had two sublevel themes: smartphones and tablets. Most of the students at the primary site used HP Elite laptops provided by the school during class, but I did not include the use of these in the data because the laptops were confined to classrooms; therefore, they could not be considered as mobile learning devices as defined by this study. Some learners readily incorporated the MLEs. These learners made comments about the smartphones and tablets. P6 said, “It’s like your second teacher.” P8 said, “Well, it was good. You know what I’m saying? How can I describe it? It was fun. Entertaining. What else can I say? It was easy.”

Other learners struggled to accept the new technology as a learning platform. P11 said, “I haven’t been trained how to use a smartphone at all.” P9 said,

> The tablets, they, really or any type of computer, anything like that it is new to me. You know it’s another thing...there probably could be some things, maybe, there could be specific things, so you could be able to find stuff. I mean it’s a learning process when you’re working with technology. Right? I would be scared because I don’t know nothing about it. I heard it’s called a tablet; it’s a smart device to help me get smart. I be like staying a little confused at first.

P10, was not interested in using her smartphone to learn. She said, “I’m not really into phones. The only time I really like them is when I’m taking pictures.” Two older

students owned smartphones, but they did not identify the phones as smartphones. Instead, they called the phones touchscreens, and neither one would describe their phone as a smartphone. P2 stated, "I got a regular phone, but I, you know, I got a phone like that, but I ain't got used to it yet to learn how to work that part."

At both research sites, the GED directors promoted new learning applications on the students' smartphones, tablets, and laptops within the classrooms. Level 5 listed the types of applications as sublevel codes. These included: literacy apps, math apps, social studies apps, science apps, and classroom apps. Within the sublevels, I incorporated specific apps used by the students and those included in the GED programs. Examples of these were Learning Upgrade, Cell-ed, Fort Bend GED, Google, YouTube, Khan Academy, Math is Fun, Quizlet, IXL, Kahoot!, and other educational applications.

The majority of students mentioned Google as their primary source for finding information, learning new vocabulary, and resolving questions about work, interests, or the news. P3's tablet was set up with a voice recognition command. P3 said, "I could just Google and ask a question, and then it popped the information up on the screen." P6 used Google to understand vocabulary words. She said,

> I used it to find out any word that I don't know the meaning. Or if I am using the app, I'm learning new words that I don't know that was there. How to spell it or how to read it. I find out a lot.

Another favorite application used by the learners was Learning Upgrade 5.055 reading and 5.105 math. The application contained courses that covered grades K-12, GED content, and high school equivalency courses.

Level 6 Adult Learner Needs contained sublevels such as finding information, easing frustrations, including technology instruction, and sharing learning apps. Themes from Level 6 appeared within the learner dialogues frequently. Two quotations about adult learners' needs that were similar to other student accounts were from P1 and P3. P1 said, "If I don't know something, I ask Siri or Goggle, and they'll give you most of the information that you're looking for." P3 said, "Google and Fort Bend was much, much better at accessing information for me to understand, and they were teaching me like online classes right there that you could get information and learn with."

To understand the adult learners' perceptions about using their smartphones or tablets as MLEs from their initial exposure to educational applications to their experiences by the end of the semester, I asked the following question during their final interviews. "Please tell me if your perceptions about how you use your smartphone or tablet has changed." Level 7 Changing Perceptions contained the sublevel themes that emerged from that question. These were 7.05 Expanding Learner Exposure, 7.10 Challenging Old Ways, and 7.15 Perceiving Apps as Tutors/Teachers. P4 said, "Well, how to use a smartphone...it changed my life a lot. It helped me to read better. It helped me to write my essays better." P3 stated,

> Well some people become frustrated, because they really don't know what they have access to. And, even me, if there's something that I can't go into on the technology or computer and get or know how to do, it's just a little bit frustrating, but I know that it's going to take some time to...it only takes some time of being more observant to accomplish what you are

trying to do. Because the information is there, and you know, it's at hand.

It's accessed right in your hands. The availability is outstanding.

Discrepant Cases

Although most of the adult learners easily incorporated MLEs into their learning programs, a few did not. P10 was never interested in using her smartphone to study, even though she enjoyed the Learning Upgrade app and found it useful. P5 was asked to leave his GED program because he used his tablet to access content that was not allowed in his GED program. Data from his first interview, his classroom observations, and his TABE result were included in the study because his inappropriate use of his MLE proved to be a distraction that contributed to his leaving his GED program.

Evidence of Trustworthiness

According to Patton (2015), establishing trustworthiness is the backbone of solid qualitative research. He mentioned that trustworthiness in research depends on "prolonged" and "persistent observation" (p. 685). This study was conducted over a three-month period and included three interviews, two observations, and a review of the adult learners' TABE results. Shenton (2004) mentioned that "credibility, transferability, dependability, and confirmability" are the key ingredients in valid qualitative research (p. 64).

Credibility

This study explored how adult learners in GED programs experienced MLEs. Credibility was established using four different means: the adult learners volunteered to participate, the three interview guides were open-ended and followed an established

guide, I was familiar with the learner population, and I used member checking to make sure the learner's responses reflected what they wanted to say. Other means of establishing credibility included: recorded interviews, verbatim transcripts, reflexive prompts, inclusion of discrepant cases, recorded observations, and reflexive journal entries.

Transferability

According to Merriam and Tisdell (2016), transferability refers to qualitative research that can be replicated because it contains information-rich descriptions of the participant demographics and settings as well as abundant evidence from quotations, observations, and notes (p. 257). For this study, the settings, participant demographics, and TABE results were reported. A coding table was included as well as a data table to show the coding process and the themes that emerged through the participants interviews, observations, and TABE results (see Appendixes J & K). Quotations from three different interview protocols were included to give future researchers information about adult learners in GED programs, the learners' dreams and expectations, their acceptance of MLEs, and their inclusion of MLEs as ongoing means of finding information and learning. Transferability was also established through the reflexive journal which contained the transcription and analytical process.

Dependability

Patton (2015) pointed out that dependability relies on an inquiry-based process that is "logical, traceable, and documented" (p. 685). This study used three research questions that tied to connectivism as its conceptual framework. Siemens' (2005) eight

principles of connectivism were compared to how the adult GED learners responded, perceived, and described using MLEs. To provide readers with a transparent report of the research, I included the procedures I used and details about the data collection, transcription and analysis.

Confirmability

This study was conducted objectively. Patton (2015) mentioned that confirmability establishes that the data collected is true and not imaginative recollections (p. 685). For this study, I have presented the data collection and analysis in a clear and sequential way. I have been transparent about any bias that I may hold, and I did not have any personal expectations about what the participants would experience or what the data would reveal. All interviews with the participants were digitally recorded, transcribed, analyzed, and coded. All data were reviewed for accuracy.

Results

The results of this study showed how adult learners in two different GED programs used MLEs to find information, to study, and to find meaning about existing and emerging technologies. The study revealed learner perceptions about participating in MLEs. These included: learners' feelings, learners' perceived comfort levels using MLEs, learners' beliefs about the role of smartphones and tablets in education, and learners' envisioned roles of MLEs in other areas of education. Furthermore, the study showed how adult learners with differing TABE level results responded to the integration of educational applications in their classrooms and as a part of their overall study plans.

The results from Research Question 1 showed that while some students had used smartphones or tablets to find information or to follow trends, none of the students had considered smartphones as MLEs (see Appendix K). The students were learning with smartphones almost organically. They had incorporated using Google and asking Siri to answer questions about everyday life and to help them discover the meanings and pronunciation of unknown words. Once the students began to see their smartphones and tablets as MLEs, their perceptions began to change.

The results of Research Question 2 show that most of the adult learners' perceptions of participating in an MLE expanded. As the school increasingly relied on the MLEs for in-class tutoring and for homework, the learners became more comfortable with applications to augment learning. Using apps like Learning Upgrade which are colorful, have music, and are game-like increased student acceptance of the apps. Several students reported that they enjoyed playing against the app. It made learning in an MLE fun (see Appendix L).

The results of Research Question 3 show that learners at different TABE score levels responded positively to the integration of educational applications (see Appendix M). One student, P1, reported being almost addicted to the Learning Upgrade application because it was paced to fit his reading needs, and it helped him practice language arts skills. He had scored low on the TABE in language arts, and he wanted to improve quickly. Other students mentioned how easy it was to learn math concepts and master problems using the Learning Upgrade math courses. Every grade level is included on the application. Every student at some point in the study mentioned how much they relied on

Google to help them understand words that they did not know. Using the educational applications gave the students confidence when working with learning content that had previously seemed unattainable.

Summary

The adult learners who participated in my study were interviewed and observed to understand how they used MLEs in the program. At the beginning of the study, most of the students used their smartphones or tablets in several ways: as a dictionary, playing games, for shopping, for transportation directions, and for social interaction. One woman used her smartphone as a camera throughout the study. As the study progressed and the students began to incorporate their MLEs in their classes and for homework, acceptance of the devices increased. Students used their MLEs for in-class tutorials and to complete homework.

The learners' perceptions about participating in an MLE expanded. Most of the students began to see their smartphones and tablets as necessary. Some used the MLEs for tutoring, while others used YouTube as their primary teacher. Two older learners initially had difficulty perceiving their smartphones as anything other than a communication device, but as they were introduced to Learning Upgrade and other engaging applications, they began to see the MLEs as exciting and helpful.

TABE results played a role in that both schools introduced more sophisticated learning applications to more advanced students. However, the students who scored the lowest on the TABE easily adapted to the Learning Upgrade, Math is Fun, and the Kahoots! applications because they made learning easy and fun.

Chapter 5 begins with a brief introduction and summary of key findings. It describes the ways the data compares or contrasts to findings in the literature review. It includes information about how the results of this study can be interpreted within connectivism, the theoretical framework for this study. It describes the limitations of the study, recommendations for further study, and the implications for social change. Finally, it provides the basis of an exhortation about the use of MLEs in adult GED settings.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this basic qualitative study was to explore the described experiences and perceptions of adult learners enrolled in GED programs using educational applications in MLEs. Eleven adult learners, seven males and four females, participated in the study. The learners used smartphones and/or tablets to learn as a supplement to classroom instruction. All four of the female participants used smartphones; two of the male participants used only tablets, two used smartphones, and three used both smartphones and tablets.

The key findings of the study revealed that student perceptions of MLEs changed over the course of the semester, moving from using smartphones and tablets as everyday tools or gaming devices to perceiving them as educational devices. The key finding from RQ1 was that students initially used Google on smartphones and tablets to find information about their everyday lives, such as looking up words they did not know. Participants did not perceive the acquisition of information via mobile applications as learning. A key finding from RQ2 was that learner perceptions of MLEs expanded. As participants' educational programs incorporated mobile apps into the learning environment, the students described positive learning experiences using the apps. In addition to perceiving the MLEs as educational venues, the learners also described their learning experiences as enjoyable. The key finding of RQ3 was that learners from differing TABE levels described educational apps on MLEs that met their learning levels and needs in positive ways and accepted them, while applications that did not meet their

needs were described in negative terms and discarded. Learners with lower TABE scores were more apt to use Google and literacy apps that provided them with vocabulary skills.

Interpretation of the Findings

The experiences of 11 adult learners using MLEs in their GED programs were explored through Siemens's (2005) conceptual framework of connectivism. The findings from the current study were consistent with the eight principles of connectivism as described by Siemens. Siemens's conception was that connectivist learning relied on the distribution of knowledge via technological connections and the development of nodes to facilitate learner participation (Duke et al., 2013; Goldie, 2016; Siemens, 2005; Yumurtaci, 2017). During the current study, instructors at the primary site as well as the director of the GED program at the secondary site incorporated MLEs into their classrooms. The integration of MLEs created blended learning opportunities in which the adult learners interacted with the smartphones and tablets to the extent that some learners began perceiving the MLEs as teachers.

Research Question 1

Research Question 1 focused on how adult learners used MLEs in their GED programs. Initially, the learners described their smartphones and tablets as communication devices, social media tools, and information portals via Google. As the learners were exposed to learning experiences using the smartphones and tablets, their ideas about MLEs changed, with most of the learners incorporating MLEs into daily study periods. This adoption of MLEs is consistent with Siemens's (2005) connectivist model in which learning expands as technology is accepted and learning is facilitated

through building connections and acquiring new information. The current study's participants' assimilation of the learning applications as a means of gathering information and studying was similar to Duke et al.'s (2013) description of connectivist principles that learning is actionable and not bound by institutional restrictions or other limitations. The learners in the current study perceived that they had almost unlimited access to information.

Key issues described as barriers to learning by the participants were understanding unknown words and language arts skills. Once the learners were presented with educational applications like Cell-ed and Learning Upgrade, they described their experiences with vocabulary and ELA (English language arts) in more positive ways. Their experiences confirm Mahid's (2018) meta-analysis of using MLEs to provide English vocabulary assistance. This finding is also consistent with Nickerson et al.'s (2017) and Wardaszko and Podgorski's (2017) studies of the effectiveness of mobile learning.

Wardaszko and Podgorski (2017) investigated game-based MLEs. The benefits Wardaszko and Podgorski reported were similar to my study in that students reported improvements in learning. However, the learners in my study described their learning differently than those in Wardaszko and Podgorski's study. Students in the current study attributed their continuous use of the applications to their game-like appeal and to educational features that met their learning needs. The game-like structure of some applications, including built-in challenges and rewards, were fun, and learners sought out opportunities to continue using them.

MLEs offer learning opportunities that are free and ubiquitous, which enable adult learners to access learning applications regardless of their socioeconomic status (Gilman et al., 2015; Schmid et al., 2015). The adult learners at both sites lacked access to quality learning materials outside of their GED programs. The mobile applications provided by the schools and the free learning applications on the participants' smartphones and tablets gave the learners access to a wealth of learning opportunities.

