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AN EXPLANATORY STUDY OF HIGH SCHOOL TEACHERS'

INTEGRATION OF MOBILE LEARNING

by

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A dissertation

submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy in the Department of Instructional Design

Idaho State University

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Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of SUH SYLVIA MANKA AZINWI find it satisfactory and recommend that it be accepted.

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February 11, 2015

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RE: Your application dated 2/6/2015 regarding study number 4233: An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

Dear Ms. Suh:

I agree that this study qualifies as exempt from review under the following guideline: 1. Research on educational practices in educational settings. This letter is your approval, please, keep this document in a safe place.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You are granted permission to conduct your study effective immediately. The study is not subject to renewal.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; fax 208-282-4723; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

Dedication

I dedicate this dissertation to my husband, Cyrille Romuald Nkonkep Ngounou, and our son David Avery Lesinki Ngounou. To my parents Mr and Mrs Suh Joseph, and to my siblings Dr. Suh-Lailam, Alvin, Chloe, Dayna, Edwin, Alvina, Jesse, and Gilbert. To Bibi, Eliana, all my friends, and church family, I could not have persisted and reached this goal without your sacrifices, love, and support during this very long journey.

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Thanks to my husband for emotionally and financially supporting me throughout my studies. Thanks to my Mum, Prisca and her family for praying for me all through my studies. I am also grateful for my friends and colleagues who have been very understanding and patient with me during this time.

There were many other teachers in my life who educated me in so many areas, each sharing their knowledge and wisdom so that my world view continues to broaden. I give thanks to them all.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

This study examined the experiences of high school teachers in Idaho and Wyoming with integrating mobile learning in their classrooms. The mixed methods sequential explanatory design was followed. Quantitative data helped to explain and build on qualitative findings (Creswell, 2013). Six research questions guided the study. An online survey and semi-structured interview were used to collect data from high school teachers in both rural and urban school districts. One hundred and four teachers responded to the survey while eight teachers were purposefully selected and interviewed. The findings of the study indicated that mobile learning integration is a relatively new process in high schools. Participants identified current mobile learning integration benefits for example for research, staying connected with other teachers, and getting formative feedback during lessons. Current challenges of mobile learning like the lack of good internet connectivity, the lack of experienced teacher support, lack of an awareness of digital citizenship, and student distraction were also identified. An in depth analysis of the findings revealed some suggestions on how to overcome these current mobile learning challenges to better the experiences of teachers such as piloting mobile learning integration, creating unGoogleable tasks, teachers' becoming technologically self-sufficient, and instituting training for professional development.

CHAPTER I

Introduction

Rapid and groundbreaking technological improvements over the past few decades have prompted the movement from weighty, stable desktop workstations to smooth, intelligent mobile devices like smartphones and iPads. According to Pietrzyk (2013), these innovations have ignited a mobile revolution. Many organizations all over the United States have embraced the utilization of mobile technology to improve productivity, including many public and private companies (Burke, 2011; Martin, 2012). Unfortunately, it seems the K-12 educational system is somewhat slower in incorporating these mobile devices into the curriculum when compared to non-educational environments.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) noted that teachers in the United States are just beginning to learn how to use mobile technologies in classrooms, and the number of teachers who have actually used them in their classrooms is small (Fritschi & Wolf, 2012). In addition, Fritschi and Wolf, claimed that mobile learning remains an emergent field, but educators are starting to recognize the potential of mobile technologies for teaching and learning in the K-12 environment. However, the number of teachers and students who own smartphones and tablets has multiplied consistently over the past five years and mobile devices are now being tested in many K-12 classrooms (Kumi-Yeboah & Campbell, 2014; Gaines & Martin, 2014). Kumi-Yeboah and Campbell referenced the Pearson (2013) national survey of 2350 elementary, middle and high school students' in the United States, and

their use of personal and school provided mobile devices in the classroom. According to

the report, more than 50% of students own mobile devices and are using them in their

classrooms for learning with the help of the teacher. The report noted that tablets were the

most common mobile devices in the K-12 learning environment. Students, teachers, and

administrators seem to use these devices on a regular basis in the school bus or

classroom, at departmental meetings, and in offices respectively.

Some researchers have suggested that many educators are sticking to their

traditional educational practices, such as the chalk board and sending students home with

handwritten assignments, which makes mobile learning integration a slow process

(Sharples, 2006; Shohel & Power, 2010; Hosler, 2013 and Devlin, 2014). For instance,

some educators still operate with a conservative view of the curriculum that allows

schools to impose on what needs to be taught. Unfortunately, being so conservative can

sometimes lead to a failure in truly teaching 21st century learning skills (Edutopia, 2014).

On the other hand, being flexible to change is important in the seamless integration of

mobile technology in the classroom (Hosler, 2013). According to the staff of Edutopia,

mobile technology can provide teachers and students with:

> Access to up-to-date, primary source material, methods of collecting/recording
>
> data, ways to collaborate with students, teachers, and experts around the world,
>
> opportunities for expressing understanding via multimedia, learning that is
>
> relevant and assessment that is authentic, training for publishing and presenting
>
> their new knowledge (Edutopia, 2014).

Today's high school students have a clear vision for how technology, in particular mobile devices, can transform their learning process (Speak Up Report, 2011). To add to that, school districts across the United States are starting to use mobile devices in their classrooms. However, when researchers examine this new mobile learning trend, very often, they immediately lean towards students' personal/individual use of these mobile devices. It is worth asking why the use and application of mobile technology in schools is often viewed from the students' experiences (Wang, Shen, Novak, & Pan, 2009; Hwang & Chang, 2011; Fernandez-Lopez, Rodriguez-Fortiz, RodriGuez-Almendros, & Martinez-Segura, 2013; Kim, Rueckert, Kim, & Seo, 2013; Chu, 2014). What about the experiences of the teachers who are responsible for curriculum development and delivery, and learning outcomes? It is also important to find out how teachers define learning with mobile technology with the intention of understanding how and why they are integrating it in their classrooms.

Mobile Learning Overview

Learning with mobile devices has been around for a number of years, but it was not until the past decade has the world witnessed an explosion of sophisticated and relatively inexpensive mobile devices and applications, thus making mobile learning an expanding trend in educational institutions (Kumi-Yeboah & Campbell, 2014).When mobile devices are adopted or implemented as tools for learning, this is referred to as mobile learning or mLearning. Research in mobile learning so far has included the use of different types of teaching and learning applications and mobile devices in many disciplines (Chou, Block, & Jesness, 2012; Chen, Kao, & Sheu, 2003; Cortez et al., 2004;

Facer et al., 2004; Gundy & Berger, 2013; Keengwe, Pearson, & Smart, 2009; Lewis, Zhao, & Montclare, 2012; Goad, 2012 and Melhuish & Falloon, 2010).

     In a non-experimental exploratory study by Messinger (2011), the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning were explored. The findings of Messinger's study suggest that teachers and students in high school are ready to adopt mobile technology, and that teachers need more training to ensure its effective integration. In addition, the findings show that though teachers are aware of students' use of mobile devices to socialize, they are unaware of the frequency with which students use these devices for learning.

     In another case study by Chou, Block, and Jesness (2012), one-to-one learning with iPads in four ninth grade Geography classrooms in a large K-12 school district in the United States, found many encouraging opportunities and technical challenges for both teachers and students. According to this study, using iPads in the classrooms leads to students becoming actively engaged, spending more time on projects, and improving digital literacy and digital citizenship. Teachers also have the benefit of easily keeping record of assessments (both formative and summative) using these mobile devices. However, the teachers complained that some students were distracted from schoolwork and needed to be redirected. The authors conclude that, although iPads improve the learning experience, one-to-one learning with them is still at its infancy and requires more research about their effectiveness.

     Mobile learning research is still in its infancy; the number of available primary research studies is still small, relative to other fields of study like e-learning (Pollara &

Broussard, 2011). Until now, most studies in mobile learning have sought to establish a foundation for mobile learning (Traxler, 2009a), develop theory (Sharples, Taylor, & Vavoula, 2005), or focus on designing activities that can be supported with mobile technologies (Leinonen, Keune, Veermans, & Toikkanen, 2014). Yet, there are still many questions to consider about mobile learning. While most of mobile learning research in the K-12 setting has looked at case studies and student perceptions, not much research has specifically focused on teachers' first hand experiences, integration strategies, benefits, or challenges, all keys to understanding if teachers will accept and integrate mobile learning in their classrooms.

Background of the Study

Learning with mobile devices has become an important part of educational institutions, businesses, and commercial organizations around the world (Sharples et al., 2008). Learning materials that at one time only existed for stationary computers (like educational websites) are becoming readily available on portable mobile devices (aTraxler, 2009; Martin & Ertzberger, 2013; Brown, Hruska, Johnson, & Poltrack, 2014). A review of literature suggests that, mobile devices encourage and support learning in non-traditional learning environments, such as museums through interactive handbooks (Hsu, Ke, & Yang, 2006; Wischart & Triggs, 2010), as a reliable resource to access authentic information (like smartphones), or as tools for encouraging collaboration among students (Cortez et al. 2004). Pietrzyk (2013) noted that middle and high school students often use mobile devices in informal settings (at home and in school buses), but are not allowed to use mobile devices in class. Research indicates that, because of the

lack of these devices in classrooms, there is a disconnect between the students'

educational world and the real world in which they are expected to succeed (Traxler,

2009b; Wang, Shen, Novak, & Pan, 2009; Looi, Sun, Wu, Seow, Chia, Wong, & Norris,

2014).

It is worth noting that some states including Utah are looking to equip all their K-

12 students with iPads, while Maine is the only state that currently has one device per

student statewide (Idaho State Department of Education Website, 2014). As reported in

the Idaho State Department of Education Website, voters in Idaho rejected a one to one

technology plan in 2010 after legislation approved the funding. However, in 2013, the

State of Idaho passed comprehensive education reform laws known as Students Come

First that included a focus on creating 21st century classrooms by integrating classroom

technology (mobile devices included) to enhance the learning experience. In July 2013,

11 school districts across Idaho were granted $3 million in state funding to put this state

vision into action. As a result of the availability of these mobile technologies, pilot

projects have been implemented with the goal of improving students' academic growth

and financial efficiencies in schools as well as identifying best practices of use. Idaho,

Utah, and Maine are among some states in the United States that have school districts that

are integrating mobile learning in their teaching and learning practices.

Not everyone in the K-12 setting supports mobile learning, though research has

suggested that it can benefit teaching and learning in the K-12 environment (Roblyer &

Doering, 2013; Kumi-Yeboah & Campbell, 2014). Roblyer and Doering reported that

when small handheld mobile devices like cellphones, eBooks, and "smart" pens were

used in classrooms, it was easier for both teachers and students to view, communicate, and share information, regardless of location. Kumi-Yeboah and Campbell (2014) suggested that the integration of tablets in K-12 learning environments helped students navigate their own learning, but very few schools were utilizing tablets in classrooms.

Some researchers have attempted to find out why some educators are resistant to accepting and adding mobile learning in the curriculum. MacCallum, Jeffrey, and Kinshuk (2014), in their study of factors impacting teachers' adoption of mobile learning, suggested that digital literacy, information and communications technology (ICT) anxiety, and ICT teaching self-efficacy were key variables in determining a more complete picture of teachers' behavioral intention to use mobile learning. Similarly, Howard (2013) noted that a teacher's lack of knowledge of the technology and the value it has in teaching could determine a teacher's resistance or acceptance of the technology in the classroom.

Other researchers have categorized the barriers to integrating technology in general as first order and second order (Brickner, 1995; Ertmer, 1999). First order barriers are those related to external factors such as; hardware, software, and setup changes. Second-order barriers on the other hand are related to internal features like the school culture and related beliefs concerning teaching and learning in relation to technology. According to Brickner and Ertmer, most often, these barriers are beyond the control of the teacher. Ertmer notes that "having to deal with numerous first-order barriers simultaneously may frustrate teachers who feel pressured to overcome every barrier" (p. 5). While Bricker and Ertmer discussed older technologies from the turn of

the millennium, the barriers to integrating technology in the classroom that they list can also apply to today's mobile technology integration.

There is limited research on mobile learning in high schools as compared to research in higher education settings (Pietrzyk, 2013). Studies done in K-12 settings have mostly focused on the perceptions of students regarding the use of mobile technology. There is the absence of thick or detailed descriptions of teachers' experiences at the frontlines of mobile learning integration. For example, Pietryk explored the common beliefs and instructional practices of K-12 educators who were identified by administrators as successfully integrating mobile technologies into their classrooms. His study looked only at in-service teachers' success stories and did not explore the stories of those who tried and failed or of those who were without assistance.

In another qualitative case study, Hosler (2013) explored the experiences, perceptions, and pedagogy of nine self-identified faculty developers and instructional designers in centers for teaching and learning, supporting faculty members who requested assistance with mobile learning at a university in Colorado. Hosler's study pointed to negligence on the part of faculty to ask for mobile learning support and the presence of many frameworks to inform technology integration efforts. The results also pointed to the absence of pedagogical and theory-based considerations when switching to mobile learning through the learning management system. Although this study did provide rich description of faculty experiences with mobile technologies and identified problematic areas, the focus was on "faculty developers" in a higher education. It remains to be seen whether Hosler's findings would be echoed in a K-12 context with classroom teachers.

Conceptual Framework of the Study

The Technological Pedagogical and Content Knowledge (TPACK) framework was developed by Mishra and Koehler (2006) as a theoretical framework for understanding what knowledge is required for teachers' successful technology integration. The TPACK framework explores the connection between three important areas of knowledge: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). The framework demonstrates how teachers' understanding of technology, pedagogy, and content can interact to produce effective teaching of different subject areas using educational technologies like mobile devices. In this framework, the interaction of the three areas of knowledge results in four other types of knowledge: Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK), Pedagogical Content Knowledge (PCK) and the Technological Pedagogical Content Knowledge (TPACK). Figure 1 is a visual representation of the components of the TPACK framework. Each of these areas of knowledge will be explored below.
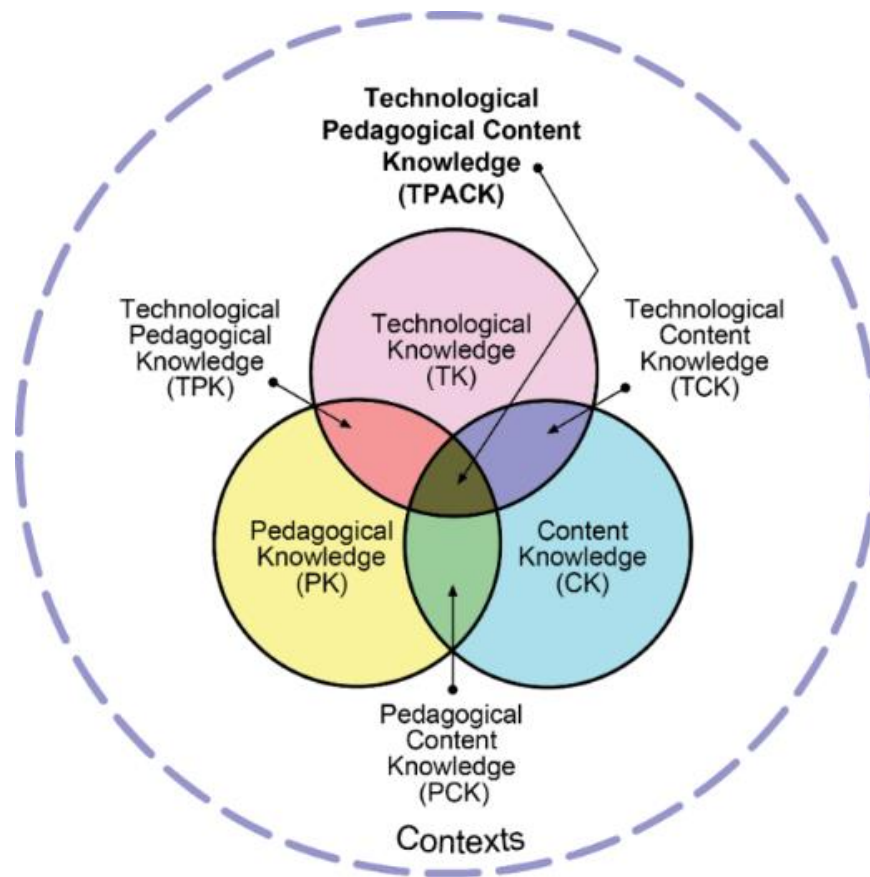
Figure 1.Components of the TPACK framework *(*diagram from http://tpack.org).

Technological Knowledge (TK). Technological knowledge (TK) refers to knowledge about various digital technologies that could be used in teaching and learning. Mishra and Koehler (2006) noted that technological knowledge is difficult to define because technology keeps changing. As a result, TK will be defined for this study as having an understanding of the most current mobile technologies that are being used in mobile learning, such as smartphones, iPads, Chromebooks and other handheld digital devices. Mishra and Koehler argued that teachers with TK know about educational mobile applications (apps), can keep up with rapid technology changes, and are good at

troubleshooting. These characteristics are helpful when it comes to mobile learning integration.

Pedagogical Knowledge (PK). Pedagogical knowledge refers to having an understanding of teaching practices and methods, such as student learning, classroom management, lesson planning and implementation, and student assessment. A teacher with deep pedagogical knowledge understands how his/her students learn and will acquire teaching skills to present materials to students so they can successfully learn irrespective of the subject taught (Mishra & Koehler, 2008). According to Mishne (2012), PK will help teachers examine and understand the process of teaching with or without technology.

Content Knowledge (CK). Content knowledge refers to knowledge about the subject matter that is to be learned or taught (Mishra & Koehler, 2008). For instance, the teacher needs to have advanced knowledge in mathematics in order to be effective as a middle school or high mathematics teacher. Mishra and Koehler suggest that teachers who have a good understanding of the subject they teach will know how to apply concepts learned to real world situations to engage their students. Mishra and Koehler noted that content knowledge should include the knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as established practices and approaches toward developing such knowledge. "Knowledge and the nature of inquiry differ greatly between fields, and teachers should understand the deeper knowledge fundamentals of the disciplines in which they teach" (Koehler & Mishra, 2009).