Within the GED program sites, the teachers introduced educational applications for MLEs and computers. Hwang et al. (2015) noted that learning becomes a continuous experience when students have access to videos and practice materials outside of schooltime. Hwang et al.'s interpretation of their findings is consistent with the data from the adult learners at the primary site who were assigned homework on their apps, which allowed them to continue to study outside of the classroom. Even though the learners at the secondary site were not assigned homework on their applications, most of them used the apps during their study periods.

Research Question 2

Adult learners' perceptions of participating in an MLE were the focus of Research Question 2. Like the students described in studies by McKnight (2015) and Mellard et al. (2016), the GED learners came from different backgrounds. Most learners reported that their perceptions of MLEs expanded after they used them in their classrooms and at home, yet a small number of participants said that smartphones and tablets were not learning spaces.

Most of the learners' perceptions about their MLEs were consistent with Siemens's (2005) principles of connectivism. Students' perceptions of the MLE as a means of accessing online teachers resonated with Siemens's description of learning through nonhuman devices. Learners described the ability to access learning connections across multiple sites and applications. The adult learners' descriptions of maintaining and sharing their learning connections were consistent with connectivist ideas about nodes of learning. Most of the learners described instances of finding connections that met their learning needs. Learners described using YouTube videos, Khan Academy, and other educational sites to augment classroom instruction and to discover information not previously known.

Connectivism is based on the interaction of learners through classes, social networks, peers, and nonhuman mechanisms (Kizito, 2016). The adult learners in the current study were observed using their smartphones and tablets during their classes to study and to help with vocabulary building. As using and sharing the MLEs with educational applications became a norm within the learners' classrooms, the students' perceptions of the MLEs expanded.

The learners used educational applications on their MLEs, especially Google, YouTube, IXL, Math is Fun, and Learning Upgrade, to increase their learning experiences. Schmid et al. (2015) mentioned that MLEs were the classrooms of the future. For the adult learners in this study, MLEs became part of the classrooms of their present.

Research Question 3

The results of Research Question 3 indicated that adult learners at different TABE levels responded positively to the use of educational applications in MLEs. One of the key findings concerned MLE acceptance. For learners with low TABE scores, acceptance and continued use of educational applications was based on perceived success. Learners with low TABE scores rejected applications that were difficult to understand but embraced apps that were easy to use and that taught new literacy or numeracy skills. Students with higher TABE scores who perceived educational apps as too easy or slow were more apt to find the applications frustrating and to discontinue using them and other similar learning platforms. Conceicoa and Martin (2016) pointed out that people either utilize mobile technologies or avoid them.

Diaz and Black (2016) pointed out the importance of understanding learners' literacy and numeracy levels and their perceptions about their education. Learners in the current study were introduced to and chose educational applications based on their TABE placements. Learners struggling with writing and reading used educational applications that provided literacy support. Some students used Google almost exclusively for finding information and word meanings. For these students, Google was a springboard for making other learning connections. Siemens's (2005) principles of connectivism indicate that connectivist learning is based on obtaining current information and on decision-making. For Siemens, decision-making creates learning opportunities that are flexible and ongoing. Siemens's viewpoint was consistent with how the students in the current study used their MLEs. Students were able to shift from one mobile application to another

when learning new information and to integrate that information into multiple areas of meaning.

The learners found educational applications on their own as well as being introduced to them in their classes. Hariadi et al. (2016) and Stevenson et al. (2015) noted the ability to find educational applications in almost every subject. Learners in the current study also mentioned the need for using their learning applications at home, away from the distractions of the classroom environment. Zhang et al. (2015) pointed out that mobile math applications allowed struggling learners a space for review and practice, which was consistent with this study's findings.

For some learners, English was their second language. Unlike the learners in Demouy et al.'s (2015) study of non-English speaking students who used English language apps and learned English in incidental ways, bilingual learners in the current study were sometimes deliberate in using applications that supported English language acquisition. One similarity that the learners in my study shared with those of Demouy et al. was that the learners became accustomed to using applications on their MLEs to meet self-perceived gaps in their learning.

One of the key findings of this study was discovering the extent to which learners depended on Google as their chief source for defining and pronouncing unknown words. The smartphones and tablets were perceived by the students as literacy support tools. Ur-Rehman et al. (2016) noted that smartphones and tablets provide support for reading because they offer dictionary services. Knowing that applications like Google, Cell-ed,

and Learning Upgrade were available on their smartphones and tablets gave the learners in my study motivation to practice their literacy skills.

Limitations of the Study

The adult learners who participated in this study were selected because they were enrolled in GED programs that were integrating digital learning, and they were using smartphones, laptops, and tablets. One limitation was that some learners faced difficulties with Internet access, so their perceptions of MLEs might differ from learners who had ongoing access to their mobile apps. Another limitation was the exclusion of the teachers' perceptions about using MLEs in GED programs. Teachers' input may have included information about their experiences with learners and about how they felt MLEs influenced student motivation and success. The exclusion of teachers' perspectives may limit transferability of the study findings to other GED locations.

This study was conducted at two church-affiliated locations. A limitation of this study may have been the affiliations of the locations. Though neither site excluded students based on religion, gender, race/ethnicity, or sexual orientation, their affiliation may have been perceived by some potential learners as exclusionary. The learners in my study were located in historically poor neighborhoods. Studies that include GED programs within public school settings or other government-funded agencies may attract learners from more diverse socioeconomic backgrounds.

In addition to these limitations, there were limitations to the use of the conceptual framework because of the exclusion of how adult students used social media to learn. My intention was to focus on how students described their experiences using smartphones

and tablets as MLEs, and my interview guides included questions about the MLEs and educational applications. I did not include interview questions about students' use of social media platforms such as Facebook and Instagram, which Siemens's (2005) theory of connectivism includes. I did not expect social media use to be a part of GED program instruction, so it was not included in the study. Researchers who use connectivism as their conceptual framework and include social media as learning platforms may find different results than those in this study.

Recommendations

MLEs offer almost unlimited access to learning opportunities. Smartphones and tablets contain features that enable learners to study almost every subject through free and paid applications (Chan et al., 2015). Because MLEs have the potential to help low-literacy adults, further research about adults in GED programs and MLEs should be considered. Four areas considering the use of MLEs in educational settings that need further research are:

1. Further basic qualitative research about adult learner acceptance of MLEs using video teaching platforms should be considered.
2. An exploration of how game-based MLEs affect learners at different TABE levels is recommended.
3. Additional research is recommended about adult educational programs that include social media platforms, like Facebook and Instagram, as learning platforms.

4. Based on the number of older learners who participated in this study, more research is needed about how older adults use MLEs.

Implications

The adult learners in the current study were intent on achieving their high school diplomas. For many of the learners, this achievement was perceived as an important step toward changing the future for their families. Educational applications on MLEs enabled the adult learners to practice literacy and numeracy skills. The data collected from this research about how adult learners perceived and described their experiences using educational applications on MLEs can contribute to the integrative process of using MLEs in future GED programs.

The implications of learner acceptance and involvement during this study are important for GED programs considering using MLEs to augment their instruction. Positive social change can result from the current study because it can be used to inform GED administrators about learner perceptions of mobile educational content that can be acquired at little to no cost. Administrators can use this study to learn how MLEs can be used to differentiate instruction that can benefit learners at different TABE levels. This information can also enable GED instructors to learn from adult learners' experiences using MLEs.

This study generated several recommendations for practice. One key recommendation is that adult learners should be allowed to use their smartphones and tablets as MLEs for learning during and out of class. Another is that GED program directors should understand that when students practice difficult or unfamiliar numeracy

and literacy problems on their MLEs, they are able to practice until they reach proficiency without teacher or facilitator interaction. This frees up time and resources ordinarily used to generate additional practice work.

Integrating MLEs into GED classrooms is motivating and extends learning opportunities. When teachers included MLEs as part of their classroom instruction, the learners perceived the educational applications as necessary components of their educational experiences. Extending learning from the traditional GED classroom into MLEs and the virtual realm has the potential to change how adult learners accept educational materials and learn.

Conclusion

MLEs offer new ways for adult learners to succeed on the GED test. The learners in this study created dreams and goals for a future that included their success on the GED test (L. Anderson, 2015). Their goals included jobs, family acceptance, and new identities as graduates. Educational applications on their smartphones and tablets offered them avenues to information and practice that was new and exciting for them. Having access to information that could be accessed as close as their hand gave them feelings of confidence and power. Their opportunities to learn were extended beyond their classrooms, and their perceptions about education expanded.

For adults who did not complete a secondary program of studies, new opportunities to learn are now present and accessible. Factors that inhibited their education can be mitigated. Through the use of MLEs, barriers like transportation, lack of childcare, and job responsibilities can be lessened because MLEs are transportable and

applications are available ubiquitously. Because many mobile applications produce scores, adult learners are able to see their progress and respond accordingly. MLEs offer unbiased learning opportunities; they are not governed or influenced by race, gender, or socio-economic status. For adult learners in GED programs, MLEs offer the potential for new educational ventures that can impact their futures and future generations of learners.

References

Ally, M., Crimus, M., & Ebner, M. (2014). Preparing teachers for a mobile world, to improve access to education. *Prospects 2014,* 44-59. doi:10.1007/s11125-014-9293-2

Ally, M., & Prieto-Blazquez, J. (2014). What is the future of mobile learning in education? *International Journal of Educational Technology in Higher Education, 11*, 142-151. doi:10.7238/rusc.v11i1.2033

Aluko, R. (2017). Applying UNESCO guidelines on mobile learning in the South African context: Creating an enabling environment through policy. *International Review of Research in Open and Distributed Learning, 18*(7), 24-44. doi:10.19173/irrodl.v18i7.2702

Anderson, L. (2015). The GED and minority language groups. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 4*(3), 57-64.

Anderson, M. (2015). *Racial and ethnic differences in how people use mobile technology.* Pew Research Center. Retrieved from http://www/pewresearch.org/fact-tank/2015/04/30/racial-and-ethnic-differences-in-how-people-use-mobile-technology/

Awuah, L. J. (2015). Supporting 21st-century teaching and learning: The role of Google Apps for Education (GAFE). *Journal of Instructional Research, 4*(2015), 12-27. doi:10.9743/JIR.2015.2

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *Qualitative Report, 13*(4), 544-559.

Retrieved from http://www.nova.edu/ssss/QR/QR13/4/baxter.pdf

Brinkley-Etzkorn, K. E., & Ishitani, T. T., (2016). Computer-based GED testing: Implications for students, programs, and practitioners. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 3*(3), 8-21.

Brinkley-Etzkorn, K. E., & Skolits, G. (2014). Anticipated effects of the GED test on educators and young adult learners. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 3*(3), 8-21.

Brown, T. H., & Mbati, L. S. (2015). Mobile learning: Moving past the myths and embracing the opportunities. *International Review of Research in Open and Distributed Learning, 16*(2), 115-135.doi:10.1973/irrodl.v16i2.2071

Bryne-Davis, L., Dexter, H., Hart, J., Cappelli, T., Byrne, G., Sampson, I.,…MMS Mtechnology Research Group. (2015). Just-in-time research: A call to arms for research into mobile technologies in higher education. *Research in Learning Technology, 23*(1), 1-10. doi:10.3402/rlt.v23.25653

Cargile, L., & Harkness, S. (2015). Flip or flop: Are math teachers using Khan Academy as envisioned by Sal Khan? *TechTrends: Linking Research & Practie to Improve Learning, 59*(6), 21-28. doi:10.1007/s11528-015-0900-8

Carter, J. (2017). Expanding access to learning with mobile digital devices. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 6*(2), 49-54.

Chan, N. N., Walker, C., & Gleaves, A. (2015). An exploration of student lived experiences of using smartphones in diverse learning contexts using a

hermeneutic phenomenological approach. *Computers and Education, 82*(2015), 96-106. doi:10.1016/j.compedu.2014.11.001

Chen, C., & Wu, C. (2015). Effects of different video lecture types on sustained attention, emotion, cognitive load, and learning performance. *Computers and Education, 80*(2015), 108-121. doi:10.1016/j.compedu.2014.08.015

Chuang, Y. (2014). SSCLS: A smartphone-supported collaborative learning system. *Telematics and Informatics, 32*(2015), 463-474. doi: 10.1016/j.tele.2014.10.004

Cochrane, T., Cook, S., Aiello, S., Christie, D., Sinfield, D., Steagall, M., & Aguayo, C. (2017). A DBR framework for designing mobile virtual reality learning environments. *Australasian Journal of Educational Technology, 33*(6), 54-68. doi:10.14742/ajet.3613

Conceicao, S. O., & Martin, L. G. (2016). Black men and the digital divide. *New Directions for Adult & Continuing Education, 2016*(150), 25-35. doi:10.1002/ace.20183

Crabtree, J. L., Ohm, D., Wall, J. M., & Ray, J. (2015). Evaluation of a prison occupational therapy informal education program: A pilot study. *Occupational Therapy International, 23*(4), 401-411. doi:10.1002/oti.1442

Davis, C. A. (2014). Unraveled, untold stories: An ethnodrama. *Adult Education Quarterly, 64,* 240-259. doi:10.1177/0741713614531067

Demouy, V., Jones, A., Kan, Q., Kukulska-Hulme, A., & Eardley, A. (2015). Why and how do distance learners use mobile devices for language learning? *EUROCALL Review, 12*(2), 10-25. doi:10.4995/eurocall.2016.5663

Denzin, N. K., & Lincoln, Y. S. (2013). *Strategies of qualitative inquiry.* Thousand Oaks, CA: Sage Publications.

Denzin, N. K., & Lincoln, S. (2018). *The Sage handbook of qualitative research.* Thousand Oaks, CA: Sage Publications.

Diaz, C. J., & Black, W. R. (2016). In search of care and structure: A study of resilient Latino students who chose enrollment in an adult basic education/under-aged general education program. *National Forum of Educational Administration and Supervision Journal, 34*(4), 32-43.

Duke, B., Harper, G., & Johnston, M. (2013). Connectivism as a digital age learning theory. *International HETL Review, Special Issue,* 4-13. Retrieved from https://www.hetl.org/wp-content/uploads/2013/09/HETLReview2013SpecialIssueArticle1.pdf

Ecker-Lyster, M., & Niileksela, C. (2016). Keeping students on track to graduate: A synthesis of school dropout trends, prevention, and intervention initiatives. *Journal of At-Risk Issues, 19*(2), 24-31.

Fink, A. S. (2000). The role of the researcher in the qualitative research process. A potential barrier to archiving qualitative data. *Forum: Qualitative Sozialforschung/Forum: Qualitative Social Research, 1*(3), Art. 4. Retrieved from http://nbn-resolving.de.urn:nbnide:0114-fqs000344.

Foroughi, A. (2015). The theory of Connectivism: Can it explain and guide learning in the digital age? *Journal of Higher Education Theory and Practice, 15*(5), 11-26. Retrieved from http://m.www.na-

businesspress.com/JHETP/ForoughiA_Web15_5_.pdf

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences.* New York, NY: Worth Publishers.

Fuller, R., & Joynes, V. (2015). Should mobile learning be compulsory for preparing students for learning in the workplace? *British Journal of Educational Technology, 46*(1), 153-158. doi:10.1111/bjet.12134

Fusch, P. L., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *Qualitative Report, 20*(9), 1408-1406. Retrieved from https://nsuworks.nova.edu/tqrl/vol20/iss9/3

Garcia, E., Elbeltagi, I., Brown, M., & Dungay, K. (2015). The implications of a connectivist learning blog model and the changing role of teaching and learning. *British Journal of Educational Technology, 46*, 877-894, doi:10.111/bjet.12184

Geckle, J. (2016). Use of multimedia or mobile devices by adolescents for health promotion and disease prevention: A literature review. *Pediatric Nursing, 42*(4), 163-167.

Gilman, E., Milara, I. S., Cortes, M., & Riekki, J. (2015). Towards user support in ubiquitous learning systems. *IEEE Transactions on Learning Technologies, 8*(1), 55-69. doi:10.1109/TLT.2014.2381467

Goldie, J. G. S. (2016). Connectivism: A knowledge learning theory for the digital age? *Medical Teacher, 38*(10), 1064-1069. doi:10.3109/0142159X.2016.1173661

Graves, F., & Bledsoe, C. (2015). Understand what research says about how to best meet the needs of your adult learners. *Recruiting and Retraining Adult Learners, April*

(2015), doi:10.1002/nst

Gu, J. (2014). A mobile informal learning solution for workplace learners. *Educational Media International, 51*(3), 185-198. doi:10.1080/09523987.2014.968449

Hammond, T., Bozdin, A. M., & Stanlick, S. E. (2014). Redefining the longitude/latitude experience with a scaffolded geocache. *Social Studies (2014), 105,* 237-244. doi:10.1080/00377996.2014920289

Hannon, K. (2017). Utilization of an educational web-based mobile app for acquisition and transfer of critical anatomical knowledge, thereby increasing classroom and laboratory preparedness in veterinary students. *Online Learning, 21*(1), 201-208. doi: 10.24059/olj.v21i1.882

Hariadi, B., Dewiyani, M. J., & Sudarmaningtyas, P. (2016). Development of web-based learning application for Generation Z. *International Journal of Evaluation and Research in Education, 5*(1), 60-68. doi:10.11591/ijere.v5i1.4523

Hart, S. (2015). High school equivalency testing in Arizona. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 4*(3), 48-50.

Hashim, K. F., Tan, F. B., & Rashid, A. (2015). Adult learners' intention to adopt mobile learning: A motivational perspective. *British Journal of Educational Technology, 46,* 381-390. doi: 10.111/bjet.12148

Hector-Mason, A., Narlock, J., Muhisani, H., & Bhatt, M. P. (2017). *State strategies to facilitate adult learners' transitions to postsecondary opportunities*. Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational

Laboratory Midwest. 1-12. Retrieved from http://ies.ed.gov/ncee/edlabs

Hedberg, J. G. (2014). Extending the pedagogy of mobility. *Educational Media International, 51*(3), 237-253. doi:10.1080/09523987.2014.968447

Hsu, Y., Ching, Y., & Snelson, C. (2014). Research priorities in mobile learning: An international Delphi study. *Canadian Journal of Learning and Technology, 40*(2), 1-22. doi:10.1142/9789814619523_0001

Hwang, G., Lai, C., & Wang, S. (2015). Seamless flipped learning: A mobile technology-enhanced flipped classroom with effective learning strategies. *Journal of Computer Education, 2,* 449-473. doi: 10.1007/s40692-015-0043-0

Ioannou, A., Vasiliou, C., & Zaphiris, P. (2016). Problem-based learning in multimodal learning environments: Learners' technology adoption experiences. *Journal of Educational Computing, 54*(7), 1022-1040. doi:10.1177/0735633116636755

Jameson, M. M., & Fusco, B. R. (2014). Math anxiety, math self-concept, and math self-efficacy in adult learners compared to traditional undergraduate students. *Adult Education Quarterly,* 1-17. doi:10.1177/0741713614541461

Janesick, V. J. (2011). *"Stretching" exercises for qualitative researchers.* Thousand Oaks, CA: Sage.

Jirasatjanukul, K., & Jeerungsuwan, N. (2018). The design of an instructional model based on connectivism and constructivism to create innovation in real world experience. *International Education Studies, 11*(3), 12-17. Retrieved from https://files.eric.ed.gov/fulltext/EJ1172128.pdf

Johnson-Bailey, J. (2016). Adult basic education and the cyber classroom. *Journal of*

Research and Practice for Adult Literacy, Secondary, and Basic Education, 5(3), 50-55. Retrieved from https://pdfs.semanticscholar.org/0e91/300997af51f2e26175a1d768b213543bbc33.pdf

Jones, A., Gaved, M., Kukulska-Hulme, A., Scanlon, E., Pearson, C., Lamcras, P., Dunwell, I., & Jones, J. (2014). Creating coherent incidental learning journeys on smartphones using feedback and progress indicators. *International Journal of Mobile and Blended Learning, 6*(4), 75-92. doi:10.4018/ijmbl.2014.100105

Karnjanapun, S. (2015). Nakhon Ratchasima teachers' using of smartphones in English language teaching. *EdMedia, 2015,* 944-950. Retrieved from https://www.learntechlib.org/primary/p/151364/

Kaufman, R., Oakley-Browne, H., Watkins, R., & Leigh, D. (2003). *Strategies for planning success: Aligning people, performance, and payoffs.* San Francisco, CA: Jossey-Bass/Pfeiffer.

Kelly, D. P., & Rutherford, T. (2017). Khan Academy as supplemental instruction: A controlled study of a computer-based mathematics intervention. *International Review of Research in Open and Distributed Learning, 18*(4), 70-77. doi:10.19173/irrodl.v18i4.2984

Kelly, S. L. (2018). *The impact of Khan Academy math remediation on ninth grade student achievement.* (Unpublished doctoral dissertation). Liberty University, Lynchburg,VA

King, K. P. (2017). *Technology and innovation in adult learning.* San Francisco, CA:

Jossey-Bass.

Kizito, R. N. (2016). Connectivism in learning activity design: Implications for pedagogically-based technology adoption in African higher education contexts. *International Review of Research in Open and Distance Learning, 17*(2), 19-39. doi:10.19173/irrodl.v17i2.2217

Knowles, M. S., Holton III, E. F., & Swanson, R. A. (2015). *The adult learner: The definitive classic in adult education and human resource development.* New York, NY: Routledge.

Konopasky, A. W., & Sheridan, K. M. (2016). Towards a diagnostic toolkit for the language of agency. *Mind, Culture, and Agency, 23*(2), 108-123. doi: 10.1080/10749039.2015.1128952

Lange, E. A., Chovanec, D. M., Cardinal, T., Kajner, T., & Acuna Smith, N. (2015). Wounded learners: Symbolic violence, educational justice, and re-engagement of low-income adults. *Canadian Journal for the Study of Adult Education, 27*(3), 83-104.

LaPelle, N. A. (2004). Simplifying qualitative data analysis using general purpose software tools. *Field Methods, 16*(1), 85-108. doi:10.1177/1525822X03259227

Laskin, A. V., & Avena, J. (2015). Introduction of mobile media into formal classroom learning environments. *Journalism and Mass Communication Educator, 70,* 276-285. doi:10.1177/1077695815601170

Liaw, S., & Huang, H. (2015). How factors of personal attitudes and learning environments affect gender difference toward mobile distance learning

acceptance. *International Review of research in Open and Distributed Learning, 16*(4), 104-131. doi:10.19173/irrodl.v16i4.2355

Light, D., & Pierson, E. (2014). Increasing student engagement in math: The use of Khan Academy in Chilean classrooms. *International Journal of Education and Development Using Information and Communication Technology, 10*(2), 103-119.

Mahdi, H. S. (2018). Effectiveness of mobile devices on vocabulary learning: A meta-analysis. *Journal of Educational Computing Research, 56*(1), 134-154. doi:10.1177/0735633117698826

Mao, J. (2014). Social media for learning: A mixed methods study on high school students' technology affordances and perspectives. *Computers in Human Behavior, 33*(2014), 213-223. doi:10.1016/j.chb.2014.01.002

McFarland, J., Stark, P., & Cui, J. (2016). *Trends in high school dropout and completion rates in the United States: 2013.* U. S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved from https://nces.ed.gov/pubs2016/2016117rev.pdf

McKenney, S., & Reeves, T. (2012). *Conducting educational design research.* London: Routledge.

McKnight, A. N. (2015). "They never really tried to reach out to us": Examining identities and confronting the emotional distance between urban youth and urban schools. *Critical Questions in Education 6:2,* 86-102. Retrieved from https://files.eric.ed.gov/fulltext/EJ1065825.pdf

Mellard, D. F., Woods, K. L., & Lee, J. H. (2016). Literacy profiles of at-risk young

adults enrolled in career and technical education. *Journal of Research in Reading, 39*(1), 88-108. doi:1111/1467-9817.12034

Merriam, S. B. (1998). *Qualitative research and case study applications in education.* San Francisco, CA: Jossey-Bass.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation.* San Francisco, CA: Jossey-Bass.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook.* Thousand Oaks, CA: Sage Publications.

Montrieux, H., Vanderlinde, R., Schellens, T., & De Marez, L. (2015). Teaching and learning with mobile technology: a qualitative explorative study about the introduction of tablet devices in secondary education. *PLoS One, 10*, 1-17. doi:10.1371/journal.pone.0144008

Munteanu, C., Molyneaux, H., Maitland, J., McDonald, D., Leung, R., Fournier, H., & Lumsden, J. (2014). Hidden in plain sight: Low-literacy adults in a developed country overcoming social and educational challenges through mobile learning support tools. *Personal and Ubiquitous Computing, 18,* 1455-1469. doi:10.1007/s00779-013-0748-x

Neuman, W. L. (2006). *Social research methods: Quantitative and qualitative approaches.* New Delhi, India: Dorling Kindersley.

Newman, A. (2015). Part one: Interest in an aptitude for technology. *Learning for Life: The Opportunity for Technology to Transform Adult Education.* Boston, MA: Tyton Partners.

Nickerson, C., Rapanta, C., & Goby, V. P. (2017). Mobile or not? Assessing the instructional value of mobile learning. *Business and Professional Communication Quarterly, 80*(2), 137-153. doi: 10.1177/2329490616663707

Nightingale, E., Greenberg, D., Branum-Martin, L., & Bakhtiari, D. (2016). Selecting fluency assessments for adult learners. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 5*(3), 18-29. Retrieved from https://files.eric.ed.gov/fulltext/ED572660.pdf

Obama, B. (2014). *President Barack Obama's state of the union address.* [Transcript]. Retrieved from https://obamawhitehouse.archieves.gov/the-press-office/2014/01/28/president-barack-obamas-state-union-address

Panzer, W., Johnson, M., & Lewis, B. (2015). High school credentialing in Wisconsin. *Journal of Research and Practice for adult literacy, secondary, and basic education, 4*(3), 44-47.

Parsons, D., & Adhikari, J. (2016). Bring your own device to secondary school: The perceptions of teachers, students, and parents. *Electronic Journal of e-Learning, 14*(1), 66-80. Retrieved from https://files.eric.ed.gov/fulltext/EJ1099110.pdf

Patton, M. Q. (2015). *Qualitative research and evaluation methods.* Thousand Oaks, CA: Sage Publications.

Percy, W. H., Kostere, K., & Kostere, S. (2015). Generic qualitative research in psychology. *Qualitative Report, 20*(2), 76-85. Retrieved from https://nsuworks.nova.edu/cgi/viewcontent.cgi?article=2097&context=tqr

Petrovic, O., Babcicky, P., & Puchleitner, T. (2014). An environment for mobile

experiential learning. *10th International Conference Mobile Learning* (2014), 271-276. Retrieved from https://files.eric.ed.gov/fulltext/ED557236.pdf

Pimentel, S. (2013). *College and career readiness standards for adult education.* Berkeley, CA: MPR Associates, Inc.

Ping, G. L. Y., Lok, C., Yeat, T. W. Cherynn, T. J. Y., & Tan, E. S. Q., (2018). "Are chemistry educational apps useful?" – a quantitative study with three in-house apps. *Chemistry Education Research and Practice, 19,* doi: 10.1039/c7rp00094d

Pinkus, A. (2015). Toward a one world schoolhouse: Interview with Sal Khan. *Independent Schools, 2015,* 42-46.

Prins, E., & Kassab, C. (2015). GED recipients in postsecondary education: A rural-urban analysis of Pennsylvania FAFSA applicants' educational, demographic, and financial characteristics. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 4*(2), 20-36.