Technological Pedagogical Knowledge (TPK). The Technological Pedagogical knowledge includes an understanding of how to use technology to teach in different ways according to the students learning needs (Harris, Mishra, & Koehler, 2009). For instance, TPK might include knowledge of how to motivate students using mobile technology or how to engage students in collaborative learning using mobile devices. Developing TPK requires building an understanding of the potential benefits and challenges of particular technologies as they can be applied in some learning activities (Harris, Mishra, & Koehler, 2009).

Technological Content Knowledge (TCK). Technological Content knowledge refers to understanding of how technology can be used to support the learning of specific subject area curriculum (Mishra & Koehler, 2006). Teachers need to be experts in their subject matter, and also they need to have a solid understanding of the various ways subject matter can be represented, especially with the application of technology. For instance, in the case of mobile learning integration, teachers must understand which mobile applications are best suited for teaching Mathematics, English, or Science, and how the content of these subjects suggests specific uses of the mobile devices.

Pedagogical Content Knowledge (PCK). Pedagogical Content knowledge refers to knowledge about specific content area (Harris, Mishra, & Koehler, 2009). PCK "covers essential knowledge of teaching and learning content-based curricula, as well as assessment and reporting of that learning" (Harris, Mishra, & Koehler, 2009, p.398). Most K-12 teachers are faced with learners with individual differences like different learning styles and different levels of prior knowledge. The combination of pedagogical

and content knowledge allows the teacher to adapt various teaching and assessment strategies to the subject matter being taught.

Technological Pedagogical Content Knowledge (TPACK). In this study, the Technological Pedagogical Content Knowledge Framework (TPACK) will provide a clear definition of mobile learning integration and the knowledge required to achieve it. Some researchers note that teachers who use technology only for administrative tasks or to deliver instruction without allowing student access are not appropriately preparing students for their future (Hayes, 2007; Wells & Lewis, 2006, and Zhao & Frank, 2003). In a model classroom setting, the teacher should view pedagogy, content, and technology as mutually supporting, merging the three domains together into their lessons to actively engage their students (Koehler & Mishra, 2008).

The TPACK framework does not recommend what content to teach, which pedagogies to use, or what technology to include in a teacher's lessons. Therefore, it is critical that teachers have teaching experience and a strong grasp of pedagogy and content knowledge. When using mobile technology, teachers need to understand that there is specific content knowledge that can be delivered using specific mobile devices, and there is mobile technology knowledge that they should possess in order for them to integrate the mobile tool into the pedagogy. Robyler and Doering (2012) adapted the TPACK framework and came up with a way of helping teachers to determine the different types of knowledge that need to be acquired to ensure effective technology integration. They indicated that teachers need to self-assess the technological knowledge (TK) they possess about the technology tool, and what they still need to learn about the

tool in order to be able to integrate that particular tool in the curriculum. Furthermore, Robyler and Doering indicated that teachers need to assess the technology pedagogical knowledge (TPK) that they possess in terms of the tool, and what they still need to learn in relation to the content.

According to Koehler and Mishra (2009), by "integrating knowledge of technology, pedagogy, and content, expert teachers bring TPACK into play any time they teach" (p.66). Teachers need to flexible when integrating mobile learning while considering the three elements of content, pedagogy, and technology keeping in mind how they interact in specific contexts and subject areas. Using the TPACK as a conceptual framework for this study will help the researcher understand what factors high school teachers consider when integrating mobile learning.

Research about teachers' content, pedagogical, and technology knowledge as a strategy for supporting the integration of mobile learning is very limited. For instance, Hodges et al. (2012) explored possibilities for 16 pre-service teachers to develop their technological, pedagogical, and content knowledge (TPACK) through the use of iPads and smartphones in teacher education, including the transfer of relevant skills and techniques to K-12 settings. The findings of the study showed that pre-service teachers developed their knowledge of using mobile technology to support mathematics teaching. This study however did not probe into in-service teachers' integration of the mobile devices. As indicated by the review of literature (Chapter II), there is not much research in terms of how in-service teachers integrate mobile technology in K-12 learning

environments as well as how they define mobile learning or the factors that support or hinder sustained integration of mobile technologies in such learning environments.

Purpose of the Study

The purpose of this explanatory study was to examine high school teachers' experiences with integrating mobile learning in their classrooms. The study specifically aimed at describing the experiences of teachers in the integration and use of mobile devices in the classroom. By examining the experiences of these educators of the 21st century, the researcher identified some common threads of pedagogical strategies for mobile learning integration, as well as benefits, and challenges of integrating mobile learning in high school classrooms.

Research Questions

Six research questions guided the study;

1. How do high school teachers define mobile learning?

2. What do high school teachers regard as effective strategies for mobile learning integration?

3. What do high school teachers regard as the benefits of mobile learning in the classroom?

4. What do high school teachers regard as significant challenges of mobile learning in the classroom?

5. How can high school teachers overcome the challenges of mobile learning?

6. What are the experiences of high school teachers with mobile learning integration in their classrooms?

All questions were answered by both survey and interviews. The interview data was explanatory, explaining, and enhancing the information obtained by survey.

Overview of Research Design

The nature of the research questions for this study required both qualitative and quantitative methods. An explanatory mixed method approach was therefore proposed for this study. An explanatory mixed method research design is a research procedure whose primary purpose is to get qualitative data to help explain initial quantitative results (Creswell & Clark, 2007).This design was well suited for this study because the researcher used quantitative participant characteristics to guide purposeful sampling for the qualitative phase of the study. The research data was collected in two phases:

Phase One involved the collection of quantitative descriptive data using a survey instrument (see Appendix A) which consisted of both closed and open-ended questions. Descriptive studies often use surveys to collect data about a population by gathering information about opinions, attitudes, characteristics, practices, and demographic information (Gall, Borg, & Gall (2007). The reason for using a survey in this study was to characterize the experiences, beliefs, and opinions of high school teachers about the use of mobile learning technology, and to identify teachers who were integrating mobile learning technologies as potential interviewees.

Phase Two involved the collection of qualitative data through interviews. Eight teachers who responded to the survey were purposefully sampled and interviewed. The qualitative data provided in-depth findings which enhanced the understanding of the information gathered from the surveys. Gall, Borg, and Gall (2010) noted that

questionnaires do not probe deeply into participants' opinions, beliefs, and inner experiences, so interviews will help fill a potential explanatory data gap. Furthermore, since some of the research questions asked for "what" and "how" information, a qualitative approach was useful in establishing a rich data set that complemented data from the survey instrument. For this study, the mixed method approach enabled the researcher to acquire, explain, and describe with a deep, rich data set that led to better understanding of the participants' lived experiences with mobile learning, and their beliefs and everyday practices with mobile learning technology. For this study, the qualitative data were collected through a sample of those teachers who met the inclusion criteria and who agreed to be interviewed.

The survey was emailed to 1000 high school teachers in schools districts in Idaho and Wyoming. Eight teachers were purposefully selected to take part in the interviews based on their experience with mobile learning.

Assumptions, Limitations, and Delimitations

The researcher assumed that participants were honest and truthful when they answered the survey and interview questions. In addition, checking for the validity of the study results was based on determining if the findings were accurate from the standpoint of the researcher, the participant, or the readers (Creswell, 2013). The results and validity of the study depended on the participants truthfully responding to the survey questions and in their interviews.

In order to reduce the likelihood of problems that could affect the findings of the study, limitations and delimitations of the study were defined (Creswell, 2013).

Limitations are those features which the researcher has no control over (threats to internal validity) while delimitations are those features of the study the researcher can control (threats to the external validity).

This explanatory study was limited in the following ways;

1. The study relied on in-service teachers' (participants) being articulate and honest about their experiences, meaning that some teachers may not have adequately communicated their experiences during interviews (Phase Two).

2. The study required the researcher's interpretation of data which might have led to mistakes or false conclusions during data analysis. The researcher collected both quantitative (survey) and qualitative (interviews) data to reduce bias and let the results emerge from the data. The fact that only those who were willing to participate were part of the study was one limitation beyond the researcher's control. In addition, the timeline for conducting the research study (gathering the data) could affect the results of the study.

3. The data for the study were collected through multiple sources including a survey and interviews. The responses from the survey and the interviews were used by the researcher as verification of the other thus, having multiple sources/perspectives made the findings of the study more credible.

4. The low response rate of 10.4% is a limitation because it can lead to nonresponse error. Sivo, Saunders, Chang and Jiang (2006) define nonresponse error as a condition wherein people of a particular group are systematically not represented in the sample because such people are alike in their tendency not to respond. There could be many teachers who failed to respond to the survey because by their very nature, are disinclined to respond

(high school teachers are busy people). The researcher had the survey open for two months in the spring of 2015 in an attempt to boost the response rate. A research advertisement was also distributed at two district superintendents meetings in Idaho (see Appendix A). Because of the low response rate, it became difficult to say how the entire sample would have responded, and so, generalizing from the sample to the intended population was risky.

5. The survey design is a limitation of the study. Only Research Question One to Five were asked in the survey. Question six was addressed during interviews.

The study had some delimitations that served as basis for continued research. The researcher used purposeful sampling when selecting the eight participants for phase two of the study. Even though many researchers justify purposeful sampling "based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (Merriam, 1998, p. 61), some view purposeful sampling as biased. Creswell and Miller (2000) note the importance of researchers' acknowledging their beliefs and biases early in the research process to allow readers to understand their positions, and then 'bracket or suspend those researcher biases as the study proceeds...individuals reflect on the social, cultural, and historical forces that shape their interpretations' (p. 127). For this study, the researcher acknowledges selection bias in the case of the interview participants. As a result of this bias, the researchers could not determine if the findings were due to pre-identified variables or due to the "hidden" or "unknown" variable that influenced selection. This

bias was addressed during interviews by setting aside researcher beliefs about how teachers in specific subject areas might integrate mobile learning.

Definition of Terms

    Explanatory design. This is a two-phase mixed methods design aimed at using qualitative data to help explain initial quantitative results (Creswell and Clark, 2007).

    In-service teachers. This study will define in-service teachers as individuals who have been hired by a school district or private school and are actively teaching.

    High School or Secondary School teacher. An individual (certified or non-certified) who teaches in any 9th to 12th grade class.

    Mobile devices/ mobile technology. For the purpose of this study, mobile devices and mobile technology refer to portable electronic devices like iPads, smartphones and tablets that are being used in the high school classrooms for teaching and learning.

    Mobile learning/m-learning. For this study, mobile learning/m-learning was defined as any sort of learning that happens when the learner is not at a fixed , predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies (O'Malley et al., 2005). However, this definition was revisited after survey and interview data were analyzed.

    Professional development. For the purpose of this study, professional development is defined as activities that develop an individual's skills, knowledge, expertise and other characteristics as a teacher (Avalos, 2011).

Mobile learning integration. Mobile learning integration refers to the introduction of mobile learning technologies in the classroom by teachers to "reinforce, extend, enrich, assess, and remediate student mastery of curricular targets" (Hamilton, 2007, p. 20)

Significance of the Study

Mobile devices like smartphone, iPads, and a wide variety of android tablets as personally owned devices in high school campuses in the United States may have encouraged a new trend of mobile learning in education (Chou, Block & Jesness, 2012). For example, Lawrence (2012) and Tate (2012) found out that students in more than 2000 school districts in the United States are now using different types of electronic devices in the classroom and that the numbers are increasing. Although mobile learning is gaining popularity and the ownership of mobile devices continues to increase, rules and regulations prohibiting the use of mobile technologies in many high schools have adversely affected the learning potential of American high school students (Koole, 2009).

The current study, exploring experiences of high school teachers using mobile devices in the classroom, has potential significance for teachers' professional growth, such as increasing motivation to integrate mobile learning and providing examples of effective strategies for mobile learning implementation. An administrator could use the findings of this study to justify more professional development opportunities for high school teachers in their school districts. Furthermore, the findings from the current study can also provide information to help improve teacher performances since teachers will

gain information on strategies for active student engagement, communication, collaboration, and assessment using mobile technology.

In the United States today, many high schools are integrating mobile learning in their classrooms. Some schools are currently piloting mobile devices in their classrooms while others have already piloted and are integrating mobile learning in their classrooms and so far teachers are sharing their success stories. There are very few research studies that have targeted teacher experiences with using mobile devices. As will be seen in the review of literature, previous research has probed student experiences with mobile learning, but there are very few studies that have examined teacher experiences with mobile learning integration.

CHAPTER II

Literature Review

The purpose of the literature review is to establish the need for an explanatory study to examine the experiences of K-12 teachers who are integrating mobile devices like iPads, smartphones, tablets, and their applications in the classroom. Mobile devices are becoming popular among teachers and students in the United States today (Project Tomorrow, 2013). Most research in mobile learning has focused on the perceptions of students about using mobile devices in the classroom. In addition, research in this area has been inconsistent in the definitions of mobile learning. Research that focuses on the real experiences of teachers, how they define mobile learning, the challenges they face in the classroom, and the effective strategies they use to integrate mobile learning is therefore not represented in current literature.

The review of previous research begins with a critical examination of how mobile learning has been defined over the years and how teachers are currently using mobile devices to align with the National Educational Technology Standards (NETS) for teachers. The National Educational Technology Standards (NETS) are a set of standards published by the International Society for Technology in Education (ISTE) for the purpose of leveraging the use of technology in K-12 education to enable students learn effectively and live productively in an increasingly digital society (NETS Project, 2008).

The literature search strategy included a list of key terms to limit the scope of the review. The established key words included mobile learning, mobile devices, mobile technology, mobile integration, digital learning, and K-12 mLearning. The literature

review included a large number of sources including ERIC, ProQuest, GoogleScholar, professional journals like the *Journal of Computer Assisted Learning*, Mobile learning conferences, dissertations, reference books, educational periodicals, and web searches.

The literature review here discusses current uses of mobile devices to improve student learning and teacher support in the classroom. This establishes the wide array of mobile devices for learning including the benefits and challenges encountered in the teaching and learning process. Also included in the review of literature is a discussion of research studies in the K-12 setting that have used the Technological Pedagogical Content Knowledge (TPACK) framework, the theoretical framework for this study. This establishes the necessary background for the basis of the study seeking to analyze and explore mobile learning integration challenges and successes.

This chapter is organized into six main topics: (a) Defining mobile learning, (b) mobile learning integration in K-12 setting, (c) the TPACK framework and mobile learning in the K-12 setting, (d) benefits of mobile learning integration in K-12 education, (e) challenges of mobile learning implementation in k-12 education, and (f) overcoming the challenges of mobile learning. Figure 2 below illustrates the main themes reviewed in the literature.
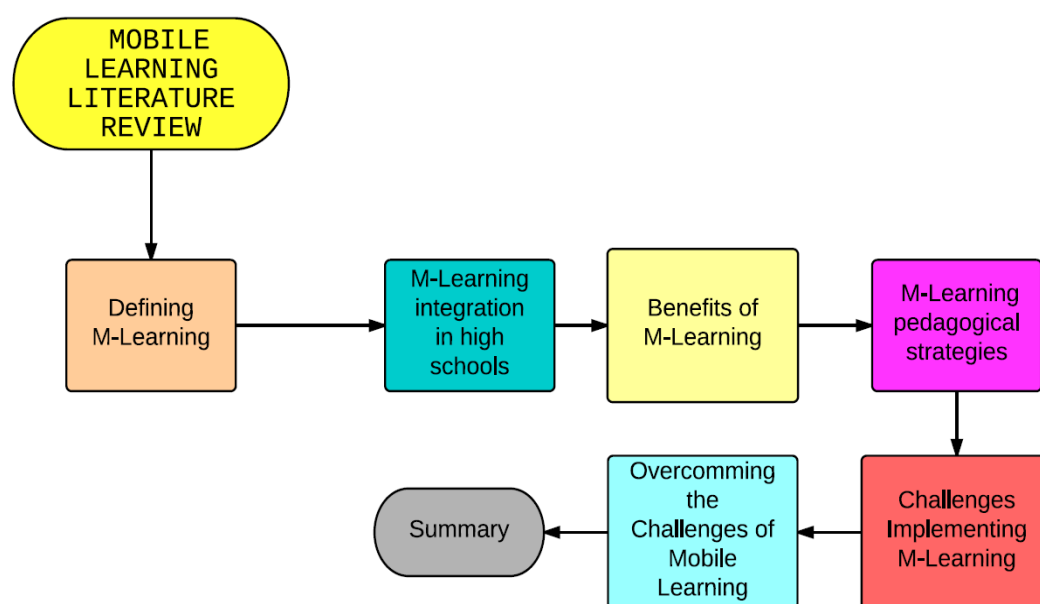
Figure 2. Sequence of research areas reviewed in Chapter II

Defining Mobile Learning

The term "mobile learning" has different meanings for different communities and

researchers. In 2009a, Traxler considered the concept of mobile learning as "new" and

"difficult to define, conceptualize and discuss" (p. 261). Several scholars also suggested

that mobile learning is defined differently by both researchers and educators (Pozzi,

2007; Traxler, 2009b; Brown-Martin, 2008). A Google search of "mobile learning +

definition" yielded 41,000,000 results; on Google Scholar, the same search terms

produced 1,440,000 results. This suggests strongly that there are many definitions and

context in which mobile learning is defined. Traxler (2009b) documented various

definitions of mobile learning in an attempt to find a consensus for a single definition of

mobile learning. Instead, he found that educators and researchers defined mobile learning

based on the context in which they were working, and the definitions focused on the

mobility of the learner, the mobile device, or the learning environment. For example, Traxler (2009b) described the mobile learning definitions by Quinn (2000) and the Mobile Learning Network (MoleNET) as being techno-centric, meaning that it was centered on technology only, which makes the definition unstable. Quinn (2000) defined mobile learning simply as learning that takes place with the help of mobile devices, while the Mobile Learning Network, a project based initiative in the United Kingdom, defines mobile learning as "the exploitation of ubiquitous handheld hardware, wireless networking and mobile telephony to enhance and extend the reach of teaching and learning" (www.molenet.org.uk). Traxler defined mobile learning as "the provision of education and training on PDAs/ palmtops/ handhelds, smartphones and mobile phones" (2009b, p.2). Traxler suggested that mobile devices include PDAs, smartphones, palmtops, and cellphones, but not laptops.