Ranieri, M., & Pachler, N. (2014). Inventing and re-inventing identity: Exploring the potential of mobile learning in adult education. *Prospects (2014), 44,* 61-79. doi:10.1007/s11125-014-9294-1

Rubin, H. J., & Rubin, I. S. (2012). *Qualitative interviewing: The art of hearing data.* Thousand Oaks, CA: Sage.

Ruiperez-Valiente, J. A., Munoz-Merino, P. J., Leon, D., & Kloos, C. D. (2015). ALAS-KA: A learning analytics extension for better understanding the learning process I the Khan Academy platform. *Computers in Human Behavior, 47*(2015), 139-148. doi:10.1016/j.chb.2014.07.002

Sammel, A., Weir, K. & Klopper, C. (2014). The pedagogical implications of implementing new technologies to enhance student engagement and learning outcomes. *Creative Education, 5*(2), 104-113 doi:10.4236/ce.2014.52017

Schmid, L., Manturuk, K., Simpkins, I., Goldwasser, M., & Whitfield, K. E. (2015). Fulfilling the promise: do MOOCs reach the educationally underserved? *Educational Media International, 52*(2), 116-128. doi:10.1080/09523987.2015.1053288

Schwartz, J. (2014). Classrooms of spatial justice: Counter-spaces and young men of color in a GED program. *Adult Education Quarterly, 64*(2), 110-127.

Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social services.* New York, NY: Teachers College, Columbia University.

Sharples, M., Kloos, C. D., Dimitriadis, Y., Garlatti, S., & Specht, M. (2015). Mobile and accessible learning for MOOCs. *Journal of Interactive Media in Education, 2015, 1,* 1-8. doi:10.5334/jime.ai

Shaw, D., Tham, Y. S. S., Hogle, J., Koch, J. (2015). Desire: A key factor for successful online GED adult learners. *Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education, 4*(1), 21-35.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*(2004), 63-75. doi:10.3233/EFI-2004-22201

Shields, T. J. (2014). Identity and learning of mathematics for adult First Nations students. *Journal of Education and Training Studies, 2*(1), 63-72. doi:10.11114/jets.v2i1.213

Shraim, K., & Crompton, H. (2015). Perceptions of using smart mobile devices in higher education teaching: A case study from Palestine. *Contemporary Educational Technology 2015, 6*(4), 301-318. Retrieved from https://files.eric.ed.gov/fulltext/EJ1105758.pdf

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instruction Technology and Distance Learning, 2*(1). Retrieved from: http://www.itdl.org/Journal?Jan_05/article01.htm

Singh, A., Strating, A. T., Romero Herrera, N. A., van Dijk, H. W., & Keyson, D. V. (2017). Towards an ethnography of electrification in rural India: Social relations and values in household energy exchanges. *Energy Research and Social Science, 30*(2017), 103-115. doi:10.1016/j.erss.2017.06.031

Smith, A. (2015). *U. S. smartphone use in 2015*. Pew Research Center. Retrieved from http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015

Smith, A. (2017). *Record shares of Americans now own smartphones, have home broadband.* Pew Research Center. Retrieved from http://www.pewresearch.org/fact-tank/2017/01/12/evolution-of-technology/

Smith, S. J., & Harvey, E. E. (2014). K-12 online lesson alignment to the principles of Universal Design for Learning: The Khan Academy. *Open Learning, 29*(3), 222-242. doi:10.1080/02680513.2014.992402

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: Sage.

Stevenson, M., Hedberg, J., Highfield, K., & Diao, M. (2015). Visualizing solutions: Apps as cognitive stepping-stones in the learning process. *Electronic Journal of e-Learning, 13*(5), 366-379. Retrieved from https://files.eric.ed.gov/fulltext/EJ1084237.pdf

Sung, M. (2015). A study of adults' perception and needs for smart learning. *Procedia – Social and Behavioral Sciences, 191*(2015), 115-120. doi:10.1016/j.sbspro.2015.04.480

Sykes, E. R. (2014). New methods of mobile computing: From smartphones to smart education. *TechTrends: Linking Research & Practice to Improve Learning, 58*(3), 26-37. doi:10.1007/s11528-014-0749-2

Tighe, E. L., Barnes, A. E., Connor, C. M., & Steadman, S. C. (2013). Defining success in Adult Basic Education settings: Multiple stakeholders, multiple perspectives. *Read Res Q, 48,* 415-435. doi: 10.1002/rrq.57

Toma, J. D. (2011). Approaching rigor in qualitative research. In C. F. Conrad & R. C. Serlin (Eds.). *The Sage Handbook for Research in Education: Pursuing ideas as the Keystone of Exemplary Inquiry.* Thousand Oaks, CA: Sage.

Tossell, C. C., Kortum, P., Shepard, C., Rahmati, A., & Zhong, L. (2015). You can lead a horse to water but you cannot make him learn: Smartphone use in higher education. *British Journal of Educational Technology, 46*(4), 713-724. doi:10.111/bjet.12176

Tracy, S. J. (2013). *Qualitative research methods.* West Sussex, UK: Wiley-Blackwell.

Turner, D. W. (2010). Qualitative interview design: A practical guide for novice investigators. *The Qualitative Report, 15*(3), 754-760.

Tutty, J. I., & Martin, F. (2014). Effects of practice type in the here and now mobile learning environment. *Journal of Educational Technology, 11*(2), 17-27. doi:10.1111/bjet.12327

Underdown, K., & Martin, J. (2016). Engaging the online student: Instructor-created video content for the online classroom. *Journal of Instructional Research, 5*(2016), 8-12. Retrieved from https://files.eric.ed.gov/fulltext/EJ1127627.pdf

Ur-Rehman, I., Shamim, A., Khan, T. A., Elahi, M., & Mohsin, S. (2016). Mobile based user-centered learning environment for adult absolute illiterates. *Hindawi Publishing Corporation, 2016,* 1-6. doi:10.1155/2016/1841287

U.S. Department of Education, Office of Career, Technical, and Adult Education. (2015). *Making skills everyone's business: A call to transform adult learning in the United States.* Washington, DC: Author.

U.S. Department of Education, Office of Educational Technology (2017). *Reimaging the role of technology in education: 2017 national education technology update.* Washington, DC: Author.

Vazquez-Cano, E. (2014). Mobile distance learning with smartphones and apps in higher education. *Educational Sciences: Theory and Practice,* 1505-1520. doi:10.12738/estp.2014.4.2012

Wang, A., Anderson, T., & Chen, L. (2018). How learners participate in connectivist learning: An analysis of the interaction traces from a cMOOC. *International*

Review of Research in Open and Distributed Learning, 19(1), 45-66. doi:10.19173/irrodl.v19i1.3269

Wardaszko, M., & Podgorski, B. (2017). Mobile learning game effectiveness in cognitive learning by adults: A comparative study. *Simulation and Gaming, 48*(4), 435-454. doi:10.1177/1046878117704350

Washburn, M. H. (2007). Mentoring women faculty: an instrumental case study of strategic collaboration. *Mentoring and Tutoring, 15*(1), 57-72. doi:10.1080/13611/13611260601037389

White, T., & Martin, L. (2014). Mathematics and mobile learning. *Tech Trends, 58*(1), 64-70. doi:10.1007/s11528-013-0722-5

Workforce Innovation and Opportunity Act of 2014, Pub. L. No. J. R. 803 (2014).

Yin, R. K. (2014). *Case study research: Design and methods.* Thousand Oaks, CA: Sage Publications.

Yumurtaci, O. (2017). A re-evaluation of mobile communications technology: A theoretical approach for technology evaluation in contemporary digital learning. *Turkish Online Journal of Distance Education, 18*(1), 213-223. doi:10.1007/s11528-013-0722-5

Zaff, J. F., & Malone, T. (2017). Moving beyond academics: The role of adult capacity in keeping young people in school. *Youth and Society, 2017, 1-23.* doi:10.1177/0044118X17725970

Zhang, M., Trussell, R. P., Gallegos, B., & Asam, R. R. (2015). Using math apps for improving student learning: An exploratory study in an inclusive fourth grade

classroom. *TechTrends, 59*(2), 32-39. doi:10.1007/s11528-015-0837-y

Appendix A: First Interview Guide

Hello, my name is Tia Wilkinson. The reason I am conducting this interview is that I am interested in understanding how adults in GED programs describe their experiences using smartphones as mobile learning environments (MLEs). I would like to talk with you about your educational plans, and I would like to know what you think about smartphones as learning tools. Your information will be kept confidential.

- First, please tell me a little about yourself. For example, what are your interests or hobbies?
- How do you feel about enrolling in this GED program?
- What areas of study are the most important to you?
- Can you give me specific areas where you might need help on the GED?

For this study, smartphones and tablets will be considered as mobile learning environments. I am interested in how you might use your phone or tablet to help you learn.

- Please tell me how you currently use your smartphone.
- How do you use your smartphone or tablet to find information? (prompt: Do you look up facts or trends?)
- Tell me how you envision a mobile learning environment.
- How would you feel about participating in a mobile learning environment to study?

One of the areas that some adult learners struggle in is math. I know some areas of math are not used in everyday life, and we might want help practicing math problems.

- How do you feel that you might need assistance in working math problems?
- How comfortable do you think you would be practicing math problems on your smartphone?
- Khan Academy is a tutoring program that is available for free as an app on most smartphones and tablets. Please tell me about any experiences you have had with educational apps.
- If you have used educational apps, how would you describe your experience?
- What are other ways you might use a smartphone or tablet to learn?

Thank you for participating in this interview. After you have completed the GED program and used a mobile learning environment, I would like to interview you again. Both interviews will be completely confidential. If you have any concerns or questions, please call or text me at 832-338-5078 or email me at tia.wilkinson@waldenu.edu.

Appendix B: Second Interview Guide: Midpoint

Hello, I am Tia Wilkinson, and it is good to be meeting with you, again. This interview is a follow-up to the one you participated in several weeks ago. If you recall, the reason I am conducting these interviews is because I am interested in understanding how adults in GED programs use smartphones as mobile learning environments (MLEs). I would like to talk with you about how you may have used your smartphone as an MLE during your GED program. The information you share will be kept confidential.

- Please tell me how your GED program is going so far.
- How do you feel about the curriculum and learning apps in the program?
- What parts of the test seem the most difficult to you?
- What types of assistance are you receiving to be successful on the test?

In our previous interview, I mentioned that smartphones and tablets can be considered as mobile learning environments. I would like to know how you are using your phone and/or tablet during this GED program.

- Please describe how you have used your smartphone or tablet during this program.
- How has using a smartphone or tablet influenced the way you study for the test?
- Please explain whether the smartphone or tablet has been beneficial to your learning experience.

- Please tell me about any experiences you have had using learning applications on your smartphone. (prompt: Have you tried the new educational apps offered in the program or any other mobile apps?)
- Using a one to five scale, with one being the lowest and five the highest, how would you rate each new educational app offered by the GED program and why would you assign that rating?
- How comfortable are you with using your smartphone or tablet as a mobile learning environment?

I appreciate the time you have given me for this interview. After you have completed the GED program, I would like to interview you again. If you have any questions or concerns, please call or text me at 832-338-5078 or email me at tia.wilkinson@waldenu.edu. Again, thank you for your participation.

Appendix C: Final Interview Guide

Hello, my name is Tia Wilkinson. It is good to meet with you again. I understand that you have completed your GED program. The reason I am conducting this final interview with you is so that I have a good understanding of how adults in GED programs perceive their experiences using smartphones and tablets as mobile learning environments. I would like for you to tell me about your experiences using MLEs during your GED program.

- Please describe how you used your smartphone or tablet during this course of study.
- Now that your program is completed, how do you feel about using smartphones and tablets to study?
- What types of information or learning apps helped you with your studies?
- Did you use educational apps like Khan Academy; and if so, how did you use the apps?

I understand that earning the GED certificate was the goal of this program. I am interested to know if you think that mobile learning environments should be included in other GED programs.

- What role do you think that smartphones or tablets have in adult education?
- How do you envision using MLE's in other areas of education? (prompt: Do you think smartphones should be used in school?)
- Please tell me if your perceptions about how you use your smartphone or tablet has changed. (prompt: How have you expanded the use of your phone or tablet?)

- If you were designing a GED program, what role, if any, would smartphones play in your adult education plan?
- Is there any further information about MLEs that you would like to share during this interview?

Thank you for participating in these interviews. After I have completed transcribing your interview, I would like to have you look over the transcripts to check for accuracy. Would you be willing to read your transcripts and let me know if I need to make any changes to them? I will contact you by email when they are complete. Please do not hesitate to call or text me at 832-338-5078 or to email me at tia.wilkinson@waldenu.edu, if you have any questions or concerns.

Appendix D: TABE Results

Participant Code:

Date:

Site:

Description of document:

What were the learners' levels in math and reading?

How does the learner perceive his/her proficiency level?

How do the learner's test levels relate to their use of mobile learning technology?

Other information:

Appendix E: Observation Notes

Participant Code #:

Date:

Description of interview site (place, time, setting):

Participant description:

Description of any technology carried by student (smartphone, tablet, laptop):

Does the learner use a smartphone or tablet during the class period?

How does the learner use the MLE during the class period?

Does the learner use the phone to find answers to questions generated by the lesson content?

Does the learner use the educational apps provided?

Does the learner seem distracted by the MLE?

What comments, if any, does the learner make about the MLE or applications?

Appendix F: Alignment of Research Questions

Alignment of Research and Data Sources

Research Questions	Interview Guide Questions/Data Sources
Research Question 1: How do adult learners use MLEs in their program?	Interview Guide 1 Questions Please tell me how you currently use your smartphone or tablet? How do you use your smartphone or tablet to find information? (prompt: Do you look up facts or trends?) What are other ways you might use a smartphone or tablet to learn? Interview Guide 2 Questions Please describe how you have used your smartphone or tablet during this program. Please explain whether or not the smartphone or tablet has been beneficial to your learning experience?
Research Question 2: What are GED adult learners' perceptions of participating in an MLE?	Interview Guide 1 Questions First, please tell me a little about yourself. How do you feel about enrolling in this GED program? What areas of study are the most important to you? Can you give me specific areas where you might need help on the GED? How would you feel about participating in a mobile learning environment to study? Tell me how you envision a Mobile Learning Environment.

How do you feel that you might need assistance in working math problems?

How comfortable do you think you would be practicing math problems on your smartphone or tablet?

Interview Guide 2 Questions
Please tell me how your GED program is going so far.

How do you feel about the program?

What parts of the test seem the most difficult to you?

What types of assistance are you receiving to be successful on the test?

How comfortable are you with using your smartphone or tablet as a mobile learning environment?

How has using a smartphone or tablet influenced the way you study for the test?

Interview Guide 3 Questions
Now that your program is completed, how do you feel about using smartphones or tablets to study?

What role do you think that smartphones and tablets have in adult education?

How do you envision using MLE's in other areas of education? (prompt: Do you think smartphones should be used in school?)

Please tell me if your perceptions about how you use your smartphone or tablet has changed. (prompt: How have you expanded the use of your phone?)

	If you were designing a GED program, what role, if any, would smartphones or tablets play in your adult education plan? Is there any further information about MLEs that you would like to share during this interview?
Research Question 3: How do adult learners in a GED program at differing TABE score levels respond to the integration of the educational apps?	Interview Guide 1 Questions Khan Academy is a tutoring program that is available for free as an app on most smartphones. Please tell me about any experiences you have had with educational apps. If you have used Khan Academy or other educational apps, how would you describe your experience? Interview Guide 2 Questions Please tell me about any experiences you have had using learning applications on your smartphone. (prompt: Have you tried Khan Academy or any other mobile apps?) Interview Guide 3 Questions What types of information or learning apps helped you with your studies? Did you use the new educational apps provided by your GED program; and if so, how did you use the apps? Observation: Note how the learners respond to the apps. TABE results: Note whether or not the learners use educational MLEs that correspond to the subjects that they scored lowest on the TABE.

TABE results: Does the learner perceive that the MLEs are beneficial or not in the areas shown on the TABE to be deficient?

Appendix G: Permission to Conduct Research Study

Date
Mr. X
Head of School or Center
Address

RE: Permission to Conduct Research Study

Dear Mr. X:

I am writing to request permission to conduct a research study at your institution. I am currently in the Ph.D. program in Education at Walden University. I am in the process of writing my dissertation. The study is entitled An Exploration of the Use of Mobile Learning Environments in the education of Adult Learners Enrolled in General Educational Development Classes.

I hope that the school administration will allow me to recruit adult learners from the GED program to participate in pre, mid, and posts interviews and class observations. Interested participants will be given a consent form to complete, sign, and return to the researcher.

If approval is granted, the adult learners will be interviewed separately in a classroom or other quiet space during their class time. I would like permission to have a space and time to conduct the interviews. The interview and observation results will remain anonymous and confidential and will only be a part of this basic qualitative research study.

Your approval to conduct this study will be greatly appreciated. I will follow up with a telephone call, and I will be happy to answer any questions or concerns you may have at that time. You may contact me at tia.wilkinson@waldenu.edu.

If you agree, please sign below and return the signed form in the enclosed envelope. Alternately, kindly submit a signed letter of permission on your institution's letterhead acknowledging consent and permission for me to conduct this study at your institution.

Sincerely,

Tia Wilkinson MLD
Walden University

Appendix H: Recruitment Flyer

Participants Needed

for a study investigating how adults perceive and use Mobile Learning Environments

Are you a GED student? Are you interested in using mobile learning environments like smartphones and tablets to learn? How do you use smartphones and tablets? Your thoughts and ideas about learning are important. If you are interested in sharing what you think about mobile learning and being a part of a new research study, please contact Tia Wilkinson at: 832-338-5078 or tia.wilkinson@waldenu.edu

Interviews will be no more than one hour long and scheduled from 9:00 am to 5:00 pm in a private setting. All information will be kept confidential.

Appendix I: Coding Table

Level			
1	**2**	**3**	**Theme**
1.00			**Feelings About the GED Certificate**
	1.05		Enrolling
		1.055	Goals
		1.060	Needs
	1.10		Progress
	1.15		Other Feelings
2.00			**Areas of Study**
	2.05		Reading
		2.055	Vocabulary (Word Meanings)
	2.10		Language Arts
		2.015	Essay
	2.15		Mathematics
		2.155	Algebra
	2.20		Science
	2.25		Social Studies
3.00			**Learner Beliefs**
4.00			**Mobile Learning Environments**
	4.05		Smartphones
		4.055	Learning on Smartphones
		4.060	Availability
		4.065	Built-in Apps
	4.10		Tablets
		4.155	Learning on Tablets
		4.160	Availability
	4.15		Envisioning Mobile Learning
		4.155	Personally
		4.160	Educational Settings
5.00			**Applications**
	5.05		Literacy Apps
		5.055	Learning Upgrade Reading
		5.060	Cell-ed
		5.065	Fort Bend GED
		5.070	Google/Dictionary
		5.075	YouTube
	5.10		Math Apps
		5.105	Learning Upgrade Math
		5.110	Google
		5.115	Khan Academy

		5.120	Math is Fun
		5.125	Calculator
		5.130	Fort Bend GED Math videos
	5.15		Social Studies
		5.155	Wikipedia
	5.20		Science
		5.205	Quizlet
	5.25		Classroom apps
		5.255	Google Classroom
		5.260	IXL
		5.265	Kahoots!
		5.270	Other Apps
6.00			**Adult Learner Needs**
	6.05		Finding Information
	6.10		Easing Frustrations
	6.15		Including Technology Instruction
	6.20		Sharing Learning Apps
7.00			**Changing Perceptions**
	7.05		Expanding Learner Exposure
	7.10		Challenging Old Ways
	7.15		Perceiving Apps as Tutors/Teachers

Appendix J: Data Table

Part Code	Theme Code	Interview Question/ Participant Response	Interview Number
	1.00	**How do you feel about enrolling in this GED program?**	1
P1	1.05	Feel good. I mean I feel good. I'm learning things I didn't know and things that I forgot.	1
P2	1.05	Fine. I enjoy it.	1
P3	1.05	I feel good about being enrolled in the GED program, because it's something that I feel like I've long-time needed. I had complications along the way, and now I have the opportunity that has presented itself again.	1
P4	1.05	I feel good, because I used to do drugs. I came to a place to get, an opportunity, to get the things I need. GED costs; I didn't have the money, but they offered it to me for free. So, I'm taking advantage of it.	1
P5	1.05 1.15	Happy about it. Cos, I was already about to get my high school diploma in twelfth grade. I went all the way through, but I had to drop out, because we was about to be convicted...from our house. I had to get a job to help my mom, and I tried going to get my GED already in Baytown, but we didn't have transportation. So, I couldn't go anymore. I missed the days, and the kicked me out already. And I came here, and they have a GED program. I was happy about that cos I will be able to get my actual GED now.	1
P6	1.05 1.10	How do I'm feeling? I'm feeling that I'm learning new things. I'm feeling more open new decisions on your problems, so that they provide. I'm feeling that I'm learning every day. I'm learning something different.	1
P7	1.05	Oh, I love this! I love school! I didn't know that I loved it so much, until I thought it. That's what I was talking about. I love school. I love getting ready for it...doing the exam...all the parts about it, but...	1
P8	1.05 1.10	I think it's pretty good, you know. I think it's going to help me. It will help me for the long terms. I think that's how you say it. I believe.	1

P8	1.05 1.10	I think it's pretty good, you know. I think it's going to help me. It will help me for the long term. I think that's how you say it. I believe.	1
P9	1.05 1.060	I was excited about it. I stopped going to school in the eighth grade, and ever since then it's been like, you know, my sister, she's older. She's got her high school and all that, and she's always telling me to go back and get my GED, because I've got to the point where I can't go to college, you know. So she's like, "You need to do something." And my life consists of the streets, before, and she's like, "You need to do something different. Get you a job." And, being that I never had the skills—I'm not going to say the skills—the chance to learn what a normal kid would be able to learn in school due to family problems. I was excited about it, because I was like I am able to get my GED, now. I'm actually clear-minded, and I'm on the right path. I'm walking with the Lord, and he's blessing me to have the privilege to do this. I was excited; I'm ready.	1
P10	1.05 1.15	I feel good. I was in and out, in and out, but this time I'm going to stay due to my son. You know with all the stuff he's going through, so hopefully I can stay focused.	1
P11	1.05 1.10	I've been in University, um I guess...I want to say...three years now. And before coming here, I had a very...um learning disability. But since I been here, you know. University has really helped me...a lot. And even summer breaks and all that I always...I don't never take off...I always just go straight. The only time I don't be here is the whole school be shut down.	1
P1	1.060	So, I need it now to go get a good job	1
P2	1.055 1.10	So, I told Mama that I wanted to go and try and get my GED. So, I can have the cap and gown, and she can see me in my cap and gown.	1
P3	1.055	I probably started with my forklift, and I tried to get my GED, and then I'll be wanting to go to truck driving and heavy equipment.	
P5	1.055	I like messing with cars and trucks, and I plan to be a mechanic when I grow up...get older. I plan to go to	1

		juvenile for kids to teach them that the way for the Lord and stuff like that. And that's pretty much it.	
P6	1.055 1.15	After that...find a good job. And have time for my son, especially on the weekends, I want to do...I still want to work during the week, so I can spend time on the weekend with my son. Oh, probably on the post office	1
P8	1.055 1.060	My goals are to get my GED and get my life back. You know what I'm saying. And when I'm done with ODM, and I get my GED, I'm trying to go up to the army. That's one of my...that's my goal.	1
		Please tell me how your GED program is going so far.	2
P1	1.10 4.05	It's going pretty good. I mean it's a little bit harder to...cos I don't use my phone as much for stuff like that, so like earlier he asked me. It takes me a while to get to it. But it's good. It's me a little bit longer to get into it.	2
P2	1.10	So, I think my grade now is good, but I'm not for sure. I'll have to find out from here.	2
P3	1.10 3.00	Well, it seems to be working pretty well for me. I'm learning some things. I'm kind of slow, but I'm learning some things by having access.	2
	2.00	**What areas of study are the most important to you?**	1
P1	2.05 2.10 2.15	Reading and language and math.	1
P1	2.055 2.10	Language which the understanding some of the words I don't understand. Like some words that we have here, I've never heard them before.	1
P2	2.055	Well...not yet...I haven't got into GED, yet. But I'm hoping to get in there, and if I have problems then I can call you and ask you some questions	1
P3	2.05 2.10 2.015 2.15 2.155	Basically, all of them now, because I don't have a GED. So, do you mean the areas that I may need some help in? I think the main thing would be the essay, and then probably a little bit of math. I need assistance with the new type of math problems that I don't quite understand yet, and I didn't have when I was going to school. They didn't have them when I was going to school.	1

P4	2.05 2.055 2.15 2.20 2.25	I need help on my reading. Number 1! My English, my science, my social studies. Right now, I'm working hard on mathematics, right now. So, that's what I really need help on—my reading and my spelling.	1
P5	2.05 2.10	Reading. I'm not dyslexic, but you can count me as dyslexic, cos I can read. I can read big words, but I can read it all perfectly, but I also read really fast, so my brain can't process the words quickly enough. It didn't affect me much, cos I mean I don't know how to write paragraphs. I can write; I have a creative imagination. I can write almost anything. I can write a story or whatever, but I can't write it properly.	1
P6	2.10 2.15 2.20	All the areas are important. But if you ask me which one is the hard part, it's math and language. Reading—all those. Science, I know what to do, so it's easy. It's not really hard. It's like it's hard to understand in the beginning, but so I know it, and it's easy to get it.	1
P7	2.05 2.055	Well, reading. Reading is good. I can read it, but I feel like when I read, I'm not getting enough within myself to do it now.	1
KI018	2.05	I really didn't say that I actually needed help on it. It's just the reading passages. I hate reading long passages. I tend to get distracted real fast.	1
P8	2.05 2.10 2.15 2.20 2.25	Everything, because I spent five years smoking meth, and that...my brain is not the same as it used to be. You know what I'm saying? So, I think it's going to take me awhile to get a lot of things...	1
P9	2.05 2.10 2.15 2.155 2.20 2.25	They are all important. Because its stuff I never knew how to do. I'm learning it now. I mean I haven't got very far into it, but since I've been in it, uh my tutor he says I learn fast. Yeah. The math. Do you know that *x* and that *y* stuff? I'm learning it, and I know some of it now, but it's kind of confusing me to sometimes.	1
P10	2.015 2.15	Math and the essay.	1
P11	2.10	Language.	1
		Learner Beliefs	
P1	3.00	When I start reading a lot, my head just starts just going everywhere. Trying to figure out and then going to the next story. It kind of messes me up a little bit.	2

P2	3.00	I don't know...too much is too hard for me.	2
P3	3.00 6.15	I'm learning some things. I'm kind of slow, but I'm learning some things by having access.	2
P4	3.00	It's refreshing. It's coming back to me how it was in my younger days.	2
P6	2.00 3.00 6.15	I keep learning new things. It was hard in the beginning, but nothing hard if we have the equipment for learning.	2
P7	3.00	Understanding enough of the situation...understanding what I mean like if I get presented with my test papers, and I don't enough about what's on my test papers, that going to bring me to a halt. What I mean that will stop me, because I don't have enough in me to just look at it and know exactly what the formality of the going by to get to that point.	2
P9	3.00	I didn't have nowhere to live. I was trying to survive the best way that I could, so I started selling drugs. And, the next thing you know, I'm using drugs and selling drugs, and I did that forever. I ain't ever worked a job. I did little odd jobs, but there wasn't no 9 to 5, like you know.	
3.00		**Please tell me about yourself.**	1
P1	3.00	I'm a quick learner. If you teach me one or two types, I'll learn it.	1
P2	3.00	I need to get there, and I want to be happy when I finish the course. I would just like to be happy cos my sisters and them told me that, "you ain't going to do...you ain't going to make it like that."	1
P3	1.060 1.15 2.155 3.00	(Talking about Algebra). Right, it's just like a stumbling block when you're trying to get your GED	1
P4	2.05 3.00	My mother put me in a special class when I was younger, so they skipped me in each grade. So, I used to be ashamed about me reading; but over the years I learned how to read better, but I came here. I had a lot of work to do. I thought I couldn't do it, so my peers and counselor told me to take my time, and they helped me out. Give myself a chance, and that's what I did, so I'm better than I was six weeks ago.	1
P5	3.00	Since I also have anxiety, I get very anxious when I'm running out of time.	1