Other definitions emphasized the characteristic of mobility in their definition of mobile learning. O'Malley et al. (2003), for example, viewed mobile learning as "any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies" (p. 1). To support this statement O'Malley et al. argued that mobile learning happened everywhere and especially in places that were never before possible such as in school buses and doctors offices. Keegan (2005) also suggested that the definition of mobile learning should focus on the aspect of mobility of the technology, but not the learner. According to Keegan, "mobile learning should be

restricted to learning on devices which a lady can carry in her handbag and a gentleman can carry in his pocket" (p.3).

Other researchers have defined mobile learning as a subsection of distance learning. For example, Pinkwart, Hoppe, Milrad and Perez (2003) defined mobile learning as "e-learning that uses mobile devices and wireless transmission" (p.5). Pinkwart et al. (2003) considered e-learning as a subgroup of distance learning. Brown (2003) summarized several definitions and later defined mobile learning as "an extension of e-learning" (Brown, 2005, p. 299). Peters (2007) also stated that it was a subset of e-learning, a step toward making the educational process "just in time, just enough and just for me" (p. 15).

More recent definitions focused on the learning aspects of mobile learning. Prasertsilp and Olfman (2014) regard mobile learning as "a mode of learning that uses mobile devices in numerous educational activities" (p.52). Mobile learning is increasingly becoming popular because most people including students and teachers own mobile devices and are looking for the quickest way to get useful information. Like Traxler (2009), Brooks-Young (2010) defined mobile learning as "any form of learning that is mediated through a mobile or, more precisely, mobile hand-held device" (p.10). According to El-Hussein and Cronje (2010), trying to assign a particular meaning to mobile learning can be challenging because many terms and words have been used to define and describe it. For example: Does mobile learning mean the mobile experience of the learner as they learn with a mobile device, the mobile experience of the educator as they teach using mobile devices the mobility of the learner, or the mobility of learning?

El-Hussein and Cronje proposed three areas of consideration when defining mobile

learning: "mobility of technology, mobility of learner, and mobility of learning" (p.7).

Most of the definitions of mobile learning since 2000 suggest that mobile learning

involves educating oneself or being taught by a teacher through mobile technology (such

as mobile phones, laptops, notebooks, or tablets). Mobile learning involves a portable

device allowing a greater number of people to continue educating themselves, sometimes

without being in a classroom. Mobile learning is becoming increasingly common in

schools and businesses. Although often considered a distance-learning technique, mobile

learning can also refer to students using hand-held devices to learn while in the

classroom. There is however no consistent definition of mobile learning across

disciplines and most of the definitions are based on a specific context. The inability of

researchers to arrive at a common definition for mobile learning indicates that mobile

learning and its applications are still in an evolutionary phase (Peng, Su, Chou, & Tsai,

2009). A study of how teachers define mobile learning in their practice is therefore

timely.

Mobile Learning Integration in High Schools

In 2006, 66 percent of middle school students and 83 percent of high school

students reported that they had personal access to a cell phone (Project Tomorrow, 2013).

In 2011, those percentages had increased remarkably by 27 percent and 17 percent

respectively. According to Project Tomorrows 2011 report, students started using more

advanced mobile devices, instead that the cell phone with limited functionality and no

Internet access was replaced by a smartphone, tablet, or both. Now, seven out of ten high school students that have a tablet also have a smartphone (Tysowski & Paul, 2014).

Mobile learning acceptance in high schools is on the rise, and school districts are looking to mobile technology to make learning more engaging and personalized for students. According to studies by both Lawrence (2012) and Tate (2012), students in more than 2000 school districts in the United States are using different types of electronic devices in the classroom and the numbers are increasing. The question of interest now is if these mobile technologies are effectively being integrated into the curriculum? Keengwe and Bhargawa (2013) argue that understanding that people in all walks of life including education perceive and interpret mobile devices differently is critical to meaningful integration of mobile technologies in education. This is so because mobile devices are an important part of everyday life. A business executive might see mobile devices as a means to increasing production and keeping in contact with clients, while a student may see a mobile device as just a way to chat with their peers. Some teachers however, may regard a mobile device as a learning and assessment tool to improve on their teaching practice. Understanding how different groups of people perceive mobile devices is therefore critical in knowing how to effectively integrate it into the curriculum. In addition, Wright and Wilson (2011) propose that even though mobile technology integration is important, "teacher educators should also recognize that technology integration is complex. And, as teacher educators, we must look for ways to prepare teachers to critically and creatively adapt and evolve when using technology" (p. 58). Researchers recommend using mobile learning in pre-service teacher education programs

in order to make it easier for educators and administrators to integrate mobile

technologies into instruction in the future (Ally, 2009; Ekanayake &Wishart, 2014).

While there is no clear standard definition of technology integration in K-12

schools, some researchers like Hew and Brush (2007) regard technology integration as

"how teachers use mobile devices to carry out familiar activities more reliably and

productively, and how such use may be re-shaping these activities" (p. 225). Fullan and

Steigelbauer (1991) believed that for technology to be effectively integrated into

instruction, there would have to be changes in (a) teacher attitudes and beliefs, (b) content

knowledge, (c) pedagogical knowledge, and (d) instructional resources, technology or

materials. We next turn to how these four characteristics can affect the integration of

mobile learning in schools.

Teacher attitudes and beliefs towards mobile learning. Hew and Brush (2007)

argue that a teacher's attitude and beliefs towards technology can be stumbling blocks to

the effective integration of technology in the classroom. Hew and Brush adopted the

definition of attitudes from Simpson, Koballa, Oliver, and Crawley (1994) as "specific

feelings that indicate whether a person likes or dislikes something" (p.229). In the context

of mobile learning integration, the teacher's attitude towards mobile devices can be

perceived as liking or disliking the use of mobile devices. Hew and Brush also defined

beliefs as "premises or suppositions about something that are felt to be true" (p. 229).

Based on this definition, teachers' beliefs may include their instructional beliefs about

teaching and learning as well as their beliefs about mobile technology.

Fristchi and Wolf (2012) interviewed 24 educational leaders, teachers, and representatives from sixteen US states, the District of Columbia and three Canadian Provinces at national, state, provincial, and local levels. The results of their study suggested that some teachers were eager to engage in mobile learning because of the flexibility it provided, but other teachers were not advocates of mobile learning because they did not know how to use the mobile devices and they did not have a positive attitude towards adopting it in their classroom. Grant and Barbour (2013) concluded that having content knowledge encouraged mobile technology use and facilitated mobile learning integration.

Pedagogical knowledge and mobile learning integration. The mobile nature of smartphones and a wide collection of tablets create an exciting opportunity for new forms of learning because mobile devices have the capability to change the nature of teacher-learner relationship, and learning materials (Laurillard, 2007). It is important that teachers have the required pedagogical knowledge in order to integrate mobile learning in the classroom. According to Laurillard, having pedagogical knowledge means that the teacher is equipped with techniques of how to support all the features of the learning activities even if they be in a far-off location with the students guided only by the tasks set, the information available online, the characteristics of the world they are in, or peer support.

Hew and Brush (2007) noted that very often the lack of technology-supported pedagogical knowledge and skills is a major barrier to technology integration by teachers. It is therefore important to explore research on effective pedagogical strategies for mobile

learning integration. Based on results from an action research study of 46 in-service teachers in Southeast Idaho (Ntuli and Suh, 2014), some strategies on how teachers could integrate mobile technologies into teaching and learning processes were suggested. The strategies were proposed based on responses to semi-structured interview questions in which the teachers were asked about their best practices in mobile technology integration. For instance, some of the strategies suggested by the teachers were based on the student's age, the subject matter they taught, the type of mobile device available and type of assessment. It should be noted that the results of the study could not be generalized since the study was conducted to find ways of increasing in-service teachers' use of mobile technology/mobile learning in K-12 learning environments (specifically in Southeast Idaho).

Table 1 below illustrates some effective strategies for mobile learning technology integration in the K-12 learning environment based on the action research study by Ntuli and Suh (2014). Table 1 illustrates that mobile learning is already taking place in the K-12 environment with mobile devices used for specific classroom activities and teaching. The table lists 11 strategies through which mobile learning can be effectively integrated in elementary, middle and high school classrooms with activities using mobile technology. Some literature will be briefly reviewed to support the proposed effective mobile technology integration strategies.

Educational games (Mathematics, Science and Literacy). In one experimental study in an elementary school in Taiwan (Hwang, 2012), mobile computer devices were used to promote the learning motivation of students. Forty six students participated in the

study with 24 in the experimental group which used mobile computer games that

matched the learning styles of the individual students in their natural science course and

22 students in the control group which used mobile computer games that did not meet the

students' individual learning styles. From the experimental results, the authors concluded

that the educational computer games not only promoted learning motivation for students

whose learning styles were matched, but also their learning achievement was

significantly better than those students in the control group. Although the study showed

that educational games were effective in improving the learning performance of students

in a science course, more research in different subject areas was suggested. More

research is also needed to find effective learning environments and integration strategies

for teachers to develop new games, especially in a mobile learning context.

Table 1

Summary of Effective Mobile Learning Technology Integrated Strategies

	Early Childhood/ Elementary	Middle School	High School
Activities (and/or Pedagogy)	Educational games-Mathematics and Literacy (Collaborative/self-directed learning)	Educational games (self-directed/collaborative)	Educational games (self-directed/collaborative)
	Podcasting (collaborative)	Podcasting (self-directed learning/collaborative)	Podcasting (self-directed learning/collaborative)
	Virtual field trips (research projects)	Blogging (collaborative)	Blogging (collaborative)
	Simulations	Webquests (research projects)	Webquests (research projects)
	Guided reading (self-directed)	Simulations (hypothesis testing)	Simulations (Hypothesis testing)
	Communication (homework reminders)	Formative feedback (Using smartphones as clickers)	Virtual field Trip (collaborative/self-directed learning)
		Individual/Collaborative work	Formative Feedback (Using smartphones as clickers)
		Communication (collaborative group work/ homework reminders)	Creating Apps/ Content creation (self-directed learning/collaborative learning).
		Note taking (self-directed learning)	Organizer(self-directed learning)
		Organizer (self-directed learning)	Communication (collaborative homework/ homework reminders)

Note. Summary of effective mobile learning technology integrated strategies. Use with permission from "Mobile Learning: Effective Strategies for K-12 Learning Environments", by Ntuli, E., & Suh, S. (2014), in Keengwe, J., "Promoting Active Learning through Integration of Mobile and Ubiquitous Technologies (pp. 135-154). Hershey, PA: IGI Global. Doi: 10.4018/978-1-4666-6343-5.

In another experimental study to determine the effect of using a mobile literacy game to improve literacy levels, (Jere-Folotiya, Chansa-Kabali, Munachaka, Sampa, Yalukanda, Westerholm, Richardson, Serpel, & Lyytinen, 2014), 573 grade one students were randomly assigned into control (N = 314) and various intervention groups (N = 259). Both the control and intervention groups were given a mobile game called GraphoGame to carry out a literacy assessment. However, the control group did not receive any intervention from the teacher during the testing while the intervention groups did. Each student in the study was assessed using a battery of locally developed cognitive tests that measured emergent literacy in arithmetic, spelling, writing, and reading among other subjects areas. The results suggested that the game had a positive effect on learning when the students were directed by their teacher in spelling. The other subject areas did not show any significant difference between the intervention and the control. The study however could not be generalized because of constraints such as large classroom sizes and the lack of sound proof walls. The results suggest that there is need for more research on effective mobile learning integration strategies in K-12 settings especially with regards to using mobile devices to play games as part of mobile learning.

Podcasting. Rudel (2006) defined podcasting as "a method of distributing multimedia files, such as audio or video programs, over the Internet using syndication feeds, for playback on mobile devices and personal computers"(p. 36). Originally used primarily for entertainment or within higher education settings, podcasts have now become more common and there are numerous examples of teachers and students from kindergarten through high school using them to enhance learning. In an experimental

study by Putman and Kingsley (2009), podcasts were used to enhance the development of science vocabulary outside the classroom. The study was conducted in a suburban school in the United States which served primarily middle to upper-middle class families. Approximately half of the students received access to the podcasts, while the others received classroom instruction only. The results of the study were based on the pre and posttests averages which showed that the group of students with access to the podcasts started with slightly higher vocabulary scores than the group that received only classroom instruction. A further analysis of the results showed that students' scores on the science vocabulary tests for the group given access to the podcasts was significantly greater than those in the group that received only classroom instruction. Podcasts therefore offer opportunities for teachers to remediate students who need additional instruction or access to content discussed in the classroom (Putman & Kingsley, 2009). Due to the relative newness of the podcast as an educational tool in K–12 settings, data to support its effectiveness are limited.

   Virtual field trips. Cox and Sue (2004) defined a virtual field trip (VFT) as a technology-based experience that allows learners to take an educational journey without leaving the classroom. Cox and Sue further explain that the VFT learning experience does not replace reality but serves to expose learners to experiences they cannot have under normal circumstances. A search for an empirical study on virtual field trips using mobile devices in K-12 settings revealed no results. There are however pre-developed virtual field trip websites for K-12 classrooms that can be accessed through mobile devices (Kirchen, 2011), offered through organization such as the Utah Education Network (has

links to other VFT websites and tools for creating VFTs), Scholastic.com (has VFT in reading/language arts, science, social studies and Mathematics with teacher guides and tips), Meet Me at the Corner (has directions on how teachers can submit VFTs for inclusion in the site repository), PBS Kids (has tours to factories on how people make things), whitehouse.gov (includes an interactive virtual tour of the white house), and 4-H (explores various aspects of horse beef, diary, poultry, wheat, and aquaculture farms). In higher education settings, research shows that virtual field trips encourage collaboration among students (Adams et al., 2010).

Guided reading. In an experimental study by Lin (2014), two English classes taught by the same teacher in a senior high school in Taiwan were recruited to participate in a ten-week online Extensive Reading Programs (ERPs). One class was assigned to the mobile group, reading their assignments on their tablet PCs; the other class, the desktop PC group, read their assignments on desktop PCs. During the online ERP, each class dedicated one class period every week for in-class reading and the participants in both classes were encouraged to read as much as possible after the class period. The results of the study showed that the mobile group outperformed the desktop PC group in online activities and reading achievement; the mobile group also showed greater appreciation of the online ERP than their desktop PC counterparts. The findings of the study suggested two directions for future studies on mobile-assisted reading; an experimental study on reading strategies on mobile devices and studying textbooks using mobile devices.

Formative feedback (using smartphones and clickers). Shute (2008) defined formative feedback as "information communicated to the learner that is intended to

modify his or her thinking or behavior to improve learning' (p. 153). In mobile learning, formative feedback comprises information like a message or display presented to the learner following the learner's input on a mobile device with the purpose of shaping the actions of the learner (Shute, 2008). In a mixed methods study to evaluate students perceptions about clickers as instructional tools to promote active learning, Oigara and Keengwe (2011) interviewed, surveyed and collected grades from 24 undergraduate students at the end of a fifteen week Geography course. The results of the study showed that students were satisfied with clickers and recommended their use in other courses. The students' participation and engagement in class lectures was also enhanced. Though in a higher education setting, the study's findings could be applied in a high school setting. The authors concluded that clickers promoted student engagement in the teaching and learning process.

Simulations. According to Banks, Carson, Nelson, and Nicol (2001), simulations are the imitation of the operation of a real-world process or system over time. Simulations are usually animated, interactive, and game-like environments where students learn through exploration (phet.colorado.edu). The Physics Education Technology (PhET) website has a collection of over 100 free active simulations for teaching and learning K-12 science. In a qualitative study of 80 fourth to eighth graders and four teachers, Perkins, Moore, Podolefsky, Lancaster, Denison, Rebello, and Singh (2012), explored the effectiveness of the simulations design to provide insights into how students in this age group learn from simulations. Through interviews and observations, Perkins et al. (2012) noted that simulations were an effective learning tool for middle

school students. Having them access these simulations at home or in their own time using mobile devices increased their engagement and interest in science.

      Note taking and collecting scientific field data. Research has shown that mobile photo note-taking has positive effects on EFL learning, particularly in memorizing and retaining English vocabulary (Anzai, 2013), in recording and documenting course content for teachers, taking pictures and storing them as notes for later use, staying connected and organized (Pegrum, Howitt, & Striepe, 2013). Pegrum, Howitt, and Striepe carried out eight case studies of pre-service teachers, using semi-structured interviews and non-participant observations to determine how the teachers used the iPad 2 in their learning. The findings indicated that iPads supported pre-service teachers learning by helping them understand content and pedagogy better. By having access to websites, they could easily use for research, stay connected with their course mates, coursework, and professors, and be better organized with their studies.

      Research has also shown that in the K-12 setting, teachers are using mobile devices to collect and analyze scientific data. In a case study carried out between 2012 and 2013, Huffling, Tomasek, Matthews, Benavides, Carlone, and Hegedus (2014) had 143 high school students use android MP3 mobile devices to record data for ongoing scientific investigations and to communicate and share findings with their classmates. In this study, students worked with ecologists and science educators for six field ecology studies (semiaquatic turtles, box turtles, frogs, lizards, salamanders, and snakes) with a focus on collecting data to help monitor local amphibian and reptile populations in North Carolina. Huffling et al. reported that the students' eagerly participated in data collection

and analysis because of the mobile devices which were equipped with WiFi capabilities, front and rear-facing cameras, and access to a statewide database where they could input the data they collected. Some of the student responses included: "It was very easy to input data, and it made me feel like I was actually a scientist" (Huffling et al., 2014, p. 37) and "filling in data electronically was very interesting because I got to experience something that scientists actually do once they capture an animal" (Huffling et al., 2014, p. 37). Huffling et al. concluded that using mobile devices made data collection more current, authentic, efficient, and engaging even though data collection was usually regarded as one of the least engaging aspects in previous investigations. There is therefore a need to explore the benefits of mobile learning in the K-12 science and other disciplines.

Benefits of Mobile Learning Integration

Mobile technologies have been used by many teachers in the past decade in the classroom and the teachers who have adopted them have recorded that mobile technologies increase student engagement and motivation, and also support teachers in the instructional process (Kobayashi & Reychav, 2014). Elias (2011) explored the benefits of mobile learning in the K-12 setting. They identified interactivity, multimedia content delivery, creation options, low cost of mobile devices with the potential of very rewarding learning experiences, and improved levels of literacy as the benefits of mobile learning. These researchers noted that even though mobile devices are mostly used for communication, mobile learning has changed the way students learn and subsequently the

way teachers are teaching. Literature about more ways in which mobile learning has benefited the K-12 environment is discussed below.

Mobile learning technologies increase student engagement. According to the Glossary of Education reform, student engagement refers to "the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their educations" (edglossary.org, 2014). Research has shown that student engagement can be seen through different perspectives (Zepke & Leach, 2010), student motivation (Schuetz, 2008), students' social and economic background (Pascarella & Terenzini, 2005), institutional support (Kuh et al., 2006), peer interaction (Moran & Gonyea, 2003), and teacher behavior (Bryson & Hand, 2007).

Furthermore, research has shown that mobile learning has the potential of facilitating student engagement in the classroom. For example, Milman, Carlson-Bancroft and Vanden- Boogart (2012) conducted a mixed methods case study to examine the implementation of one-to-one iPads in pre K-4th grade classes. In this study, seven teachers and 10 students from different grade levels were observed and interviewed, and teachers completed a survey afterwards about the implementation, use of, and perceived impact of iPads in the classroom. The findings of the study showed that when teachers used the iPad during lessons, high levels of student engagement in learning were recorded. This was evident when students remained absorbed in writing or drawing on the iPad after the lesson was over.

Henderson and Yeow (2012) conducted a case study in a primary and intermediate school located in Auckland, New Zealand, one of the earliest adopters of the iPad as an educational tool in the classroom. The findings from semi-structured interviews with teachers and IT staff suggested that the iPad's main strengths are the way in which it provides quick and easy access to information for students and the support it provides for collaboration. Henderson and Yeow also noted that that student engagement increased when learning with iPads because iPads have display screens similar in size to that of a story book. Henderson and Yeow concluded that that iPads benefited teachers by giving feedback in real time, thereby encouraging student engagement as well as reducing distraction from tasks.

In a pilot project by Chou, Block and Jesness (2012), teachers were put in a focus group and asked questions about how mobile devices engaged their students. The findings indicated that mobile technology helped the teachers keep the students engaged throughout the class period. Teachers also reported that they had students play games to prepare for final tests leading to improved test scores as compared to previous test scores when they did not use mobile devices to prepare for tests. The study also reported that teachers used apps to engage students in activities in which they would normally be distracted. Teachers reported that they could use apps with updated subject content to engage students in discussions and enhance participation.

In a single case study of teachers using mobile devices in the elementary classroom, Ciampa and Gallagher (2013) found out that students' motivation and engagement in learning activities were improved by their use of iPods, which also

resulted in increased student productivity. In addition, Ciampa and Gallagher observed that the iPods made both quiet and inattentive students to become engaged and focused in classroom activities. In this study, parents also believed that the experience of using informative iPod Touch apps had several motivational features that sustained student attention and facilitated learning.

Swan, Hooft, Kratcoski, and Unger (2005) carried out a mixed methods study on the uses and effects of mobile computing devices on students' motivation to learn, engagement in learning activities, and support of learning processes in K-8 classrooms in Northeast Ohio. Some of the mobile computing devices used in the study were handheld computers, digital cameras, scientific probes, and wireless writing pads. The findings of the study suggested that students had an increased motivation to learn due to mobile device use which further led to an increase in the quality and quantity of student work. This was evident by students completing and submitting mobile computer assignments on time, "something they never did before with paper and pencil assignments" (Swan et al., 2005, p.105). Swan et al. concluded that elementary and middle school students benefited from mobile computing devices in a variety of ways like note taking, drawing, and writing assignments both inside and outside the classroom. Most of all mobile computing devices have the potential to personalize learning and improve the overall teaching and learning process.

From the above analysis of some relevant literature which included a pilot study with a focus group, a single case study, a mixed methods study, and a TV news interview about how mobile learning benefits the teaching and learning process by improving

students engagement, it is evident that there is lack of quality research on the integration of mobile devices and their benefits in the K-12 learning environment. From the review of literature on how mobile learning increases student engagement, mobile learning seems to increase students motivation to learn, improve peer to peer collaboration and even facilitate the teaching process for teachers.

Using mobile learning technologies for teacher support. Mobile technologies can be used in classrooms to assist the everyday activities of a teacher. Leach, Power, Thomas, Fadani, and Mbebe (2005) conducted a case study of some teachers in a primary school in Cape Town, South Africa, who used handheld computers in their teaching as part of the Digital Education Enhancement Project (DEEP). The study was aimed at finding out the benefits of using handheld computers in the professional development process and professional practices. The findings of the study suggested that handheld mobile computers supported teachers with performing personal tasks like maintaining an address book or a journal. This made teachers to be more flexible with using handheld computer devices for instructional purposes (Leach et al., 2005).

Mobile devices like smartphones can help support instruction when used to collect data for assessments and real time feedback from students (Fritschi & Wolf, 2012). Fritschi and Wolf's mixed methods study including interviews and a survey of 24 teachers in 16 different states in the US noted that, teachers who were familiar and comfortable with using mobile devices in their classroom were more likely to embrace their use for instructional purposes. Fritschi and Wolf found out that those teachers who used mobile devices like smartphones for carrying out personal tasks were more

successful in planning instruction and collecting resources using mobile technology than teachers who did not. It is important to note that the literature on mobile learning explored by Fritschi and Wolf focused on the goal of having students' learn to succeed in the real world rather than on the technology that was used to achieve the goal.

Mobile learning technologies for classroom support. Mobile devices are loaded with features and tools that can assist in instruction in primary content areas (Banister, Reinhart, & Ross, 2014). Maher (2013) carried out a qualitative case study of 16 elementary pre-service teachers' use of the iPad during their student teaching. Through data gathered from participant journals, focus groups, and staff interviews, Maher found out that teachers used a variety of apps as well as inbuilt features of the iPad to support the learning of Mathematics, English, Drama, Human Society and its Environment (Geography, History, Environmental studies), Art, and Physical Education. For example, Maher noted that pre-service teachers supported using features of the iPad like the camera to capture evidence of learning as well as for providing real time feedback to students during excursions, and apps like Flashcards, Futabla, and Puppet Pals to support English as a Second Language (ESL) learners, Show me, Virtual Die, and Songify to teach Mathematics. Maher concluded that iPads and the apps are very beneficial for teaching elementary lessons. In addition, iPads can be used to support even non-teaching activities in the classroom like assessments and self-reflection. However, introducing iPads or any other mobile device in teaching requires careful planning.

Mobile learning technologies enhance communication. Mobile technology can assist teachers when it comes to communicating with parents, students, and other

teachers/colleagues (Fritschi & Wolf, 2012). The use of mobile devices in two schools in the United States discussed below has shown that mobile devices like smartphones phones can assist teachers to better communicate with their students. For example, at Sacred Heart Cathedral Preparatory in San Francisco, teachers have used text messages to gain students attention and engage them during class lessons (Sacred Heart Cathedral Preparatory website, 2014). Teachers at this school use Remind 101, a free text messaging mobile application to communicate with parents and students in a safe environment. Mobile devices have also been used to elicit feedback from parents (Fritschi and Wolf, 2012). In a practical example, Fritschi and Wolf (2012) reported that at Shelby County Schools in Alabama, teachers send emails to parents which include a link to a website where they can respond to a survey designed by the district using the Poll Everywhere Application, which is a customized audience response system for mobile devices.

Rau, Gao, and Wu (2008) studied student-teacher communication in high school students and found that using mobile communications technology was motivating to the learner. Rau, Gao, and Wu noted that combining mobile communication with Internet based protocols could be positive, although, caution should be used if the teacher requires public expression (as compared to individual communication with the instructor).

Mobile learning using QR codes helps students find information quickly. QR (quick response) codes are "two dimensional images that when scanned by a smartphone's camera, prompt the smart phone to open a web-page or display an image, video, or text" (Coleman, 2011, p. 1). In an experimental study by Hung et al. (2014), QR

codes were used to help students identify plants quickly in their school yard using

smartphones. Students who did not have smartphones had a harder time identifying plants

as compared to students who had smartphones. The results of the study suggested that

QR codes provided a learning system for elementary students to explore life science

topics in an engaging and motivating way outside the traditional classroom. In addition,

Tucker (2011) noted that QR codes have real potential to enhance communication in

schools like in North Carolina's Guilford County Schools, where QR codes are built-in to

the school district's website to provide parents with links to athletic schedules, parent-

teacher conference information, registration deadlines, staff directories, weather-related

announcements and school lunch menus.

Mobile learning encourages collaboration between and among teachers and

students. In a 2012, the United Nations Educational Scientific and Cultural Organization

(UNESCO) carried out an in-depth literature review, interviews with educational leaders

at the national, state/provincial, and local levels, and an email survey about exploring the

potential of mobile technologies to support teachers and their instructional practice. One

of the findings of the study was that teachers rarely collaborated with their peers or other

teachers in their school district. In a similar report, Wei et al. (2010) noted that teachers

in the United States reported an average of 2.7 hours per week of collaboration, while

only 16% acknowledged working together with other staff members in their schools. This

statistic suggests that there is not very much collaboration among teachers in K-12

education. Research however has shown that when teachers work together or collaborate

with one another they can easily identify student learning needs and share, review, and

provide feedback on instructional practices that address these needs (Goddard, Goddard & Tschannen-Moran, 2007; Gray, 2011).

In a study of fourth-grade students and teachers in a large urban school district located in the Midwestern United States, Goddard, Goddard, and Tschannen-Moran, (2007) found out that the students displayed higher achievement in mathematics and reading when they attended schools characterized by higher levels of teacher collaboration with mobile devices. Goddard, Goddard and Tschannen-Moran noted that teacher collaboration using mobile devices could improve instruction and build expertise. In addition, constant collaboration between teachers and students could improve classroom instruction opportunities that promote honest feedback and commitment. With mobile technology, collaboration is enhanced as educators can easily share content and experiences (Fritschi and Wolf, 2012).

Mobile learning makes assessment of student work easier. Mobile technology can also help teachers in the assessment of their students work. For example, in a qualitative study of 12 high school students, Backer (2010) reported that using smartphones as assessment tools was helpful to students who had experience; however, not all students were capable of using their smartphones to do the assessment. However, students' motivation to learn independently was increased and their sense of responsibility improved when they used the smartphone for assessment. The study did not look into teachers' experiences when they implemented technology for the first time and how this could have impacted students' experiences. In another study, Ciampa and Gallagher (2013) used the iPod Touch as a formative assessment tool and to identify

students who needed more one-on-one time with the teacher. The results showed that teachers were better equipped and able to identify students who needed help using the Poll results from the iPod than when they did not have a mobile device.

Similarly, in a pilot project at Gilford County Schools in North Carolina, a seventh-grade mathem teacher used a tablet issued by the State Department of Education to demonstrate new concepts and ideas and to do spot quizzes. According to the teacher, she was able to immediately assess "who does not get it" and used the tablet as a tool to drive instruction (Guilford County School Website, 2014). Burden et al. (2012) conducted another study that integrated iPads in the classroom to encourage in-service teachers to explore alternative activities and forms of assessment for learning. The results showed that teachers became more organized during formative and summative assessments since they could monitor students' progress and enter the information on an already designed system.

From the review of literature, it is evident that mobile learning is beneficial to the K-12 learning environment as it increases student engagement, provides teacher and classroom support, makes assessment easier and encourages collaboration among teachers and students for an overall better learning experience. However, not much empirical research is being recorded about actual benefits in real classroom situations. Most of the studies are pilot studies or case studies which cannot be generalized. It is therefore important to systematically explore mobile learning benefits in real classroom conditions.

Challenges of Mobile Learning Integration

Using mobile technology in the classroom has shown some benefits, but some legitimate concerns have been raised. Although there are currently no federal or state laws that prohibit using mobile devices in the classroom or for learning, many schools have policies which prohibit students from bringing them to school. Most teachers do not give a thought to the use of mobile devices, let alone integrating them in classroom instruction (Moeller & Reitzes, 2011). Consequently, teachers often assume they cannot and should not consider these devices as learning tools (Lin et al., 2012). Most students today are technology savvy and teachers now face unique challenges and opportunities in their teaching (Lin et al., 2012). Some teachers' have regarded the presence of mobile devices in the classroom as a limiting factor to meaningful learning (Aquino, 2014). For meaningful learning to happen, learners have to be constructive, active, cooperative, intentional, and working on authentic tasks (Jonnassen, Howland, Moore, & Marra, 2004). When this does not happen in a classroom that has integrated mobile learning, challenges are bound to arise. Some challenges of mobile learning that have been raised in literature are explored in this section of the literature review. The challenges are divided into two groups; technical challenges and social and educational challenges.

Technical challenges of mobile learning. Integrating m-learning effectively in the K-12 classroom can be challenging from the technical point of view for a number of reasons. Some of these technical challenges recorded in literature are briefly discussed below.

Small screen and keyboard size. Maniar, Bennett, Hand and Allan (2008)
reported an experimental study of 45 students on the effects of screen-size on video-
based mobile learning. The study was aimed at exploring the effect of screen size on the
learner' subjective opinion of mobile learning. To explore this, each participant watched
a five minutes educational video (about industrial economics) on their allocated mobile
device. The findings indicated that regardless of the screen size of a mobile phone,
students tended to have a positive overall opinion of mobile learning and watching the
video significantly increased their knowledge of the subject area. However, Maniar et al.
found out that when the mobile learning environment relied heavily on video based
material displayed on a mobile device with a small screen, such as an average mobile
phone, then the effectiveness of the learning experience could be inhibited. Elias (2011),
in an article on the instructional design principles of mobile learning pointed to small
screen sizes with poor resolutions, color, and contrast as some of the challenges teachers
encounter with designing effective instruction.

In another experimental study, Kim (2014) explored the psychological effects of
screen size on smartphones acceptance in the classroom. The study had 130 participants
who were high school students. Kim (2014) used the Technology Acceptance Model
(TAM) to compare students using large smartphones screens (5.3 inches) and those using
small smartphone screens (3.7 inches). The results showed that a large screen, compared
to a small screen, was likely to lead to higher smartphone acceptance since the
smartphones with larger screens had better quality. This positively influenced the
perceived ease of use of and attitude toward using mobile devices for learning.

Limited connectivity and the inability to access the internet. Barbour, Quinn, and Eye (2014) conducted a case study of six 10-12 grades students enrolled in an Advanced Placement European History course, offered by a statewide, supplemental virtual school in the Midwest. The students were directed to use their cellphones to access the Mobl21 app as part of their History lesson. Only two of the six students could access this app on their cellphones because they did not have access to the internet. The teacher then had them use a desktop computer. The results of the study showed that students had a negative perception of using their smartphones for learning and the teacher had a difficult time implementing the planned lesson. The results of this study cannot be generalized because it was a case study. However, more empirical research studies have pointed to the inability to access the internet on mobile devices as a challenge to mobile learning integration (Ting, 2012; Palalas, Berezin, Kramer, Appiah, & Gunawardena, 2014).

Social and educational challenges of mobile learning. Some mobile learning challenges are linked to social aspects of life such as cheating by texting answers, taking pictures of tests and looking up answers from the internet while other mobile learning challenges apply generally to education. For example, some national, regional, district, and institutional rules strictly prohibit the use of mobile devices in schools. Such educational policies effectively forbid educators from engaging with mobile learning and, as a consequence, hinder potential educational innovations (UNESCO, 2012). It should be noted, however, that none of these challenges are too great to be overcome. Many strategies already exist, or are currently being developed, to maximize the educational benefits of mobile devices while still ensuring equity and safety for all users.

Limited time to plan instruction. Research suggests that some teachers complain about not having enough time to plan the integration of mobile devices in their classrooms. For example, in a case study of the potentials of the iPod touch use for K-12 English Language Learners (ELL) in the United States, Liu, Navarrette and Wivagg (2014) surveyed, interviewed, and observed four ELL middle school teachers and their students for the first and second cycle of the 2010 and 2012 school years respectively. The aim of the study was to find out the experience and perceptions of teachers and students toward of the use of iPod touch. The result of the study showed that the iPod touch supported language and content learning, provided differentiated instructional support, and extended learning time from classroom to home. Liu, Navarrette and Wivagg however, identified some challenges to implementing the iPod touch, specifically the great amount of time needed by the teachers to prepare for lessons that require the use of the device. In addition, the teachers reported that they needed more professional training to effectively integrate the device with dedicated support staff to assist them when they had technical problems. Liu, Navarrette and Wivagg also noted that while teachers recognized the benefits of training, it was an increase to their regular workload. The teachers pointed out that some students had difficulties using the camera function while others avoided teacher-managed settings. Consequently, teachers were faced with the challenge of properly monitoring student use while supporting mobile device use in the K-12 learning environment.

Personal comfort level. In a survey study carried out in 2012 by the Bill and Melinda Gates Foundation of 401 grade 6-12 teachers in the United States about the

existing barriers that prevent or deter teachers from using technology in the classroom, 62% of teachers reported that personal comfort level was one of the "biggest barriers to incorporating technology into their teaching." (p. 2). From this analysis of teacher attitudes and beliefs about mobile learning, it is important therefore for this study to examine more closely the beliefs and attitudes of teachers as concerns integrating mobile learning in the K-12 environment.

   Distractions, multitasking, and inappropriate use. Many K-12 schools in the United States have banned the use of cellphones on campus with the major reason that they present a distraction to students, and interfere with both classroom time and study time. For instance, in a quantitative study by End, Worthman, Mathews, and Wetterau (2010), 71 students were asked to view an educational video, take notes, and take a short quiz afterwards. The students who were randomly assigned to video viewings which were interrupted by the ringing of a cell phone performed significantly worse on the quiz compared to students who did not experience that distraction. Campbell and Russo (2003) also reported findings that mobile phone use in college classrooms was particularly appalling and that students frequently complained about the distraction of phones ringing during class time.