P6	3.00	Those make me nervous, and I also if they do that, I know that's the rule, so I need to get concentrated like I need to be silent or concentrate on the place where I want to be.	1
P7	3.00	So, I feel that I can move *on...regardless.* And it don't make no difference about the age...Like I tell them, "I account for myself.	1
P8	3.00	I spent five years smoking meth, and that...my brain is not the same as it used to be.	1
P9	3.00	I loved going to school when I was younger. And, like I said due to lifestyle and my family in the past, I didn't get to finish. I had to turn to the streets.	1
P10	3.00	I'm 44 years old. I have a 22-year-old with the mind of a 7-year-old who is incarcerated. My interests and hobbies are helping the elderly and disabled.	1
P11	1.00 1.060 2.15 3.00	I used to love math, when I was incarcerated. I was incarcerated for forty years, and I went to school there...in prison. I got over 5,000 hours in school, so I still don't have a GED. I used to go to school back then.	1
	4.00 5.00	**Please tell me how you currently use your smartphone?**	1
P1	4.05 4.155 5.110 5.270 6.05	I mean I use it to play games, or if I don't know something, I ask Siri or Goggle, and they'll give you most of the information that you're looking for. That's about it.	1
P1	4.05 5.075 5.155 6.05	If I'm looking for certain specific things, I ask for it. I ask for images, videos, and the little Wikipedia	1
P2	4.05 5.070 6.05	Well, like if I want to look for something in the dictionary, I go to Google and find whatever information I want, and then I'm through.	1
P3	4.05 5.110	Well, the way I currently use it is like a phone—a normal phone that I know of. I just use Google like I do on the Internet.	1
P4	4.00 4.05	I never used a smartphone; I never used a tablet. I just learned how to work a computer a little bit—about three and a half four weeks ago.	1
P5	4.05 4.10 4.155	Khan Academy, the GED learning classes, and since I already had anxiety back with it, I had to have something else in the background for me to be able to	1

	5.115 5.075 5.065	pay attention, so I multi-windowed with it. And then I would put this genre called "dubstep." With spread X, it's like electronic music, and that's my study music. I put that in the background while I'm doing Khan Academy.	
P6	4.055 5.070 5.060 5.110 4.065 5.125 5.075	Cell-Ed. And also, we use Google, too, to check the definitions or meanings of the new words that we're learning. And I also use that calculator, yeah. So, and then I use them to view some videos on math on YouTube. Yeah.	1
P7	4.05 5.125 5.10 5.120 5.105	Okay, I do. The onliest thing I really do on it is my math. Math. I don't do it often, but then by me doing it sure, that's doing me good. I can hit the subtraction and the fractions and stuff like that.	1
P8	4.05 5.075 4.155 5.270	Just watch videos and go to Facebook, all that new stuff, new generation. You understand?	1
P9	4.10 2.155	I don't use the tablet. I used it one time, and I had to stop using it, cos I couldn't figure out how to get into it. It was the apps. I got into the GED—the algebra part of it, and when I got into it, it took me to something else. It was confusing, being that we got a lot going on here.	1
P9	4.05 5.070 6.05	(On the smartphone). I looked up a lot of stuff, because my mother she is good at that. She's always finding stuff, and a lot of times if I didn't know something, I could look it up. It could be about words or whatever. Somebody might say a word, and I hear it and wonder what it means, so I go look it up.	1
P10	4.05 4.065 4.160 5.270	Just talking and texting. And maybe the pictures.	1
P11	4.05	Well, you know getting a smartphone, is just nothing easy you know? Cos I know a lot of peoples that has smartphone, and they still don't get it yet. So, I cain't	1

		say about that, because I never had a smartphone, so I haven't been trained how to use a smartphone at all.	
	4.00	**How would you feel about participating in a mobile learning environment to study?**	1
P1	4.155 4.160	How? I mean I would feel good just spending some time in the program.	1
P2	4.155	Um...let's see. It might just be something like...whatever...You know? Whatever y'all give me I try to go.	1
P3	4.155	I feel like that would be interesting. That's interesting to me.	1
P4	3.00 4.055 4.155	I feel good! It's helping me. You know, it's helping me to do better and to be a better person in life. I asked too many people to do this and do that, and why not go and try and learn it and get better at it?	1
P5	3.00 4.155 4.160	It's pretty cool, and it keeps me...like if I'm not blocked out from everything, it keeps me to where there's still a little freedom here.	1
P6	3.00 4.055 4.155	I feel good. It's very important to know more things than I know...that I don't even know it was there, but it's new problems coming up. I mean I'm affected. And I like to learn the new stuff.	1
P7	3.00 4.155	Well, I would like it. I would like it. I don't see no reason why I wouldn't like with cos with the times and stuff like that because I have special things that going on in my life...and I got some at home and....you know, I don't find myself using it, if I feel like I don't want to use it, I don't put it on.	1
P8	3.00 4.155 4.160	I think it would be new things to me. You know what I'm saying? Because I never participated in anything. In school I was a little bit shy kind of person. So, I think it would be nice to meet new people and do new stuff.	1
P9	4.00 5.125	That would be like using a calculator. Wouldn't it?	1
P10	4.00 4.155	That's fine.	1
P11	4.00	Yeah. Okay.	1
	4.00	**Tell me how you envision a Mobile Learning Environment.**	1
P1	4.055 4.155 4.160	I mean it would be hard to explain because you learn from the phone, but I think you just learn more from an actual teacher because you can ask questions.	1

		Something you don't understand, you can't ask somebody that's teaching you or the phone's teaching you can't go back and ask it, "I didn't understand this." See what I'm saying?	
P2	4.055 4.155 4.060	Umm...I would probably...I would probably try to express myself, and be...I would try to be independent...and try to learn things, and if I don't understand I can come to peoples and ask them questions, and that I would try to get where I'm going. I need it.	1
P3	4.155 4.060	I think it could be possibly nice, because I mean it's kind of like…it can be brought where I'm at.	1
P4	4.155 4.060 6.10 6.15 7.05	Well, today, technology is taking over everything. Instead of staying back. Everything's going to be technology in the next 10 or 15 years.	1
P5	4.155 6.10 6.15	I mean it would be cool. Cos I'm a millennial, so I feel like technology is better than the old way, but I also wish that we could do it the older way.	1
P6	4.155 5.110 6.05	It's good help for everybody. And doesn't matter what the age, adult, teenager, little ones. And very good, it does a good job. Cos we have everything now, everything—any information, anything we're concerned about. Anything we can go ahead and google.	1
P6	4.05 4.060 4.155 6.15 7.05	Yes, it's very important. A phone, now, is like your second hand. Like you cannot go nowhere without your phone. Cos when you miss it or you left it at home, you feel dizzy something cos you use it for pf, for text, to check your email or for a lot of things. It's like part of your life, now.	1
P7	4.155 4.060 4.05	If I had to vision it, I would have a stream (screen) setting up, and I would know exactly what button I'm hitting with the writing on it to tell me what direction...cos you going to need direction, like...Really, now I don't have direction and stuff. I would have to push a button and try to find it, but I would like to have it setting up, so you know use that to look at what...push this button to get that...like that. You know?	1
P8	4.00	I don't know. It's hard. I can't think of a thing.	1

P9	4.155	As long as it is helping me to learn something that's going to be healthy for me as far as living a good life and be on the right path. Yea, that would be lovely; that would be exciting, and it would be much appreciated.	1
P10	4.05 4.155	I don't know. I'm not really into phones. The only time I really like them is when I'm taking pictures, so... I really can't answer that.	1
P11	4.155 4.060	Well, I guess I would have to do it. You know? If everybody got to do it, I guess I would have to do it.	1
	3.00 4.00	**How comfortable do you think you would be practicing math problems on your smartphone or tablet?**	1
P1	3.00	I really don't need help in math.	1
P2	3.00	Well, I might struggle a little bit, trying to get it, but I would, you know...if I had problems, I would just ask somebody	1
P3	3.00 4.155	I think I would be pretty good, if someone was there to instruct me.	1
P4	3.00	I feel good!	1
P5	3.00 4.155	Pretty easy. Cos I'm really good at doing multiplications. I'm really good at doing math. I am not a mathematician, but I'm really good at math. I can understand it, really easy.	1
P6	3.00 4.155	Good.	1
P7	4.05 4.155	I would be. You know, if I knew how to do it. I have app on my phone, but I don't to go to it.	1
P8	3.00	I think it would be all right.	1
P9	3.00	That would be nice. Of course, I would like to write it down, too. I don't know why, but I write down stuff. I'm more able to remember it.	1
P10	3.00	Not good.	1
P11	3.00	Well, I would have to...I would have to try it out.	1
		How comfortable are you with using a smartphone or tablet as a mobile learning environment?	2
P1	4.05	I don't use my phone as much for stuff like that, so like earlier he asked me. It takes me a while to get to it. But it's good. It's me a little bit longer to get into it.	2
P2	3.00 4.05	You know if I could get one and try to learn how to work it, I probably do good.	2

P3	2.15 4.10 4.060 4.155 5.065 6.15	When I was doing the math, the tablet was great for me. Because it showed you an illustration all...and the people would come on. Say for instance, like Fort Bend.	2
P4	4.10 4.155	I would be scared because I don't know nothing about it. I head it's called a tablet; it's a smart device to help me get smart, I be like staying a little confused at first. That first couple of times, I might try using it; I can get with the system and learn it. I want to learn how to use it.	2
P6	3.00 4.05 4.155	I feel comfortable, cos I know how that they're the things I need to know to get my GED. But I have to come here, to concentrate, to dedicate time to learning, because if I keep it at home and no one's there, but I not going to have that time for that. I'm happy.	2
P7	3.00 4.05 4.155	Very comfortable, because that's something of my own that I could pass and get no stress with it. That's something that I could do on my own.	2
P8	4.05 4.155	I think 100 %. I think it's just like a phone. Right? Then I think it would be 100%.	2
P10	4.05 4.155	It's just a distraction. Period. It's something that I don't want to get like glued to the phone, and you know forget about other stuff.	2
P11	4.155	Well, I can't say, until I do it. I hope it will be alright.	2
	4.05	**How has using a smartphone or tablet influenced the way you study for the test?**	2
P3	4.055 4.155	It influenced my study by being...well...with my headphones on, closes out the noise surrounding noise...okay?	2
P6	4.055 5.060 4.160	Yes. Yes, because I like to share that thing with somebody who's not available to come to learning and at the place. You know?	2
P7	2.055 4.05 4.065 4.155 6.15	Well, it's great. Because I found out that you can go on there...things that are setting up here for instance, like if I want to know something, there's some buttons I can hit, and it can do it. Pronounce it for you, pronounce it like I have bad speech, and my speaking it out don't come plain enough for me. So that means I can't do it, because I'm not saying it right. So, I can use the phone, and it will pronounce it.	2

P8		I work with the tutors and the papers that they bring. That's what I do.	2
P10		Me, I haven't used it.	2
	4.05 4.10	**Now that your program is completed, how do you feel about using smartphones or tablets to study?**	3
P2	3.00 4.155	It's not a problem. As long as I'm learning, I think it would be easy.	3
P3	4.05 4.10 4.155	That's a great idea to me. The tablet you can see a little bit better, but smartphone works. Either one of them is excellent.	3
P6		I'm feeling good. Powerful.	3
P7	4.055 4.060	I think it's something good. Eventually, you're going to need it anyway. I think it's good; it's opened up a lot of...well, it's opened up a lot of positions for me. Like, it's a face like for me. The decision...make a good decision that I would say sit down and wouldn't know how to do it. Then all I had to do is get that...get the computer.	3
P8	4.150	I'm comfortable with it. You know what I'm saying? I think I can do it.	3
P9	4.10 4.155 4.160	Well, I would use the tablet, if it would let me get through. But as far as my phone, I hardly ever use my phone. I've used it a couple of times to just look up things, like the Methodist Hospital.	3
P10		I'm a little confused here.	3
P11	4.05 4.055	Well, I this using it will help a lot. Cos, using smartphones...that's why they are called smartphones...If there's something we don't know, we can just go to the smartphone, and it helps us a lot.	3
		What role do you think that smartphones and tablets have in adult education?	3
P2	4.05 4.055	Learning. Learning how to just get to how you want to express yourself. You know how to get somebody...get learning so that you don't have to depend on people to help you with things. You need to do it yourself.	3
P3	4.05 4.10 4.055 4.060 6.15	I think they should have a pretty good important role. What role? I think it plays a substantial part...a main part in education. For me, it does. If there's something that you get hung up with, not knowing how to get access to correctly use it on computer. If you have someone to show you that, basically your learning is unlimited.	3