   Multitasking is also a concern when integrating mobile learning in K-12 classrooms. Research indicates that attempting to attend to more than one task at a time can be challenging for human reasoning (Marois & Ivanoff, 2005). However, most K-12 learners report considerable multitasking involving media, such as listening to music while doing homework, or sending/receiving text messages while studying (Roberts,

Foehr, & Rideout, 2005). Ophir, Nass, and Wagner (2009) conducted a series of

experiments with 19 high school students to address whether there are systematic

differences in information processing styles between chronically heavy and light media

multitaskers. The results indicated that heavy multitaskers performed worse when trying

to switch tasks compared to those who did not often multitask, apparently because they

were less able to filter out irrelevant stimuli (Ophir, Nass, & Wagner, 2009).

Lack of digital citizenship. In addition to distractions and multitasking,

inappropriate use of mobile devices in K-12 educational settings pose a challenge to

effective mobile learning integration. Inappropriate behaviors like cyberbullying,

"bullying using mobile phones and the internet" (Smith et al., 2008, p. 376), access to

inappropriate web sites outside the control of the school's filtering software, and also

excessive texting. For instance, in a survey study of 533 secondary school students from

five schools in the United Kingdom, Smith et al. reported that phone call and text

message bullying were prevalent and had an emotional toll on students.

Increasingly, schools are reporting misuse of digital content in the form of

plagiarism, cheating using a cell phone on tests, YouTube videos of unauthorized

recordings, and cyberbullying of students though the use of email, social networking sites

like Facebook, and text messaging. With the availability of the Internet, mobile devices,

and a digital native population in most school districts, a critical need appears for an

understanding of what it means to be a digital citizen.

Cheating by texting answers, taking pictures of tests and looking up answers

from the internet. In a qualitative study on digital cheating and plagiarism among middle

school students, Ma, Lu, Turner, and Wan (2007) used multiple focus groups and interviews to verify why students cheat. The study found that peer pressure was the main factor that motivated students to cheat using digital devices. The findings also indicated that activities that are engaging and relevant to students' own interests can help reduce cheating. In an attempt to avoid cheating, some schools have banned the use of mobile devices like cellphones during school hours. For example, Putnam High School in Granville, Illinois has banned the use of cellphones during school hours to avoid cheating in exams (Putnam County High School Website, 2014). The banning of cell phones or other mobile devices is one of the greatest challenges to mobile learning integration.

Overcoming the Challenges of Mobile Learning

Some teachers are very tech savvy especially with mobile devices. As a result they are comfortable integrating mobile devices into lessons while other teachers regard mobile devices as being out of their comfort zone, as a result they avoid integrating them into their teaching. Mobile learning is beset with challenges but the benefits outweigh the challenges. Research and some educators have suggested ways of overcoming the challenges of mobile learning.

Professional development for mobile learning. As the literature review suggests, mobile learning has the potential to offer great opportunities for teachers in K-12 education (Wiley, 2012). Professional development geared towards using mobile technologies for instruction can help teachers increase student achievement and better meet the students' needs (Hwang, 2012). With careful planning and implementation,

school districts can develop technology training programs for in-service teachers to create awareness of the benefits of integrating mobile learning in their classroom instruction.

To ensure that teachers receive the assistance they need to unlock the potential and effective integration of mobile technologies in the classroom, some frameworks have been suggested to help teachers evaluate the process. In the state of Idaho for example, the SAMR model by Puentedura (2009) has been adopted by some school districts (Idaho State Department of Education, 2014). SAMR stands for Substitution, Augmentation, Modification and Redefinition. The SAMR model holds that technology like a mobile device can be used in learning activities in the following ways:

Substitution. Mobile device acts as a tool substitute, with no functional change.

Augmentation. Mobile device acts as a direct tool substitute, with functional improvement.

Modifications: Mobile device allows for significant task redesign.

Redefinition: mobile devices allows for the creation of new tasks previously inconceivable (Puentedura, 2009).

Hockly (2013) described English Language Teachers' incorporation of mobile learning using the SAMR model. In this case study, nine participants used cellphones to learn English. The purpose of the study was to use the SAMR model to evaluate the effectiveness of learning English using a mobile device. Hockly, used a mobile learning task that involved Substitution by giving learners short dictations which they wrote down as Short Messaging System text messages or on a note-taking function on their cellphones instead of writing them down using a pen or pencil. In this example, the

teachers substituted a cellphone for pen and paper; the dictated texts could be saved and

shared electronically. In a mobile learning task that involved Augmentation, the students

created short stories using the text option which they uploaded to a blog for others to

comment on. This added a level of what Hockly called functional improvement and

enhancement. With the modification stage, the learners worked in groups using their

mobile phones to prepare a video presentation. This allowed them to practice with one

another, and edit their final product together. This gave the learners a chance to work on

their language skills hence a better performance. Finally, with redefinition, the cellphones

were used to create a completely new task. Hockly used a global positioning system

(GPS) to find locations outside school which led to students having a virtual field trip

experience. The results of the study suggested that the SAMR model was an effective

framework for scaffolding the integration of mobile learning in the classroom. Through

the SAMR framework, teachers can assess and evaluate the effective use of mobile

technology in the classroom. The classroom activities outlined above suggest a certain

amount of knowledge with mobile devices on the part of teachers and learners. It is

therefore important that teachers and learners be mobile literate.

Teachers need to identify appropriate mobile technology tools for learning.

In a study of teacher perceptions of instructional technology integration, Gorder (2008)

reported that teachers who used technology regularly in their classroom had greater

satisfaction in the results of their instruction. This suggests that teachers who integrate

digital devices will find it beneficial in the long run (Gorder, 2008). For example,

Murphrey, Miller, and Roberts (2009) randomly surveyed 310 agricultural science and

technology teachers in Texas to establish baseline data regarding the adoption of iPods and similar technologies in their classrooms. Murphrey et al. reported that while agricultural science and technology teachers have knowledge of iPods, Mp3 players and related technologies, there was little support for them to actually create their own podcasts, use them in the classroom, or promote them for student use. However, teachers who utilized iPods and Mp3 players in their classrooms said the devices were helpful in areas such as homework support and organization of content. Murphrey et al. concluded that teachers were generally "late adopters" or "laggards," while students were "innovators" or "early adopters" of mobile technology. Some of the teachers reported strong interest in pre-produced curricula and FFA materials, particularly for training materials for career development events, which could be used on iPods or Mp3 players. The study however focused on just agricultural science and technology teachers. It will be interesting to find out what teachers of other K-12 subject areas think about adopting mobile devices in their classrooms.

On the other hand, Palak and Walls (2009) pointed out that the most significant predictor of technology use in the classroom was the teachers' attitude towards technology. Palak and Walls (2009) recommended that teachers be taught more about how to effectively integrate technology into their classrooms to ensure that students come first rather than concentrating on training teachers to use a specific device. Similarly, in their study of secondary mathematics teachers use of technology in their classrooms, Goos and Benninson (2008) established that, "Teachers' own perceptions of their professional development needs in this area (mathematics) centered on finding enough

time and getting enough help from colleagues so they could explore planning and pedagogy to integrate technology into their everyday classroom practice" (p. 127).

More and more schools are moving toward mobile learning in the classroom as a way to take advantage of a new trend of electronic devices that offer portability and ease of use on a budget. The ban on mobile devices maybe a passing trend. IPads, smartphones and tablets are increasingly becoming the tools of choice for today's educators (Chen & Denoyelles, 2013). Mobile learning technologies can offer teachers and students a more flexible approach to learning. Students always seem to love the computer labs (Chen & Denoyelles, 2013). But imagine them having these computers as learning tools in the formal classroom, in the school hallway, while they are working out, and on field trips? The teacher therefore needs to have the technological knowledge on how these devices can be applied to teaching students (Koehler and Mishra, 2009).

The need for awareness in mobile digital citizenship in high school classrooms. Digital citizenship is defined "as the norms of appropriate, responsible behavior with regard to technology use" (Ribble & Bailey, 2007, p. 7). In 2010, Ribble and Bailey redefined digital citizenship referring to it as "a concept, which helps teachers, technology leaders, and parents to understand what students/children/technology users should know to use technology appropriately" (p. 1). Ribble and Bailey went on to explain that "it is a way to prepare students, children, and technology users for a society full of technology" (p. 1).

Ribble and Bailey (2007) wrote lengthily on the nine elements that lead to the "visa to digital citizenship": etiquette, communication, education, access, commerce,

responsibility, rights, safety, and security. It is important to note that the word "visa" is synonymous to the word "permit" or "pass," which implies that students should be taught about digital citizenship before they start learning with mobile devices or with devices that are connected to the Internet. For example, Ribble and Bailey viewed students who use their cellphones to send non-class-related messages back and forth during a class lesson as lacking digital etiquette. They believed that educators should inspire students to use technology in a responsible way to avoid misusing privileges. For each of the nine elements, Ribble and Bailey, suggested appropriate strategies teachers could use in the classroom to ensure proper use of mobile technology.

Hollandsworth, Dowdy, and Donovan (2011) noted that the "lack of digital citizenship awareness and education can, and has, led to problematic, even dangerous student conduct" (p. 37). If students need to use mobile technology effectively as a learning tool, they need to be taught how to use the technology tool appropriately. Ribble (2010) called this learning process "digital literacy" when everyone spends time learning about technology before using it. Teachers need to provide a good example by displaying appropriate and responsible behavior when using mobile devices themselves. Among the characteristics of appropriate and responsible behavior are the social, ethical, and legal issues associated with students' use of mobile technology.

In a quantitative study by Hollandsworth, Dowdy, and Donovan (2011), 500 practicing library media specialists were asked if teachers and administrators in their districts were aware of and taught about digital citizenship issues. The respondents rated their level of awareness from very aware of digital citizenship issues to no awareness.

The results indicated that about half of the respondents believed teachers were aware of digital citizenship issues (49.4%), while 8.2% thought teachers were very aware of these issues. About a third (35%) believed that some teachers were aware of digital citizenship issues but that most teachers were not. Only 7% of media specialists responded that teachers were not aware of these issues.

When it came to administrators, the respondents rated them somewhat higher than teachers with 55% indicating that administrators were aware of digital citizenship issues and 20% indicating that their administrators possessed higher levels of awareness of issues surrounding digital citizenship. If the perceptions of the media specialists are correct, the results suggest that the knowledge of digital citizenship issues is not universal, and that more administrators seem to have a greater attentiveness toward digital citizenship concerns than many teachers. Teachers are expected to act as role models to the students to ensure effective transitioning to mobile learning digital citizenship yet they may have less knowledge about the issues (Hollandsworth, Dowdy, & Donovan, 2011).

In another quantitative study by Hollandsworth, Dowdy, and Donovan (2011), reported in the same article respondents from 14 states were asked what specific digital citizenship skills were taught to their students. Their responses indicated that less than half of the school districts surveyed taught their students about digital citizenship skills like avoiding plagiarism, preventing cyberbullying, respecting copyrights, using appropriate cellphone etiquette, and evaluating electronic information. The results surprisingly indicated that while these skills are taught in some of these schools, they are

not included in the state standards. Hollandsworth et al., suggested that digital citizenship

skills be included and taught in the K-12 setting to encourage teachers to integrate mobile

learning in their classrooms. Similarly, O'Brien's (2010) article about creating better

digital citizens noted that:

> If digital citizenship is to become part of our school as well as part of our daily
>
> lives, and educators are to take on the responsibility to help our young people to
>
> know right from wrong and appropriate from inappropriate in the 21st century
>
> digital world, it seems essential that a concerted national K-12 approach is
>
> needed. (p. 2)

This comment made back in 2010 suggested that schools needed to have a universal

approach of meeting the needs of the digital revolution.

Literature Review Summary

This literature review has covered information and past research on mobile

learning from the perspective of the teachers, although some of the research also

addressed the learners' perspective. The review of literature indicates that there are still

research gaps to be addressed. One of these is the lack of agreement in the definition of

mobile learning that has persisted among researchers since the year 2000. In addition,

there is still a lack of empirical and systematic research on the technological,

pedagogical, and content-based aspects of mobile learning integration in K-12 schools, in

spite of the large number of pilot projects and case studies. Numerous, challenges and

benefits have been noted from previous publications, but mobile learning keeps changing

which gives birth to new strategies, benefits and challenges. This study will address these

strategies, benefits, and challenges, as well as practices that could help overcome the

challenges and strengthen the benefits. The literature review also explored some mobile

learning strategies for effective mobile learning integration suggested by researchers. A

review of these pedagogies indicates that they cannot be applied to all teaching practices

because of the variation among mobile technologies being used. Finally, mobile digital

citizenship is explored as an important aspect of overcoming the challenges of integrating

mobile learning in the high school learning environment. These five areas in which

research gaps have been identified (definition, mobile learning integration, benefits,

challenges, and overcoming the challenges of mobile learning) are to be addressed by the

current study.

CHAPTER III

Methodology

As stated in Chapter 1, the purpose of this explanatory study was to examine high school teachers' experiences with integrating mobile devices like iPads, smartphones, Chromebooks, and tablets, in teaching. According to Elizabeth Crawford, an educational marketing strategist at Intel, in the United States, "Schools are definitely adopting mobile technology for students across the board" (Chambers, 2014, p. 1). More teachers find themselves using mobile technologies in their classrooms for teaching, thus impacting how students learn today. This study is designed to answer questions about (a) how high school teachers define mobile learning (b) their experiences (past and present) with mobile technology integration in the classroom (c) the benefits and challenges of using mobile devices, and (d) effective integration strategies for teaching and learning with mobile devices in the classroom.

This chapter on methodology summarizes the research design, sampling procedures, data collection, and data analysis used to investigate high school teachers' experiences in integrating mobile devices in the classroom.

Five research questions guided the study; the discussion of methodology indicates which procedures and data set address each question.

1. How do high school in-service teachers define mobile learning?

2. What do high school teachers regard as effective strategies for mobile learning integration?

3. What do high school in-service teachers regard as the benefits of mobile learning in the classroom?

4. What do high school teachers regard as significant challenges of mobile learning in the classroom?

5. How can in-service teachers overcome the challenges of mobile learning?

6. What are the experiences of high school teachers with mobile learning integration in their classrooms?

Research Design

Mixed-methods sequential explanatory design. The nature of the research questions for this study required both qualitative and quantitative methods. This implied using a mixed methods design. Mixed methods is "a procedure for collecting, analyzing, and integrating both quantitative and qualitative data at some stage in the research process within a single study for the purpose of gaining a better understanding of the research problem" (Ivankova, Creswell, & Sheldon, 2006, p. 30). The reason for using both types of data was rooted in the fact that neither quantitative nor qualitative methods were sufficient by themselves to answer the research questions. A mixed-methods sequential explanatory design was proposed for this study. A mixed-methods sequential explanatory design is a research procedure with the primary purpose of obtaining qualitative data (text) to expand and enrich initial quantitative results (numeric) (Ivankova, Creswell, & Sheldon, 2006). This design was also well suited for this study because the researcher used quantitative participant characteristics to guide purposeful sampling for the qualitative phase of the study. The procedure was done in two phases:

Quantitative Phase One.

Phase one involved the collection of quantitative descriptive data using a survey instrument (questionnaire) that consisted of both closed-ended questions and an open-ended question. Descriptive studies often use surveys to collect data about a population by gathering information about opinions, attitudes, characteristics, practices, and demographic information (Gall, Borg, & Gall, 2007). The quantitative data and their subsequent analysis provided an overall understanding of the research problem. A major goal of the quantitative phase was to identify teachers who were actively and successfully using mobile learning in their classrooms, from whom would be selected participants for Phase Two.

Participants. The inclusion criteria for selecting the participants for the quantitative phase one included high school teachers in the state of Idaho and Wyoming. This was done by selecting a convenience sample. Convenience sampling involved selecting a sample that suited the purpose of the study (Gall, Gall, & Borg, 2010). For example of the 1000 survey invitations that were emailed, the researchers was only interested in achieving a sample size of greater than 100 who would take part in the research and eight participants who will be selected for interviews. As such, the researcher continued to invite high school teachers in Idaho and Wyoming to take part in the research until the sample size was reached. The researcher collected data from 60 high school teachers in Idaho and 18 teachers in Wyoming. Twenty five teachers did not indicate their state. These states were selected by the researcher because of their

proximity to each other -all located in the intermountain west. Participants' email addresses were collected from their school district websites and used to forward the survey link. The researcher first contacted the district superintendents' to introduce the study and get their consent to forward the survey to their teachers. Contacting superintendents may have also helped to increase the response rate for the survey. All teachers who participated in the study had integrated mobile learning in their teaching in their classroom.

Instrument. The survey was administered in phase one of the study. Gall, Gall and Borg (2010) refer to a survey as a "method of data collection using questionnaires to collect data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized" (p. 230). This sample population represents high school teachers in both rural and urban school districts in Idaho and Wyoming. For the purpose of this study, the researcher designed an online survey instrument. The survey instrument had seven sections comprising: demographics, defining mobile learning, mobile learning integration, effective mobile learning strategies, benefits, challenges of mobile learning and overcoming the challenges of mobile learning. The online survey contained 18 questions (see Appendix A): Section I contains eight closed-ended demographic questions; Section II had one open ended question about defining mobile learning; section III had five close-ended questions about mobile learning integration; Section IV contained one Likert scale type question with seven statements about the benefits of mobile learning; Section V had one Likert scale type question with eight statements about the challenges of mobile learning; and Section

VI had one Likert scale type question with four statements about overcoming the challenges of mobile learning. Section VII of the survey asked the respondents whether they were willing to participate in the interview. The closed-ended questions (Section I and III) were formatted as check boxes; most of these questions allowed only a single response, but some (such as the question on "subject taught") allowed multiple responses. The open-ended question on defining mobile learning (Section II) was formatted as a text box, with 150 number of words available for the response. The Likert scale type questions (Sections III, IV, V, and VI) provided a five point scale, from Strongly Disagree (1) to Strongly Agree (5), with Uncertain in the middle (3). The numeric values that were assigned to the present responses on Likert-scale questions allowed the researcher to quantitatively analyze the data. The open-ended question helped the researcher collect the range of definitions of mobile learning.

Strengthening the validity and reliability of the survey instrument. This dissertation focused on using both quantitative and qualitative analysis and a triangulation of data sources to aid internal validity (Meijer, 2002), wherein both survey and interviews were used to gather data. The constructs represented in the research questions (definitions, strategies, benefits, and challenges) formed the framework of the questionnaire; and both the constructs and formatting of the questionnaire underwent several stages of review for validity.   For this study, the survey instrument was reviewed by a subject matter expert and the researcher's dissertation committee for content validity which is the degree to which a test measures an intended content area (Creswell, 2013), and with recommendations from the committee, changes were made to ensure that the

survey instrument measured what it set out to measure. Since all the survey items were self-developed, some steps were taken to verify the construct validity of the study. First, experienced researchers in the field of mobile learning were consulted to discuss the wording of each item. The instrument was then revised based on the feedback collected. Then, all the survey items were subjected to a two-stage conceptual validation exercise using the procedure recommended by Moore and Benbasat (1991). The first stage consisted of "unstructured sorting" which included looking at the wording of all survey questions to check for grammatical errors and sentence construction; and the second stage consisted of 'structured sorting' of all items in the survey making sure that each survey item had quality. The two-step sorting procedure was very helpful in verifying construct validity especially because new survey items were developed.

To ensure reliability, the researcher pilot-tested the questionnaire with a convenience sample of two teachers. The results of the reliability testing suggested making survey questions optional. The questionnaire was piloted with spaces provided for the respondent to make criticism and recommendations for improving the questionnaire (Gall, Gall and Borg, 2010). According to Bryman and Bell (2007), the expert review panel needs to ensure external validity by covering the following four questions: (a) Does the survey appeal to a variety of social and psychological groups? (b) To what extent will the survey be effective in a variety of settings? (c) Can the findings be generalized in the past and the future? and (e) Will the fact that participants knew that they are participating in a survey affect the way the questions were answered?

Procedures.

Data collection. Data was collected online using a self-developed and expertly

reviewed survey. The core survey items formed questions which reflected all six research

questions with variables about defining mobile learning, mobile learning integration,

effective mobile learning strategies, benefits, challenges of mobile learning, and

overcoming the challenges of mobile learning. These variables were identified through

the analysis of the related literature. Section VI of the online survey gave the participants

the option to agree or disagree to disclose their email contact information so that the

researcher could contact them for interviews for phase two of the study. The

questionnaire was administered online using LimeSurvey. LimeSurvey is a web

application available through the College of Education at Idaho State University. When

the participants received the email notification from the researcher, it contained the

informed consent letter. By agreeing to open the survey and by clicking next, the

participant gave their consent to participate in the study. Participants' information was

kept anonymous unless they entered their email address in Section VII to be contacted for

interviews.

Teachers responded to the series of five point Likert scale, yes or no, and one

open-ended question by clicking on the web-page buttons provided. After completing the

survey, the teachers clicked the submit button which then transmitted the data to the

researcher's LimeSurvey account. Teachers were allowed to submit the survey without

having completed the entire questionnaire. The survey was kept active for two months to

collect the maximum possible number of responses. When the specified survey time

window elapsed, the survey web page was closed. All the survey data were imported into Excel and then transferred to an external hard drive only available to the researcher solely for use with this research. All contents of the hard drive remained confidential.

Data analysis. Data analysis were based on the type of questions that were examined in the study. For quantitative phase one of the study, the survey instrument had one open-ended, 13 closed-ended, and four Likert scale questions.

Survey Section I (demographics). Part one of the survey was designed to gather demographic data on in-service teachers who have integrated mobile learning in their classrooms. The demographic questions were close-ended. The demographics were used mostly for descriptive purposes. Included in the demographics section were questions related to gender, highest level of education, grade level and subject taught, number of years of experience with teaching, and level of mobile technology skills. These items provided the researcher with information that was later used to purposefully select participants for Phase Two of the study. The information gathered is presented in Chapter 4, using percentages of the participants represented.

Survey Section II (Defining mobile learning). Section II responses were sentences or phrases by which respondents provided a definition of mobile learning. The inductive approach proposed by Creswell (2002) was used to code data. To categorize the data, specific segments of text were highlighted and grouped. Codes were developed to represent the definitions that were given. Based on the literature review, some predefined codes were used in addition to whatever new codes arose. Some of the derived predefined codes included the following: mobility of learner, mobility of device, mobility of learning

environment, subsection of distance learning, and learner characteristics. The coding this far was open coding where distinct concepts and categories form the basic units of the analysis of raw data (Creswell, 2013). Next, the initial codes were reexamined to further focus the data and develop new categories. Furthermore, the new codes were studied to develop highly refined themes. This is referred to as axial coding (Creswell, 2013). These successive levels of coding provided the researcher with documented and well organized answers to research question one.

Survey Section III (Mobile learning integration), Survey part IV (Benefits of mobile learning), Survey Section V (Challenges of mobile learning), and Survey part VI (Overcoming the challenges of mobile learning). All these sections of the questionnaire contained five point Likert scale questions and were analyzed in the same manner. The data collected via LimeSurvey were exported to an Excel spreadsheet and numbers were assigned to the variables. Coding, or the process of assigning numbers to the levels or values of each variable (Gliner et al., 2009), was based on the Likert scale. High numbers (4 and 5) were used for "agree" answers and low numbers (1 and 2) to "disagree" answers. Frequency counts (percentages) and some measures of central tendencies (mean and standard deviation) were used to further analyze the data.

Qualitative Phase Two.

Phase two involved the collection of qualitative data through interviews. The qualitative data provided findings to support the information gathered from the surveys. In addition, qualitative data and their analysis refined and explained some of the statistical results obtained in phase one by exploring participants view in- depth

(Ivankova, Creswell, & Sheldon, 2006). Gall, Borg and Gall (2010) noted that surveys do not probe deeply into participants' opinions, beliefs, and inner experiences, so using in-depth interviews will help fill a potential explanatory data gap. For this study, the qualitative data was collected through a sample of those teachers who met the inclusion criteria and who agreed to be interviewed. The inclusion criteria for phase two was: accepting to be interviewed, being an experienced science, math, humanities, or social studies teacher.

Participants. The purpose of the sample for Phase Two was to find teachers who exemplified strong and regular integration of mobile learning or a commitment to mobile learning. The last question of the survey instrument identified participants who were willing to be interviewed for the study. The responses to demographic items and the Likert-scale items indicated whether the willing participants met the criteria of "strong and regular integration" of mobile learning. Fourteen teachers indicated their interest in being interviewed for phase two of the study. Among the 14, eight teachers were purposefully selected and interviewed by the research. The eight teachers' included four science teachers, two social studies teachers, one history teacher, and one mathematics teacher.

Instrument. The researcher conducted phone interviews using an Mp3 phone recorder app on a smartphone and a tape recorder for backup. The interview questions were semi-structured whereby each participant responded to the same questions. The interview questions asked teachers to expand on their experiences with mobile learning integration (research question 6) in relation to success stories, failures, the first day they

used mobile devices in their classroom, and their persistence. In addition, the interview asked probing questions about data collected in the surveys that was not well understood. A sample of the contact letter to the interviewee and interview protocol is included in Appendix B. Gall, Gall, and Borg (2010) recommends using standardized and semi-structured interviews to reduce bias. In total, eight interviews were conducted with a total of eight interview questions. Gall, Gall, and Borg (2010) recommend piloting the interview guide and procedures to ensure the collection of reasonably unbiased data.

Pilot testing the interview. Two high school teachers (one from Idaho and one from Wyoming) were interviewed by the researcher as part of a pilot study. During the phone pilot interviews, the researcher was alert to communication problems (such as audio going out and volume) and other issues that suggested the need to rephrase questions or revise the procedure. Based on the results of the pilot study, Question one of the interview was rephrased and the teachers were asked to redefine mobile learning.

Strengthening the consistency and credibility of the interviews. Validity and reliability was considered and used in the development and implementation of the interviews and data collection. Alreck and Settle (2004) clarify that validity and reliability of interview data depend on consistency. The same interviewer completed each interview of the study, thus establishing a level of consistency across all interviews. Each interview was recorded using an Mp3 call recorder app and a tape recorder and the researcher transcribed each interview by listening to each recording and typing out the transcript on a word document. Alreck and Settle described the need to minimize both error and bias by having just one individual transcribe the data to maximize validity of

the data. The interview questions were asked in the same order for all participants, thus eliminating one potential source of error. Interviewees were informed that there is no right or wrong answer and not knowing how to answer a question was an adequate response, therefore minimizing potential response bias.

Procedures.

Data collection. The researcher conducted a professional interview with semi-structured interview questions directed towards answering the research questions. An already created set of instructions and prompts helped direct the interviews for each selected participant. The entire interview was recorded to enable easy transcription of the data. Based on the pilot study, the interview protocol was adjusted so that the interviews lasts for about 25 minutes. The researcher transcribed each interview. Member checking was done by allowing the participants to review the transcripts to verify if they agreed or disagreed with the information (Creswell, 2013). The transcripts were then be securely stored and accessed only when needed by the researcher.

To ease the collection and recording of interview data, an online spreadsheet was created using Microsoft Excel. Microsoft Excel enabled the quick entry of data evidence for color coding. The Excel document was password secured.

Data analysis. Data analysis is a complex process that requires careful and deliberate considerations on the strategies to use. Creswell (2013) emphasizes the need to continuously reflect, ask new analytical questions, construct memos to self, and use the process to revisit collecting new data as additional questions are revealed. This requires extensive time and a commitment to an ongoing review and analysis of the data.

For qualitative phase two, Creswell (2013) recommends continuously revisiting the research questions to determine if the analysis is yielding results that are leading towards answers to the questions. Based on the above recommendation, the data from teacher interviews and their responses were analyzed for common themes (Creswell, 2013), and coded from the notes taken by the researcher during the interviews. This was done by mapping out the relationship of the textual data to the research questions and by making clear pathways between the research questions and coding (Creswell, 2013). Although there were eight interview questions, transcripts were coded and analyzed holistically in order to develop themes. For example, an answer to interview question two provided rich detail about Research Question 6.

Interpretational analysis was used to analyze the interview responses. Gall, Gall, and Borg (2010) stated that a researcher can use interpretational analysis by identifying patterns, themes, or constructs. Once patterns, themes, or constructs were identified within the research, the data was then organized using color codes and interpretations were made and conclusions drawn. The analysis methodology was synthesized based on steps from models of interpretational analysis presented by Gall, Gall, and Borg (2010). According to Gall, Gall and Borg (2010), interpretational analysis involves seven steps to code and classify qualitative data to ensure that the important constructs, themes, and patterns emerge. *Figure 3* shows a visual representation of Gall, Gall, and Borg's (2010) seven step data analysis through interpretive categorization.
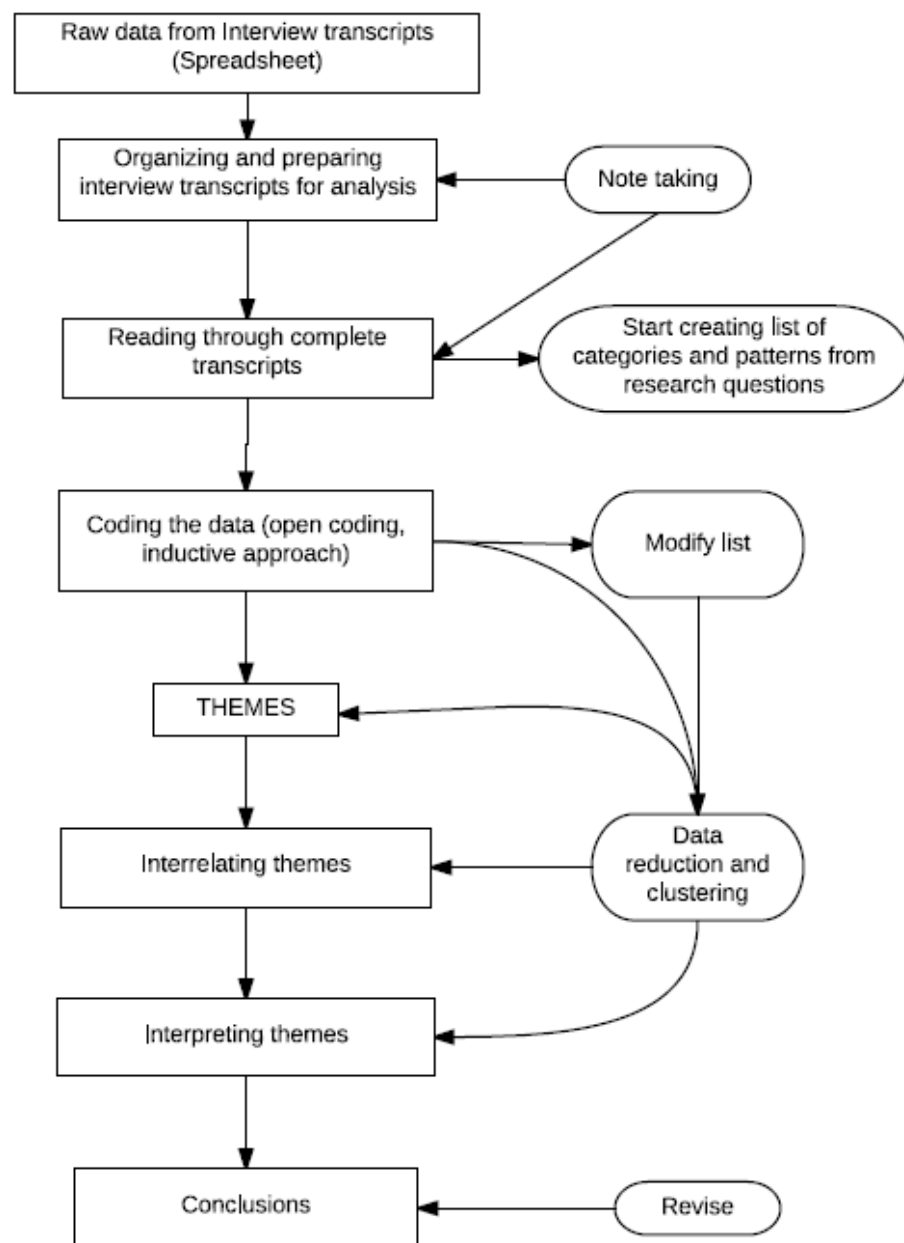
Figure 3. Visual representation of Gall, Gall, and Borg's (2010) seven step data analysis through interpretive categorization

The first step was to enter the data into a spreadsheet (Gall, Gall, & Borg, 2010). The second step was to review the data (transcripts) by reading through in their entirety. The third step was a second full reading of the data. The goal of this step was to identify new meanings, understandings and explanations that emerged through a thorough review of data. The fourth step was the reduction of unnecessary data to focus on the important data that supported the research questions. This was done by open coding. Open coding enabled the researcher to read through the data several times and then to start creating tentative themes for chunks of data that summarize what the researcher sees happening (not based on existing theory-just based on the meaning that emerges from the data). During this step, examples of participants' words and established properties of each code were recorded. This is the step where themes and interpretations were developed. The fifth step was the review of the full set of collected data to locate evidence that supports the interpretations developed in the prior step. The sixth step was writing the first draft of the data and interpretation summaries. The last step was the revision of the written summaries using feedback from the participants and the identification of quotes from the evidence that will support the interpretations. In addition, the researcher sought the help of a data analysis expert in the field of educational technology to further validate the data.

Figure 4 portrays the sequence of the research activities in the study. It specifies the data collection and analysis procedures, and lists the products or outcomes from each of the stages of the study. It also shows the connecting points between the quantitative and qualitative phases and the related products, as well as specifies the place in the

research process where the integration or mixing of the results of both quantitative and qualitative phases occurs.

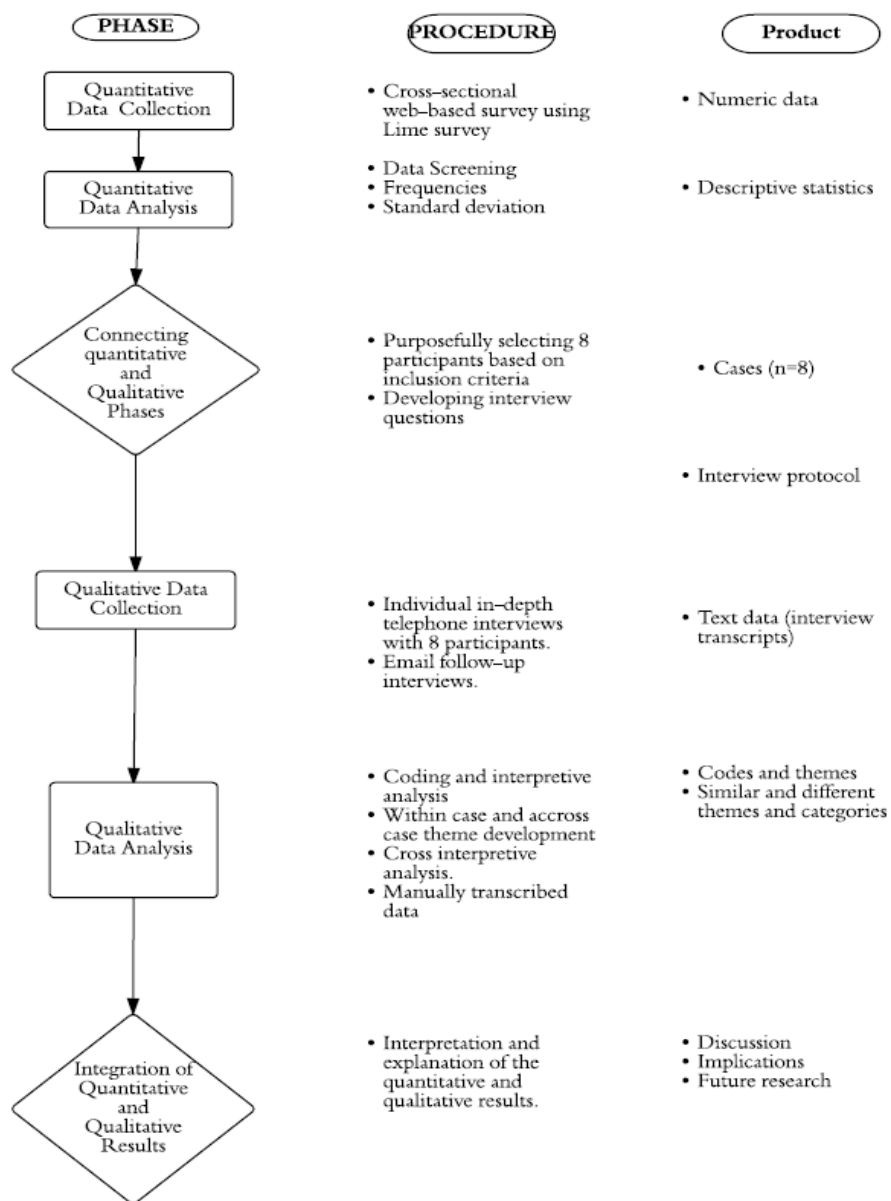| PHASE	PROCEDURE	Product
Quantitative Data Collection	• Cross–sectional web–based survey using Lime survey	• Numeric data
Quantitative Data Analysis	• Data Screening • Frequencies • Standard deviation	• Descriptive statistics
Connecting quantitative and Qualitative Phases	• Purposefully selecting 8 participants based on inclusion criteria • Developing interview questions	• Cases (n=8) • Interview protocol
Qualitative Data Collection	• Individual in–depth telephone interviews with 8 participants. • Email follow–up interviews.	• Text data (interview transcripts)
Qualitative Data Analysis	• Coding and interpretive analysis • Within case and accross case theme development • Cross interpretive analysis. • Manually transcribed data	• Codes and themes • Similar and different themes and categories
Integration of Quantitative and Qualitative Results	• Interpretation and explanation of the quantitative and qualitative results.	• Discussion • Implications • Future research

Figure 4. Visual representation of the mixed-methods sequential explanatory design procedures adopted from Ivankova, Creswell, and Sheldon (2006).