P4	4.05 4.10 4.055 6.15	I think they have a lot to do with it, because I'm just learning...I'm new in the technology industry, and y'all...they making technology where a person like me can learn, get familiar with it, and start using it cos one day we not be able to use pen and paper. Everything's going to be technology, so it's good to have that kind of machine out here for people who don't know how to use it. I can learn how to use it.	3
P6	4.05 4.055 4.155 4.160 5.110 5.270 7.00 7.15	Like your second teacher. (She laughs.) Yeah, cos even when you are in the class time, if you don't know what thing it is...what they talking about, you can search in the information on Google and information that we catch on the apps, either.	3
P7	1.060 2.055 4.05 4.055 5.05	Oh, I think it's got a lot to do with it. You know? And I think that's much help. It's a help, because it's really like nip...how do you say it? Nip it to the...It really is a good. I mean well, I can't find the words to say about it. But what I'm thinking, it's needed in the GED because that could be the beginning of a study to break down and to go through the words and know the meanings. It's really...it's awesome...it's good for it.	3
P8		I don't know. I don't know how to explain that question right there.	3
P8	4.10 4.155	Yes. A lot. It would be way easier. You know what I'm saying? Especially for somebody...do you know what I'm saying...that have sometimes difficulty with memory loss and stuff.	3
P9	4.10 4.155 4.160	It depends on the person. The person...because some people can learn off a tablet, and some people can't. Some people just cain't get it. You know. They need a person to show them. You know? But I know that a lot of people are computer smart. People that have the tablet or could maybe gain the talent or who are willing...yeah, it would play a good role of using them.	3
P10		I don't know.	3
P11	4.00 4.05 4.155 4.160	It should help us a lot. Because I think that if not for that...there a are a lot of us that we won't, you know, too much make it. That will help us move forward with those mobile programs like that.	3

		How do you envision using MLE's in other areas of education? Do you think smartphones should be used in schools?	3
P3	4.15 4.155	It should help us a lot. Because I think that if not for that...there are a lot of us that we won't, you know, too much make it. That will help us move forward with those mobile programs like that.	3
P4	4.15 4.155 6.15	Yes. Yes. No doubt. Because there's a technology world today now. When I was in school, we didn't have too many computers to get taught on; but now-a-days, it's good for society if we learn how to do it the right way.	3
P6	4.15 4.160	Yes, only for that...only for learning...yes, I think.	
P7	4.15 4.160 6.15	Yes. Well, I mean. Yeah, I think so. I don't know about nobody else. If it's just for education, yes. I don't think it's for everything else. If you using it just for education, it's swell. Nothing else. Cos you could use if for all kinds of stuff. Stuff that ain't no good.	3
P8	4.15 4.160 6.15 7.05	Yes. Yes. Well, when I was in high school and middle school...you know what I'm saying...we only had the old laptops, and they didn't have no new stuff. You know what I'm saying? So, I think it would be easier for the kids, and to do their homework and stuff like that. Do you know what I'm saying? I don't know.	3
P9	4.00 4.05 4.10 4.155 4.160 6.15	Yeah. Yeah, and at the same time we had a decision that was similar to this, and about how technology...and technology plays a major role...computers, smartphones, tablets, and all that. It's a big role in people's lives today, but it probably would be good for a high school, but I believe for elementary, for kids, and going through middle school, I think it would be better for a human to be there and show them and tell them. cos people get lost in other things, in computers and stuff. And they do, and they get caught up, you know. It is good for a person that's more mature. You know?	3
P10	4.00 5.110	Yes. Because if you want to go to something like Google, because Google can help you a lot.	3
P11		Yes.	3
		Have your perceptions about how you use your smartphone or tablet changed?	3

P2	4.155 4.160 7.00	Nice. It's changed. Well, I want to learn what all the lessons that they have showed you how to do a deal on there. When it comes time for taking the test, you would be ready for it...to try to pass it.	3
P3	4.155 4.160 6.15 7.05	To me, it's expanded. I think it expanded. Little kids, adults, everybody is using them...electronic devices. Everybody that has access.	3
P4	2.015 2.10 4.05 6.05 6.10 7.00	Well, how to use a smartphone...it changed my life a lot. It helped me to read better. It helped me to write my essays better. I don't have to worry about no pen or pencil or scratch or using other paper, and I can go to different buttons on a keyboard and spell a word...the computer or a smartphone will spell it for me correctly.	3
P6	4.05 3.00 4.055 4.065 6.15 7.05 7.10 7.15	Before when I don't coming to study, so I used my phone for other things that I don't get...I don't get...what I can say? I don't get any good...I don't use the phone for something important like a Facebook. I don't really care about any of that. I was using my phone for games or something else. Now, when I see my phone, and I open my phone I know I have to do some app there because I need to go over and over, because I want to learn more. So, my games app...I not using that anymore.	3
P7	3.00 4.055 4.155 6.15 7.05	Well, I know more about it. I have learned to do a little more. You know, with it...you know what I'm saying? That I didn't know before. I have come out of my little bit of what I was stuck in. I growed a little...you know, like I growed.	3
P8		Wow. Can I skip that question?	3
P9	4.05 4.055 6.05	I see myself using it when I need to. If I need information that I can't get through maybe a human or something. I'm not too fond of...they're good...the technology and the smartphone...it's good...it's a good tool, depending on how a person uses it. Like I said earlier. And I'm not too much with the social media and all that with smartphones and tablets, because a lot of that is on there, too.	3
P10	4.065	Um-um. I'm just pictures.	3
P11	4.05 6.05	Instead of me trying to dig my head in and figure it out, all I would have to do is go to my smartphone.	3

	6.10	The smartphone has all the information in it to help you.	
		What role, if any, would smartphones or tablets play in an adult education plan?	3
P2	4.155 4.160 6.05	Well, I want to learn what all the lessons that they have showed you how to do a deal on there. When it comes time for taking the test, you would be ready for it...to try to pass it.	3
P3	4.05 4.055 4.060 4.10 4.150 4.160 6.05 6.15 6.20	Well basically, I would make it available for people to use, and get them introductions and some skills to learn, and make sure that they are not computer illiterate. Then let them attempt it, familiarize themselves with learning the information from it.	3
P6	6.05	I think to get current information for political parties or whatever for get news or to investigate somebody like Martin Luther King or Benjamin Franklin or those ...historical people.	3
P8	4.060 4.160 6.15 6.20 7.05	Well, it would make it easier for guys. You know what I'm saying? It would make it easier. I don't know... I want to make it available for everybody all the time. For everybody	3
P9	1.060 4.10 4.150 4.160 5.065 5.130 6.15	I would probably have it where they could only get into GED and nothing else. It would be straight GED stuff. These tablets now...I mean it's got the GED on it, but you can onto other...and in a place like this, to keep people focused, you know. Just for GED. I would have it for GED only. Nothing else is on there. You cain't get on YouTube; you cain't do none of that. Cos people...like I say...them little ads pop up and then BAM! Their minds start wandering. And there goes the neighborhood. Right there.	3
P11	4.155	A lot. A hundred percent.	3
		What types of information or learning apps helped you with your studies?	3
P2	5.055	Learning Upgrade. It was just...you know...offered courses about...you know...about what grade you learn in...and how many years you were there....and I	3

		think...I've forgot all the others. There was a lot of work in there.	
P3	2.10 2.015 5.065 5.130	What type of information...information on GED has helped me with my studies. The last information that I was looking at was the one on the lady was teaching about the essay writing. The essay, the grammar, the ways to prepare your essay, such as the introduction, the three body paragraphs, and the conclusion. And it sets you up, and it basically tells you how to pull your information out of the story and make a decision on which side you agree with. It's best to go with the more strong evidence, and so far that's what I'm learning. That's it.	3
P3	5.115	Yes, I used Khan Academy some.	3
P3	5.055 5.105	(Learning Upgrade): I think that gives you greater opportunity because it gives you a challenge. And challenging...it's more interesting to have an app challenge you to answer the questions, and it seems like a faster learning process to me. Cos once you're challenged with it and you're answering the questions, that's quite beneficial to...stimulating your knowledge... your brain production.	3
P4	2.05 2.10 2.15 5.055	Well, mathematics, language, reading, and spelling would help me a lot.	3
P6	5.055 5.105	To the pronunciation, the spelling, and math is good because it is coming from the first level to the fifth grade? Yeah, it is so helpful. I still working on it. I not complete and all, yet.	
P6	5.115 6.05	Khan Academy? I checking what I have, but I go back with Learning Upgrade and Cell-ed because that is more...how I can say? More? Easy for me to use it for now. Because Khan Academy I think it is complete, all the stuff you need is there, but I just want to go step-by-step without jumping to the more...More? what do I say...More full of information or teaching? But I want to go at a time when I can do the first ones.	3
P7	5.055 5.105 6.15	Well, it opened up my sense of thinking. And it opened up like it seemed like it's so hard... what it do, it make it more easy for me to get to it. I didn't have that understanding.	3

P8	5.055 5.075	Well, Learning Upgrade. See what I'm saying? That would be one...YouTube...I don't know what else I can use.	3
P9	2.155 4.155 5.115	You know before it did let me go through that. Before when I first came about 5 months ago, I did use it. That's the first thing I did go on. I got a tablet. I didn't go on a computer. I got a tablet that would pull up the Algebra and all that.	3
P10	5.055 5.105	We uh...Learning Upgrade.	3
P11	5.055 5.105 5.120 5.265	Whatever we are learning in here.	3
		Did you use the new educational apps provided by your GED program? How did you use the apps?	3
P2	5.055	(Learning Upgrade): It was just...you know...offered courses about...you know...about what grade you learn in...and how many years you were there....and I think...I've forgot all the others. There was a lot of work in there.	3
P2	5.060	(Cell-ed): I don't think so. I don't think that I did that.	3
P3	4.155 5.055 6.15 7.10	Yes, you have to concentrate. You have to use your brain. In other words, you really have to use your brain, and it's a rewarding feeling, especially when you get some correct answers.	3
P3	4.155 5.055 6.15	Because otherwise, your attention can be diverted, and you think that you are learning something, but you are not really learning something, and it's boring. But that was uplifting.	3
P4	2.15 2.155 5.105	The mathematics. Algebra.	3
P6	2.055 2.15 5.055 5.155	To the pronunciation, the spelling, and math is good because it is coming from the first level to the fifth grade? Yeah, it is so helpful. I still working on it. I not complete and all, yet.	3
P6	2.05 2.15 4.155 5.055 5.105	I like to use it when I have time by myself, and I can pick any math or reading, but I like the most I like it when they qualify that what you doing is great. Yeah.	3
P6	2.155	I try to use the negative numbers in the Pre-Algebra.	3

	5.105 5.115		
P6	5.060	(Cell-ed): I don't be using this semester. (Last semester): Yes. It was so helpful. A lot.	3
P7	5.055 5.105 5.120 6.15	The app. The one on the computer. I thought it was fun to do this and to see it. Once, you make an error...to make sure you don't make an error. Don't mess up, or you're going to have to double and go all the way back. Come all the way. So, it's best to know what to study...to pay attention. So, they was great. I liked that.	3
P7	5.055 6.15	(Learning Upgrade): It was good. I liked that. Only thing, I just couldn't get enough of it in one. You know how you get stuck with it, and it be so familiar and good for you, you just don't want to mess it up. You want to keep on doing it. But you have to take your mind and put in this to keep them right answers, cos otherwise you gone be there on that all day.	3
P9	2.155 5.115	(Khan Academy): I tried. It wouldn't let me get into Algebra, though. No. It came up, and it said...it came up and it had four different...it had sections with different equations and equations like what I had told you. But when I hit the equations, it wouldn't let me get in it. It wouldn't let me go on nothing.	3
P10	2.15 5.105	We uh...Learning Upgrade. Oh, it helped me a lot. Especially with the math. I'm supposed to be in this class, but I'm not ready. So, it helped me with my percents, my negatives and positives, and like that.	3
P11	5.055 5.105	Yes, the Learning Upgrade. We had to type in Learning Upgrade on the computer. And it had a lot of information in there. We just typed in Learning Upgrade, and we put our headphones on. With the headphones, it tells us either whatever we learn...math, reading, whatever, and you just push the correct answer whatever it is.	3
	5.00	**Did the educational apps correspond to the subjects TABE scores?**	
P1	5.055 5.060 5.105 5.110 5.115 5.125	Reading: 7^{th}, Math: 9^{th}, LA: 5^{th}. Grade levels increased for reading and math.	

	5.120 5.25 5.255 5.260		
P2	5.055 5.110 5.120 5.265	Reading: 3rd, Math 3rd, LA: 1st. Reading and math levels increased, while LA scores slightly decreased.	
P3	5.055 5.065 5.075 5.110 5.130 5.270	Reading: 5th, Math: 4th, LA 5th. Reading and math were not retested using the TABE instrument. LA scores improved.	
P4	5.055 4.065 5.110 5.125	Reading: 2nd, Math 2nd, LA: 2nd Subject areas were not retested; however, ER reported doing much better on math.	
P5	5.075 5.25 5.270	Reading: 6th, Math: 8th, LA: 7th. Subject areas were not retested, and participant was expelled from the program. EZ has a reading disability.	
P6	5.05 5.055 5.060 5.075 5.105 5.110 5.115 5.125 5.155 5.260 5.270	Reading: 5th, Math: 9th, LA: 9th. Second TABE testing showed multiple grade level increase in all subjects. ID is also in an ESL class at the University.	
P7	5.055 5.070 5.110 5.120 5.125 5.265	Reading: 4th, Math: 3rd, LA 3rd Second TABE testing showed reading levels slightly decreased; math and LA grade levels increased by 1 grade.	
P8	5.055 5.065 5.075 5.10	Reading: 3rd, Math: 4th, LA: 3rd. Second TABE tests were not available. PL passed the GED math test. PL works with 3 tutors several times a week.	