Methods Summary

In summary, Chapter III discussed the methodology that was used to carry out the research study. The overall design of this study was a sequential explanatory mixed method design. This research design used both qualitative and quantitative data to explain high school teachers' experiences with integrating learning using mobile devices like iPads, smartphones, Chromebooks, and tablets, and their applications in teaching. Quantitative data was collected using an online survey of randomly sampled in-services teachers in Idaho and Wyoming who have experience integrating mobile learning, while qualitative data was drawn from interviews of eight teachers purposefully selected to get a deeper understanding of in-service teachers' experiences with mobile learning integration.

CHAPTER IV

Results and Findings

The purpose of this study was to examine the experiences of high school teachers in Wyoming and Idaho as they integrate mobile learning in their classrooms. The results reported in this chapter include two sections. The first section describes characteristics of the 104 respondents to the survey as well as characteristics of the eight participants interviewed. The second section of this chapter reports quantitative and qualitative findings addressing research questions posed in Chapter I:

1. How do high school teachers define mobile learning?

2. What do high school teachers regard as effective mobile learning strategies?

3. What do high school teachers regard as the benefits of mobile learning in the classroom?

4. What do high school teachers regard as significant challenges of mobile learning in the classroom?

5. How can high school teachers overcome the challenges of mobile learning?

6. What are the experiences of high school teachers with mobile learning integration in their classrooms?

Participant Demographics

Following the division of this research study into two parts, there are also two sets of participants to describe: the 104 respondents to the quantitative survey and the eight participants selected to be interviewed. First, the 104 respondents will be described

according to responses on the demographic sections of the survey instrument as well as to the basic description of their use of mobile devices for learning. Then, the interview participants will be introduced in greater detail.

Description of the Survey Respondents. As described in Chapter III, the researcher in the spring of 2015, emailed survey links to a population (N) of 1000 high school teachers in the states of Idaho and Wyoming. Of the 1000 survey emails, 368 (37%) surveys were emailed to teachers in Wyoming, while 632 (63%) were emailed to teachers in Idaho. A total of 109 responses were received. Of these responses, 64 were full responses while 45 were incomplete responses. Five surveys were removed from the study because significant portions were not answered. For example, when a respondent did complete any item in Sections III, IV, V, VI and VI of the survey, that survey was eliminated. A total of 104 eligible responses were considered for the study. The number of suitable responses received was not particularly large. This means that no inferences can be made back to the original population of 1000 and certainly not back to the larger population of secondary teachers. Table 2 summarizes the demographic results.

Table 2

Description of the Survey Respondents

Demographic Variable	Number of Responses (n)	Percentage of valid responses (%)
Gender (81 valid responses)		
Male	32	39.51
Female	49	60.49
Level of Education (104 valid responses)		
Bachelors	45	43.27
Masters	52	50.00
Doctorate	3	2.88
Other	4	3.85
Grade level (236 valid responses)		
9th grade	44	18.64
10th grade	59	25.00
11th grade	63	26.70
12th grade	63	26.70
Other	7	3.00
Subject taught (99 valid responses)		
Art	4	4.04
Business	3	3.03
Foreign Language	2	2.02
Health and/or Physical Education	1	1.01
History and/or Social studies	16	16.16
Mathematics	8	8.08
Music	2	2.02
Reading	6	6.06
Science	24	24.24
Special Education	4	4.04
Other	29	29.29

More females than males responded to the survey. A majority of the teachers had Masters Degrees. Four teachers indicated they had degrees other than the above which included two post masters endorsements and two Doctors of Education. Teachers also indicated that they taught more than one grade level. Most of the teachers taught all high

school grade levels which included 9th, 10th, 11th and 12th grade. Teachers were also asked

to indicate what subject they taught. It is important to note that some teachers indicated

that they taught more than one subject giving a total of 99 responses. As indicated in

Table 2, the highest proportion of respondents indicated "other" as subject area taught,

followed by science and then history/social science. Music and Foreign Languages were

the two lowest subject areas reported.

Teachers were also asked to indicate the number of years of teaching experience,

their mobile learning experience, and their mobile learning skills. Table 3 summarizes the

results.

Table 3

Respondents Teaching Experience, Mobile Learning Experience and Mobile Learning Skills

Variable	Number of Responses (n)	Percentage of valid responses (%)
Teaching experience (80 valid responses)		
1-5 years	16	20.00
6-10 years	17	21.25
11-15years	13	16.25
Over 15years	34	42.50
Mobile learning experience (74 valid responses)		
This is my first year	8	10.81
More than a year	39	52.70
More than 3 years	27	36.49
Mobile learning skills (81 valid responses)		
Beginner with support	25	30.87
Confident on my own	32	39.51
Capable of teaching others	22	27.16
Other	2	2.47

Over 42% of the teachers indicated that they had over 15 years of teaching experience. A majority of the teachers had over one year experience with using mobile devices in their classrooms. Teachers were also asked to indicate their State and say whether their school district was rural or urban. Table 4 summarizes the results obtained.

Table 4

Rural or Urban School District and State

Variable	Number of Respondents (n)	Percentage of valid responses (%)
State (79 valid responses)		
Idaho	61	77.23
Wyoming	18	22.79
School District (82 valid responses)		
Rural	43	53.75
Urban	37	46.25
Other	2	2.5

Of those that indicated a state, 77.23% indicated they were from Idaho; this is higher than the 63% of surveys which were distributed to Idaho teachers, while the 18 reported from Wyoming (22.79%) is less than the 37% sent to Wyoming teachers. Because of the large number of surveys returned without state identification (23% of the total 104), it cannot be determined whether the responses obtained reflect the distribution of surveys by state. The teachers also indicated that their school districts were either rural (43, 53.75%) or urban (37, 46.25%).

Other descriptive information (types of mobile devices used, ownership, and frequency of use), collected in Section II of the survey added value to the study. Table 5 summarizes the information on mobile devices.

Table 5

Ownership, Frequency of Use and Mobile Devices

Mobile device integration	Number of Respondents (n)	Percentages
Mobile Device Ownership (73 valid responses)		
I own it	16	21.92
The school/district owns it	49	67.12
N/A	8	10.96
Frequency of Mobile Device Integration (69 valid responses)		
Never	2	2.90
Rarely	5	7.25
Sometimes (5-10 times a year)	17	24.63
Frequently (weekly)	26	37.68
Always (daily)	17	24.63
Other	2	2.90
Types of Mobile Devices Used (132 valid responses)		
iPads	22	16.67
iPods	7	5.30
Smartphones (iPhones and Android)	22 44.15%	33.33
Tablets	17	12.88
Chromebook	16	12.12
Probes	7	5.30
Other	19	14.39

The results indicated that most mobile devices used in high school classrooms are owned by the school district. Teachers also frequently use these mobile devices in their classrooms. Smartphones were the most used mobile devices for mobile learning; however, tablet-sized devices (e.g. iPads) were reported to be used together with smartphones.

In summary, 104 high school teachers responded to the survey. Some participants did not respond to some questions, hence the reported "n" for individual questions varied. Some survey items were strictly descriptors, such as the types of devices used, who owns the devices, frequency of use, and attitudes toward mobile learning. These survey items do not directly relate to the research questions, but they help the researcher describe the sample.

Teachers were also asked to indicate their level of agreement regarding statements about their attitudes towards integrating mobile learning in their classroom. This was important because it helped the researcher to determine how teacher attitudes influenced their decision to or not to integrate mobile learning. Using a Likert Scale, the teachers were asked to rate the degree of their agreement with statements relating to their attitudes to integrating m-learning in their teaching as follows: 5 = strongly agree (SA), 4 = agree (A), 3 = uncertain (UC), 2 = disagree (D), 1 = strongly disagree (SD). Table 6 summarizes the results.

Table 6

Teacher Ratings Regarding Statements about TPACK and Integrating Mobile Learning

Statement	Level of Agreement (percentage)				
	SA	A	UC	D	SD
I have a positive attitude towards integrating mobile learning (n = 66)	25.76%	51.52%	12.12%	9.09%	1.52%
I like integrating mobile learning in my lesson (n=66)_	25.76%	47%	19.70%	4.55%	3.03%
Mobile learning integration is complex (n=66)	24.24%	31.82%	24.24%	13.64%	6.06%
I have enough training to help me effectively integrate mobile learning (n = 66)	7.56%	28.79%	24.24%	25.76%	13.64%
I have technical knowledge to integrate mobile learning into my lessons(n = 66)	10.61%	48.48%	24.24%	12.12%	4.55%
I have the pedagogical knowledge to integrate mobile learning into my lessons(n = 66)	12.12%	36.36%	42.42%	7.56%	1.52%
I have the content knowledge to integrate mobile learning into my lessons(n = 66)	34.85%	42.42%	16.67%	4.55%	1.52%

The results indicate that the teachers' survey had positive attitudes towards mobile learning. Teachers also have technical, pedagogical, and content knowledge to integrate mobile learning in the classroom. The results however indicate that mobile learning is complex and teachers do not have enough training to effectively integrate mobile learning in the classroom.

Description of the interviewees. The researcher conducted in-depth phone interviews with eight teachers who were identified from the survey. The selection criteria to be interviewed included; providing an email address in the survey to be contacted for interviews, teach the sciences, humanities, math, or social sciences, and have at least one year of mobile learning integration experience. The demographics of the participants are presented in Appendix C. In deciding which of the eight volunteers to interview, care was taken to select at least one participant from each major content area: Science, Math, Social Sciences, and Humanities. Of the eight teachers who agreed to be interviewed, four of them were science teachers, one teacher taught math, two teachers' social studies, while only one taught history. The interview pool consisted of four male and four female teachers. Six teachers reported their age to be between 31 and 40, and two teachers were between 41 and 50. Five teachers reported that they had Master's degree and two others reported having a Bachelor degree. Four teachers were from Idaho while four were from Wyoming. Also, six teachers indicated that their school districts were rural. One teacher indicated that their school district was suburban while one indicated that their school was urban. The following paragraphs describe each of the participants interviewed.

JR is a History teacher in a rural school district in Wyoming. He is 50 years old and has been teaching for 27 years. JR sounded confident and comfortable with the researcher as he was in his discussion about mobile learning technologies. He has started integrating mobile learning technologies into his teaching more than three years ago and was thus a frequent user of mobile devices in the classroom. He saw himself as capable of teaching his colleagues mobile learning integration strategies. I interviewed JR on April 21st, 2015 at 5pm after he was done with classes for the day. I used an MP3 Call recorder App on a smartphone and a tape recorder for backup to record the phone conversation. The interview session started with some light conversation to build rapport and it lasted for 22minutes.

JK is a high school science teacher in a suburban school district in Wyoming. He is 40 years old and has been teaching for 15 years. JK is very knowledgeable about mobile learning integration strategies to enhance mobile learning. He records his lessons and puts them online where his students can later access and replay. He has a Bachelor's degree and he first started integrating mobile learning technologies into his teaching more than three years ago and says he is capable of teaching others when it comes to his mobile learning skills. I interviewed JK on April 24th, 2015 at 5pm after he was done with classes for the day. I used an MP3 Call recorder App on my smartphone and a tape recorder for backup to record the phone conversation. The interview session which started after I reintroduced the purpose of the study lasted for 25 minutes.

TR is a chemistry (science) teacher in an urban school district in Wyoming. She is 35 years old and is a new mom. She has been teaching for seven years. TR sounded confident and comfortable both with the researcher and in her discussion of mobile learning technologies. She first started integrating mobile learning technologies into her teaching more than three years ago and said she frequently uses mobile devices in her classroom. She feels confident that she could teach her colleagues mobile learning integration strategies. I interviewed TR on April 22nd, 2015 at 3pm after she was done with classes for the day. I used an MP3 Call recorder App on a smartphone and a tape recorder for backup to record the phone conversation. The interview session which started with some light conversation to build rapport and it lasted for 25 minutes.

WY teaches social studies in a rural school district in Idaho. She is 45 years old and has been teaching for 6-10 years. WY sounded confident and comfortable both with the researcher and in her discussion of mobile learning technologies. She first started integrating mobile learning technologies into her teaching more than three years ago. She frequently uses of mobile devices in her classroom and also teaches online. She feels competent enough to teach mobile learning skills to her colleagues. I interviewed WY on May 6th, 2015 during her lunch hour (12 noon). I used an MP3 Call recorder App on a smartphone and a tape recorder for backup to record the phone conversation. The interview session started with some light conversation to build rapport and it lasted for 20 minutes.

ER teaches social studies in a rural school district in Idaho. He is 40 years old and has been teaching for over 15 years. He sounded confident when he explained the way he integrates mobile learning in his teaching. He has a bachelor's degree. ER has integrated mobile learning technologies for more than a year. I interviewed ER on May 4th, 2015 at 4.00pm after he was done with classes for the day. I used an MP3 Call recorder App on a smartphone and a tape recorder for backup to record the phone conversation which lasted for17 minutes.

MG teaches science in a rural school district in Idaho. She is 40 years old and has a Master's degree. She sounded very confident in the way she integrated mobile learning in

her teaching. She has been teaching for over 15 years and has more than a year experience with integrating mobile learning with her students. She is a frequent user of mobile devices in the classroom especially when supplemented with desktop computers. I interviewed MG on May 5th, 2015 at 9.00am before her classes for the day. I used an MP3 Call recorder App on a smartphone and a tape recorder for backup to record the phone conversation. The interview lasted for 14 minutes.

CR is a science teacher in a rural school district in Wyoming. She is 37 years old and she considers herself a "computer nerd". She has a Master's degree and has been teaching for over 15 years. She has a deep passion for educational technologies in general. I interviewed CR on May 5th at 3pm after she was done with the classes for the day. I used an MP3 Call recorder App on a smartphone and a tape recorder for backup to record the phone conversation. She said she was capable of teaching others mobile learning skills. The interview lasted for 25 minutes.

PL is a Math teacher in a rural school district in Idaho. He is 41 years old and has been teaching for 13 years. He first started integrating mobile learning technologies into his teaching more than three years ago and says he is capable of teaching mobile learning skills. He builds computers in his free time. I interviewed PL on May 4th, 2015 at 11am when he had a brief break in between classes. He was very optimistic about the direction of mobile learning. I used an MP3 Call recorder App on my smartphone and a tape recorder for backup to record the phone conversation. The interview session started after I reintroduced the purpose of the study and it lasted for 20 minutes.

The semi-structured interviews consisted of eight questions. The teachers were asked about their technological, pedagogical, and content knowledge relative to mobile learning, and their experiences with integrating mobile learning in their classroom, especially as concerned their success stories, failures, the first day they brought a mobile device into the classroom, and reasons why they will or will not persist with mobile learning. The information gathered from interview question two was integrated into the findings of the six research questions. The interview protocol is included in Appendix B.

Results and Findings

This section presents findings which address the six research questions posed in Chapter I. The discussion in this section is organized according to research questions.

Information relevant to the research question obtained from the quantitative survey is presented first, followed by the detailed information gained from the interviews.

Research Question 1: How Do High School Teachers Define Mobile Learning?

To answer this question, the researcher collected and analyzed definitions from both the survey and interviews. The data was analyzed using the inductive approach suggested by Creswell (2013). According to Creswell (2013), inductive coding begins with close readings of text and consideration of the multiple meanings that are inherent in the text. A single open-ended question on the survey asked the teachers to define mobile learning in their own words; responses to this survey item were relevant to Research Question 1. Sixty-eight survey respondents (63.55%) provided definitions of mobile learning on the survey. The eight interviewees also provided definitions of mobile learning. The definitions are included in Appendix D.

The definitions were read several times by the researcher to identify themes and categories. To analyze the responses from the survey, a coding frame was developed and the definitions were coded. The researcher identified 125 text. An overview of the inductive coding process is shown in Table 7.

Table 7

The coding process for the definition of mobile learning using the inductive approach.