P9	5.075 5.10 5.115	Reading: 6th, Math: 4th, LA: 9th. Participant has not been retested with the TABE tool, He has almost passed the GED math test twice; he missed by 3 points.	
P10	4.065 5.055 5.105 5.110 5.120 5.265	Reading: 7th, Math: 6th, LA: 7th. Second testing showed that TR has not advanced but slightly decreased in her grade levels. She reports little use of her smartphone as an MLE, yet she uses her smartphone and computer during class and for information.	
P11	5.055 5.105 5.120 5.25 5.265	Reading: 5th, Math, 5th, LA: 4th. The second round of TABE testing showed that all content areas increased by at least one grade, with LA increasing by 2.	
		Learner perceptions about benefits of MLEs for deficit areas on the TABE	
P1	5.05 5.060 6.10	Observation Notes: P1 scored lowest on the ELA test. He said that the Cell-ed app was "not for him because the voice is too slow." He said, "The entire pace is too easy." He stops listening if he thinks an app is "boring – frustrating." He said, "It wants you to read something that you can already do." P1 also said, "The app needs an accelerated version." The app, at the present speed, is not helpful.	
P1	2.20 4.05 4.055 4.065 5.125 5.220 5.255 5.260	Observation Notes 2: P1 was not given a science test, but his math scores were at the 9th grade level. He used his smartphone to study science words using Quizlet and Quizlet flashcard app During class he used the calculator, IXL, Google classroom, and Quizlet's scorecard to find work he needed for practice.	
P2	2.05	Observation Notes 1: P2's TABE results were in the early elementary school range. She did not use the MLEs during class.	
P2	2.05 5.055	Observation Notes 2: The participant used Learning Upgrade English. She found it useful to study along with her notebook work.	
P3	2.10 2.015	Observation Notes 1: P3 scored the lowest on ELA. He did not use the MLE during the class. He	2

	4.155 5.065 5.075 6.05	mentioned needing more assistance with writing essays. The last information that I was looking at was the one on the lady was teaching about the essay writing. The essay, the grammar, the ways to prepare your essay, such as the introduction, the three body paragraphs, and the conclusion	
P3	2.10 5.055 7.10	Observation Notes 2: The participant was using Learning Upgrade English. He enjoyed the challenge of the game and mentioned it several times.	
P4	2.05 2.15 3.00	TABE Results: The participant's scores are at the 2nd grade level. Observation Notes 1: The participant was not able to use the MLEs because of lack of Internet access. ER is aware that his reading and math levels are low. He says that he needs help in reading and spelling, and he understands that learning to read is a priority for him right now. He mentioned that he was in a "special class" in school. He did not pass grades; he was moved/placed from grade to grade. ER is aware that he needs help in every content level.	
P4	2.15 2.155 4.155 4.160 5.105	Observation Notes 2: The participant used the Learning Upgrade Math course on a tablet. he was very absorbed in the lessons. At first, he seemed nervous, but he was soon comfortable with the concepts. He scored 50% on the lesson, which meant he would have to retake it. He was excited about the app and wanted to try the lesson again.	
P5	2.05 2.055 2.10 5.075	Observation 1: The learner was using a computer. He was supposed to working on a lesson, but he was listening to YouTube videos in the background. TABE results: The participant's TABE scores were in the middle school range. The learner describes his reading ability as low on vocabulary skills. He believes that he has a reading disability because he reads fast but does not retain what he reads. He also struggles in writing.	
P5		Observation 2: The learner had access to a tablet and computer but did not use either one during the class.	

P6	2.055 2.10 4.05 4.055 4.160 5.070 5.260 5.270 6.05	Observation 1: P6 used her smartphone and a laptop during her class to look up words that she did not know. She used Google to find information about the subject. She also used the myGED and IXL apps during class. TABE results: ID understands that she is not proficient in English. Spanish is her first language. Reading is not easy for her; her scores indicate that she is reading at mid-fourth-grade level. She is very interested in math, and her scores greatly improved between testing dates. She moved from a fifth-grade level to a ninth-grade one. Language Arts is difficult for ID, but her scores greatly improved between January and April.	
P6	2.05 4.05 4.055 4.160 5.060 5.260 6.05 6.20	Observation 2: P6 used Cell-ed and IXL during reading class. She used her smartphone and a class-provided laptop. ID mentioned that she is learning English, and the pace of the Cell-ed app, though somewhat slow, was perfect for her understanding. She said that she really loved using the app and was sharing it with her friends that were also learning English.	
P7	2.05 2.055 2.15 4.05 4.055 4.160 5.070 6.00 6.05	TABE results: The participant's reading, math, and LA scores are in the 3rd to 4th grade levels. The learner is aware that she struggles in reading and math. She reads her Bible and reads her homework for class. The learner used Google and Webster's dictionary app to look up words that she does not know during class. She answered a phone call during class, which was distracting to her and other learners. She mentioned that she had used her smartphone to learn new words and their meanings, and that she had used those words in her presentation to the class.	
P7	5.070	Observation 2: The learner did not use the educational application provided by the school, during the lesson. Instead, she used Google. She was also cautioned by her instructor and the school secretary for talking on her smartphone during class.	

P8	2.10	TABE results: PL's grade levels match those of an elementary school student. PL is aware that he has difficulty retaining information. He was on meth for about 5 years, so he knows he has to learn a great deal. He is also an immigrant from Mexico, and so he was not in English programs, until he was 11 or 12. PL was also in classes for children with learning difficulties, but he does not recall what they were. Observation Notes 1: The learner did not use technology; he was working one-on-one with a tutor.	
P8	2.05 4.10 4.155 4.160 5.055 6.15	Observation Notes 2: The learner was working with a tablet on a reading lesson in the Learning Upgrade application. He seemed very confident using the MLE. He completed a Supporting Details lesson and referred to the reading passage frequently to complete his assignment. Even though he read slowly, he made 100% on the lesson. He smiled frequently throughout the lesson.	
P9	2.055 2.15 2.155 4.155 4.160 5.115 5.270 6.15	TABE results: The participant's math level is the lowest of his grade-level results. P9 says that he understands basic math functions, but he does not understand Algebra. He struggles with vocabulary. He uses Khan Academy and an app by St. Paul University Observation Notes: The student did not use the tablets offered by the school; the integrity of the tablets had been breached, so a firewall inside the tablets kept students from being on the Internet. The student used paper copies of Algebra problems.	
P10	2.05 2.10 2.15 4.05 4.065	TABE results: The participant's scores indicated that she has achieved proficiency at the 6th and 7th grade levels in math, reading, and ELA. Observations Notes 1: P10 mentioned using her phone to take pictures and talk. She was not very interested in using her phone to learn more about the subjects she needs to pass the GED.	
P11	2.15 4.160 5.10	TABE results: The participants scores were consistent with those of an intermediate elementary school student. P11 is aware that he struggles in all subjects.	

	5.105 6.15	He used the apps provided by the school on the school computers but not on his phone. Observation Notes: P11 used the Learning Upgrade application for math lessons that connected to his classroom notebook lessons. He used his phone to make calls during the class, disrupting the class.	

Appendix K: Adult Learners' Use of MLEs

Research Question and Observation	Interview Guide Questions/Data Sources
Research Question 1: How do adult learners use MLEs in their program?	Interview Guide 1 Questions **Please tell me how you currently use your smartphone or tablet?** P3: Well, the way I currently use it is like a phone—a normal phone that I know of. I just use Google like I do on the Internet. P10: Just talking and texting. And maybe the pictures. P1: I mean I use it to play games, or if I don't know something, I ask Siri or Goggle, and they'll give you most of the information that you're looking for. That's about it. **How do you use your smartphone or tablet to find information? (prompt: Do you look up facts or trends?)** P2: Well, like if I want to look for something in the dictionary, I go to

Google and find whatever information I want, and then I'm through.

P7: The onliest thing I really do on it is my math. Math.

P6: Oh for, recipes, tips for how to do the hairstyle for other lifestyle. Everything is there. Okay. I check everything I want to know. New videos on music. See what new colors or what to style your hair. Things like that. Like recipes for teas stuff natural. I love to check that, too.

What are other ways you might use a smartphone or tablet to learn?

P4: I know how to use a calculator; I know how to get to the date. I know how to get to YouTube.

P10: Google.

Students in XXX University used Google frequently during to look up words that they did not know. They also used the

First Observations:

phones' built-in calculator application during class.

Several students talked on their phone during class, which distracted the entire class.

Students at the mission school worked with tutors, worked alone on computers, or used tablets to study. None of the students or tutors used a phone during class.

Interview Guide 2 Questions

Please describe how you have used your smartphone or tablet during this program.

P3: **W**hen I was doing the math, the tablet was great for me. Because it showed you an illustration all...and the people would come on. Say for instance, like Fort Bend.

P6: I use it to learn more reading, math, and social studies, all the programs that

app have it. I want to take advantage, but it's a lot to learn. It's very interesting.

Please explain whether or not the smartphone or tablet has been beneficial to your learning experience?

P7: I think it's swell. Anything like computer on the cell phone. It's just like computer; I think it's swell. It's bringing...you know? Cos this is something that I didn't know that I could do.

P9 I used it to pull up my stuff on there, but other stuff popped up...I mean... I tried to pull up some math stuff, and stuff popped up on there, but it wasn't what I was trying to get to.

Appendix L: Perceptions About MLE Participation

Research Question and Observation	Interview Guide Questions/Data Sources
Research Question 2: What are GED adult learner perceptions of participating in an MLE?	Interview Guide **How would you feel about participating in a mobile learning environment to study?** P1: How? I mean I would feel good just spending some time in the program. P2: Whatever y'all give me I try to go. **Tell me how you envision a Mobile Learning Environment.** P4: Well, today, technology is taking over everything. P5: I mean it would be cool. Cos I'm a millennial, so I feel like technology is better than the old way, but I also wish that we could do it the older way. The new way makes us lazier. It actually does that.

How comfortable do you think you would be practicing math problems on your smartphone or tablet?

P6: I feel good. It's very important to know more things than I know...that I don't even know it was there, but it's new problems coming up. I mean I'm affected.

P8: I think it would be all right.

Interview Guide 2 Questions

How comfortable are you with using your smartphone or tablet as a mobile learning environment?

P10: Um-um. It's just a distraction. Period. It's something that I don't want to get like glued to the phone, and you know forget about other stuff.

P1: I think it would be that new one that Level Up or Learning Upgrade.

How has using a smartphone or tablet influenced the way you study for the test?

	P6: Yes. Yes, because I like to share that thing with somebody who's not available to come to learning and at the place. You know?
	P7: Well, it's great. Because I found out that you can go on there...things that are setting up here for instance, like if I want to know something, there's some buttons I can hit, and it can do it.
Second Observation	Prior to the second observations, teachers had integrated several mobile applications into their teaching practices. One teacher used Kahoots! to engage her students, while two others relied on IXL as a homework app. All of the teachers had introduced reading and math apps, and the students were using them at home and in the classroom
	Interview Guide 3 Questions

Now that your program is completed, how do you feel about using smartphones or tablets to study?

P11: Well, I think using it will help a lot. Cos, using smartphones...that's why they are called smartphones...If there's something we don't know, we can just go to the smartphone, and it helps us a lot.

What role do you think that smartphones and tablets have in adult education?

P4: I think they have a lot to do with it, because I'm just learning...I'm new in the technology industry, and y'all...they making technology where a person like me can learn, get familiar with it, and start using it cos one day we not be able to use pen and paper. Everything's going to be technology, so it's good to have that kind of machine out here for people who don't

know how to use it. I can learn how to use it.

How do you envision using MLE's in other areas of education? (prompt: Do you think smartphones should be used in school?)

P10: Yes, if you want to go to something like Google, because Google can help you a lot.

P11: UV: It should help us a lot. Because I think that if not for that...there a are a lot of us that we won't, you know, too much make it. That will help us move forward with those mobile programs like that.

Please tell me if your perceptions about how you use your smartphone or tablet has changed?

P2: Nice. It's changed.

P3: To me, it's expanded. I think it expanded.

If you were designing a GED program, what role, if any, would smartphones or tablets play in your adult education plan?

P6: Like your second teacher. (She laughs.)

P9: Some people can learn off a tablet, and some people just can't get it. People who have talent with technology or computers, it would play a good role.

Appendix M: Learner Responses at Different TABE Levels

Research Question and Observation	Interview Guide Questions/Data Sources
Research Question 3: How do adult learners in a GED program at differing TABE score levels respond to the integration of the educational apps?	Interview Guide 3 Questions **What types of information or learning apps helped you with your studies?** P6: I go back with Learning Upgrade and Cell-ed because that is more...how I can say? More? Easy for me to use it for now. Because Khan Academy I think it is complete, all the stuff you need is there, but I just want to go step-by-step without jumping to the more...More? what do I say...More full of information or teaching? But I want to go at a time when I can do the first ones. P8: Well, Learning Upgrade. See what I'm saying? That would be one...YouTube...I don't know what else I can use.

Did you use the new educational apps provided by your GED program; and if so, how did you use the apps?

P10: Learning Upgrade. Oh, it helped me a lot. Especially with the math.

P3: (The Fort Bend GED app). The last information that I was looking at was the one on the lady was teaching about the essay writing. The essay, the grammar, the ways to prepare your essay, such as the introduction, the three body paragraphs, and the conclusion. And it sets you up, and it basically tells you how to pull your information out of the story and make a decision on which side you agree with.

TABE results: Note if the learners use educational MLEs that correspond to the subjects that they scored lowest on the TABE.

Students at XXX University who scored low on the TABE test in reading, language

arts, and math used the Learning Upgrade math and reading courses in class. They also used the Math is Fun app and the Kahoots app. Almost all of these students used Google to look for vocabulary words that they did not know.

Students at the mission school who scored lowest on the TABE were given individual tutors, and they rarely used the tablets other than for practice problems.

Students in the intermediate and higher levels of TABE levels at the university also used Learning Upgrade math and language arts, but they also used Quizlet, IXL, Khan Academy, and Cell-ed. They, too, used Google, but they also used other apps like Wikipedia.

Adult learners practicing for math at the mission used Khan Academy, Fort Bend, myGED, and YouTube when the Internet was accessible.

TABE results: Does the learner perceive that the MLEs are beneficial or not in the areas shown on the TABE to be deficient?

The learners at the university enjoyed using Learning Upgrade to help with their notebook work. Learners observed in the science class used the Quizlet app to study for science vocabulary tests, and they used the calculator app to complete their math and science work.

All the students at the university program who used the IXL app spoke highly of it.