Coding Frame	Data
1. Initial read through text data	76 definitions in five pages of text
2. Identify specific segments of information based on how it related to the research question.	125 segments of text
3. Label the segments of information to create categories	Six concepts • Making use of Internet resources • Mobility of Learner • Mobility of learning process/anytime/anywhere • Mobility of technology • Subset of distance learning • Nature of mobile device
4. Reduce overlap and redundancy among categories	Four categories • Making use of Internet resources • Anywhere, anytime learning with technology • Subset of distance learning • Nature of mobile device
5. Create a model incorporating most important categories	Three themes • Making use of internet resources to enhance/guide/facilitate instruction • Learning assisted by personal electronic devices (iPads, cellphones, Chromebook, and laptops). • Anywhere, anytime learning using 21st century technology

Note: Adapted from Creswell, 2002, Figure 9.4, p.266

The coding frame included six contexts in which mobile learning has been defined by previous research, as discussed in Chapter II, and some new codes based on the 68 responses. The codes from the literature review were: mobility of device, mobility of learner, mobility of the learning process, and subset of distance or online learning. The new codes were: learning using internet connected devices and nature of mobile devices. Table 7 illustrates the coding process using inductive analysis. This process was used to develop categories, which were then conceptualized into broad themes. For example one definition of mobile learning was:

> *Mobile learning means that there is no fixed learning atmosphere or device nor does it mean that a teacher has to be present. It is a student learning on location and giving evidence of that learning.*

This response was considered to contain two different concepts or contexts of mobile learning definition and therefore was counted as two units of definition contexts and was assigned two different code numbers that related to two different categories. The first segment of text "*Mobile learning means that there is no fixed learning atmosphere or device nor does it mean that a teacher has to be present.*" fitted into the category "Mobility of learning process". The second text unit of meaning was determined to be: *"It is a student learning on location and giving evidence of that learning"* this text segment was considered to fit into the category "Mobility of learner". Thus these two text units of meanings were counted as two units. In all a total of 125 text units emerged.

Three themes emerged from the definitions of mobile learning:

1. Making use of internet resources to enhance, guide, and facilitate instruction

2. Learning assisted by personal electronic devices (iPads, cellphones, Chromebook, and laptops).

3. Anywhere, anytime learning using 21st century technology

Table 8 illustrates the number of text segments represented in each mobile learning definition and the distribution of themes. It is important to note that some of the definitions incorporated multiple concepts, categories, and themes.

Table 8

Defining Mobile Learning

Themes	Number of text segments
1. Making use of internet resources to enhance/guide/facilitate instruction	52
2. Learning assisted by portable electronic devices (iPads, cellphones, Chromebook, and laptops)	48
3. Anywhere, anytime learning using 21st century technology	25

The above tallies summarize the frequency of occurrence of the component text segments present in the definition of mobile learning by the teachers. The statistics indicate that the greatest text segments included in the definitions was "making use of internet resources to enhance, guide, and facilitate instruction" and "learning assisted by a portable electronic device (iPad, cellphone, Chromebook, and laptop)", while the

segment "anywhere, anytime learning using 21st century technology" was least included. The following comments from surveys and interviews illustrate the themes.

Theme 1: Making use of internet resources to enhance/guide/facilitate instruction):

Engaging, sharing, connecting and sharing our learning through the unlimited use of the World Wide Web.

The use of a portable electronic device that is connected to the Internet or network for the purpose of researching, gathering, and sharing data for the purpose of gaining and demonstrating knowledge.

Mobile learning involves students using portable internet capable devices to assist in their learning. For example, using a tablet or a phone to conduct research, using a laptop to write a paper, etc.

Some teachers defined mobile learning based on being connected to the Internet. Though the word Internet was used only in three definitions, other definitions referred to the use of the World Wide Web (www), learning management systems, and social media as being an important aspect of mobile learning. All these definitions were therefore categorized under this theme.

Theme 2: Learning assisted by portable electronic devices (iPads, smartphones, Chromebook, e-readers, and laptops):

Mobile learning is using devices such as cell phones, tablets, and laptops as tools for learning.

Using an electronic device that is mobile to enhance learning.

Mobile learning uses a portable electronic device to increase a person's understanding and apply knowledge.

It is worth noting that most teachers referred to mobile learning technologies as portable or personal electronic devices. The word "device(s)" was use in 20 definitions indicating the importance of having that word in the definition of mobile learning. Other definitions included under this theme is a list of different types of mobile devices (iPads, smartphones, Chromebook, e-readers, and laptops).

Theme 3: Anywhere, anytime learning using 21st century technology:

Mobile learning is using the available 21st century technology to improve and expand educational learning opportunities.

Mobile learning can be defined as having anytime/anywhere access to classroom information. It can be students in a 1-to-1 set up, with students having their own computer device throughout the school year and an online learning management system.

Using mobile technology (smartphones, tablets, and e-readers) to engage students in learning in and out of the classroom.

It is important to note that the words "technology" or "technological" were used in 25 definitions. The words "anywhere" and "anytime" were often used together. Other words or phrases like "on the go", "take the teaching/learning with me", and "at my convenience", inferred learning anywhere, anytime and so they were included under this theme. The following comments from respondents are examples that illustrate this point:

The ability to actively progress in your academics while on the go. Being able to

communicate and give the help needed on a students (sic) level of understanding.

The ability to take the teaching/learning with me and continue the learning

process.

The findings from research question one indicate that high school teachers include

in the definition of mobile learning the three notions of making use of Internet resources

to enhance, guide, and facilitate instruction, learning assisted by personal electronic

devices (iPads, cellphones, Chromebook, and laptops), and anywhere, anytime learning

using 21st century technology.

Data from the survey revealed different ways in which high school teachers define

mobile learning in the classroom but did not give a clearer picture of how their

definitions influenced the way they integrated mobile learning. The interviews revealed

that the inconsistency in the way teachers define mobile learning affected the way they

integrated mobile learning. The difference between the definitions given in the survey

and those given during interviews clearly illustrate this.

Interview data also revealed that most teachers assumed that most of mobile

learning takes place outside the classroom. For instance one teacher said:

"...it's breaking down the walls when they learn so it's not only within the climate

of whether they are in my classroom, but also learning outside the classroom."

For some teachers, the term mobile learning is not often used in the learning

environment. One teacher said:

I have never thought about coming up with a definition. It's not a term I use. But I guess I can say, allowing a person to learn in different places. I guess I can say that it is allowing my students to use computers in different locations.

In summary, most high school teachers are not consistent when it comes to defining mobile learning. There is a lot of variation in definitions, as well as definitions evolving with time and context, but in general, the three major themes that emerge from both survey and interview definitions show that each definition has a relevant notion of what mobile learning means.

Research Question 2: What Do High School Teachers Regard As Effective Mobile Learning Strategies?

To answer this question, Section III of the survey was developed. Section III focused on particular integration strategies, and whether teachers felt they had the technological, pedagogical, and content knowledge to implement such strategies. The learning strategies listed in this section were gleaned from literature reviewed in Chapter II. Table 9 reports the frequency with which respondents checked off listed strategies; they were also given the option to enter other strategies they dimmed relevant into a text box.

Table 9

Specific Mobile Learning Strategies Integrated by Respondents

Mobile learning strategy	n=64 # of responses= 306	Percentage
Individual/Group Collaboration	51	16.66
Gaming	13	4.25
Communication (Homework reminders)	41	13.39
Note Taking (taking pictures/videos/recording)	45	14.70
Texting	15	4.90
Formative Feedback (e.g. Clickers)	18	5.88
Podcasting /Blogging	6	1.96
Virtual Field trips	16	5.22
Webquests	22	7.18
Simulations	25	8.16
Learning Organizer	16	5.22
Guided Reading	16	5.22
Other	22	7.18
Total number of responses	306	

Sixty four teachers responded to this question with a total of 306 responses because the teachers were prompted to select all strategies they used. Teachers indicated that individual/group collaboration was the mobile learning strategy they used most often, followed by note taking and communicating through homework reminders. Podcasting was the least used mobile learning integration strategy. For strategies not included in the list, teachers indicated that robotics, recorded lessons, research, email, web exams,

accessing information, record keeping, video lessons, virtual labs, apps, distance

teaching, and looking up information quickly could also be used to integrate mobile

learning in the classroom. Interestingly, *gaming* was indicated by only thirteen

respondents, despite the fact that games and gaming are emerging trends in computer-

based and mobile learning (Kluge & Dolonen, 2015).

Interview data indicated that teachers generally are supportive of integrating

mobile learning in their classrooms. Most of the teachers indicated that they most often

integrated mobile learning for research purposes either at the beginning of the lesson or

during the lesson as illustrated by what some of the interviewees said.

One teacher said:

I integrate mobile learning at the beginning of their learning for study stuff. So, I

like them to do a little research first before I start talking about it. I like them to

do it first in their learning process because they are interested in the mobile

devices like they want to search and they want to find things.

A second teacher said:

I might start a class off with some minor research assignments, something very

minimal and then build on that so that their research skills be up to par when they

get to assignments that require more.

A third teacher said:

The fact that internet is connected, is really my concern. I am most interested in

having access to online tools for research during class time

The findings indicate that technological, pedagogical and content knowledge are important when integrating mobile learning. However, one teacher indicated that technological knowledge did not have to be superior when integrating mobile learning. One of the interviewees believed that students know the technology and should figure it out themselves. She said:

> *I personally feel that my knowledge does not have to be superior. I am pretty good with just giving them stuff and letting them find things and figure things out because they know how to do it.*

Research Question 3: What Do High School Teachers Regard as the Benefits of Mobile Learning in the Classroom?

In order to have a better picture of what high school teachers regard as benefits of mobile learning in the classroom, the researcher listed a series of statements based on literature about the benefits of mobile learning and asked teachers to indicate their level of agreement with each statement (survey Section IV, Appendix A). Table 10 summarizes the results obtained.

Table 10

Benefits of Mobile Learning Integration in High Schools

Statement	SA	A	UC	D	SD	M	SD	n
Mobile learning increases student motivation and engagement	20.31%	45.31%	26.56%	6.25%	1.56%	3.77	0.9	64
Mobile learning increases communication	17.18%	40.63%	28.13%	12.5%	1.56%	3.59	0.97	64
Mobile learning improves collaboration skills.	15.63%	25%	42.19%	17.18%	0%	3.39	0.95	64
Mobile learning fosters classroom support	14.07%	31.25%	39.06%	14.07%	1.56%	3.42	0.96	64
Mobile learning improves real time feedback	34.38%	34.38%	25%	3.13%	3.13%	3.94	1.01	64
Mobile learning encourages self-directed learning	13%	25%	18%	2%	2%	3.77	0.94	64
Mobile learning makes grading of student work easier	18.75%	21.88%	37.5%	17.18%	4.69%	3.33	1.11	64

Results from the survey statements about the benefits of mobile learning show a

mean of above three. The results suggests that the strongest agreement is for student

motivation, self-directed learning, and opportunity for real time feedback. From the

results mobile learning increases student motivation and engagement, increases

communication, improves collaboration skills, improves classroom support, improves

real time feedback, encourages self-directed learning, and makes grading student work easier. Forty percent of the respondents did not complete this question.

Interview data revealed three themes about the benefits of mobile learning; research, staying connected with other teachers and getting student formative feedback during lessons.

Research. Interview data indicated that teachers generally found mobile learning beneficial for research. This can be illustrated by the testimony of the following teachers. The first had this to say:

....but at their age they are just dying to encounter computers and researching

using computers. Having them find information is at the tip of their fingers.

The second said:

Mobile learning helps them to build on their research skills.

The third said:

What the kids don't know often times is the method on how to access information.

They know how to play games with their smartphones but they don't necessarily

know how to find information about storming for the best deals or something in

history. I can help them with regards to how to complete research so that they can

find the information they need to show what they know.

Staying connected with other teachers. Most teachers shared the view that staying connected with other teachers via mobile learning tools like *Twitter* allowed them to share what they have learned or taught in their classes with the world, tap the knowledge of other teachers to help them make even stronger connections with the

material, and even provide students with real-world problems at a moment's notice. One teacher said:

> *I found that if I stay connected with Twitter, I am following a bunch of teachers and they are tweeting out some of the cool things they have done with some of their students. You know I take tidbits from there but a lot of times I don't have time to read my tweeter feed so I am missing a bunch of stuff. I will take the little nuggets when I can.*

Another teacher said:

> *Learning how to use social media and technology to engage students is possibly very helpful for my kids learning. Some of my colleagues have taken the first step. One of the science teachers has her own Facebook page where she posts homework assignments and things that she taught that day in class. This way, when students are checking their feeds, homework assignments and reminders will unavoidably show up on the screen. This is a good way to get my students' attention and remind about upcoming tests or homework.*

Getting student formative feedback during lessons. Some teachers indicated that using school owned mobile learning technologies like Chromebooks in their classroom made getting student feedback easy. One teacher said:

> *I use Socrative, an app that shows real-time poll results for both multiple-choice and short-answer quizzes in my classroom. My students use their Chromebooks at the end of the class to answer specific questions in order to get a comprehensive look at whether they understood the concepts discussed that day.*

While there were no specific interview questions about the benefits of mobile learning, one of the interview questions required teachers to talk about their success stories. The success stories seemed to address the benefits of mobile learning. The success stories are discussed under Research Question Six.

Research Question 4: What Do High School Teachers Regard as Significant Challenges of Mobile Learning Integration in the Classroom?

Teachers were asked to rate their degree of agreement to statements about the challenges of mobile learning. These challenges were derived from the literature. Table 11 illustrates the responses of the teachers.

Table 11

Challenges of Mobile Learning

Statement	SA	A	UC	D	SD	M	SD	n
There is a lack of training	17.46%	41.26%	19.05%	15.87%	6.34%	3.48	1.15	63
I am out of my personal comfort level when using mobile devices to teach	4.76%	12.69%	20.63%	49.21%	12.69%	2.48	1.03	63
My students are not digitally literate enough	4.76%	15.87%	11.11%	42.85%	25.39%	2.32	1.16	63
We have limited Internet connectivity at our school/problems with accessing the Internet	6.34%	26.98%	12.69%	26.98%	26.98%	2.59	1.32	63
My students get distracted when using mobile devices	33.33%	44.44%	7.94%	11.11%	3.18%	3.94	1.08	63
There are too many mobile devices to choose from	6.34%	29%	30.16%	42.85%	6.34%	2.71	1.01	63
I have to focus on preparing for testing hence no time to integrate ML/There is a lack of time for planning mobile learning integration	7.94%	23.80%	12.69%	33.33%	20.63%	2.67	1.28	63
Student use the mobile devices inappropriately (like cheating or cyberbullying)	19.05%	31.75%	25.40%	17.46%	6.34%	3.4	1.17	63

Results from the survey statements about the challenges of mobile learning reveal that the lack of training and students getting distracted when using mobile devices were the most significant challenges. Any mean value that was above 3.5 is significant. This is showed by means above three (3.94 and 3.48 respectively). In addition, the results also suggested that limited connectivity, teachers being out of their comfort level when using mobile devices, too many mobile devices to choose from, inappropriate use of mobile devices in cheating and cyberbullying, the lack of time for planning mobile learning integration, and students not being digitally literate enough are not much of a challenge in mobile learning. Forty one percent of the respondents did not complete this question.

Interview data revealed three major themes: Lack of good internet connectivity, lack of experienced teachers support, and lack of student knowledge about digital citizenship.

Lack of good internet connectivity. The findings suggest that most school districts lack good Internet connectivity which might influence the zeal for mobile learning integration since the Internet is an important part of the equation. This finding was supported by survey data. One teacher said:

> *The difficulty of connecting to the Internet through Wi-Fi. The difficulty of overcoming server software to allow instructional programs to work or the laptop computers. The difficulty of keeping up to date with all the changes that they put on district computers. I suppose, if I were an electronic or software engineer and did nothing my whole life but computer software then I might be able to*

understand how to keep up with the challenges of using mobile devices in my

classroom.

Lack of an experienced teacher for support. Another teacher suggested that the lack of IT support or more experienced teacher support with the technology makes mobile learning integration challenging. According to the teacher:

...even when I go to IT and ask them, that's what they do. They research the

situation and try to find answers...and so I will say that's the majority of it not

only doing the research but having support around that is able to assist whether it

be IT or more experienced teachers.

Another teacher noted several challenges they experienced in their school district from doing pilot projects, including the lack of students' knowledge of digital citizenship (supported by survey data), learning how to care for school owned mobile devices and academic dishonesty. She noted that:

We find that we need to spend much time teaching kids digital citizenship. We

have to teach the kids how to take care of somebody else's property. We had a lot

of breakage last year and we have quite a bit this year. We also found out that the

opportunities for dishonesty is pretty high. In order words, we found out that kids

were copying and pasting answers

The findings of the study suggested that most teachers experience challenges with mobile learning. Some of the teachers interviewed while acknowledging the challenges gave suggestions of how these challenges could be overcome.

Research Question 5: How Can High School Teachers Overcome the Challenges of Mobile Learning Integration?

Teachers were asked to rate the extent of their agreement with statements regarding overcoming challenges of mobile learning in high schools. As discussed in Chapter II, previous research points out four major correlates to overcoming those challenges. They include: professional development, being an early adopter, having a positive attitude, and awareness of digital citizenship. Section VI of the survey instrument asked respondents to rate their agreement on these four correlates. Table 12 presents the descriptive data for the 60 responses received on this section.

Table 12

Overcoming the Challenges of Mobile Learning Integration

Statement	SA	A	UC	D	SD	M	SD	n
There is a strong need for professional development in mobile learning integration at my school	25%	40%	15%	15%	5%	3.65	1.16	60
The teacher needs to be an early adopter of mobile learning	15%	36%	29%	17%	3%	3.42	1.05	60
The teacher needs to have a positive attitude towards mobile learning	37%	50%	7%	2%	5%	4.12	0.98	60
There is a need for increased awareness of mobile digital citizenship in the high school setting	30%	47%	15%	7%	2%	3.97	0.94	60

Most of the teachers (65% of 60 total responses) agreed that professional development in mobile learning integration in schools was a good strategy to overcome mobile learning challenges, but 15% were uncertain about whether professional development was needed, and about a quarter of respondents did not agree that there is a need for professional development in mobile learning integration..

Based on the survey results obtained, having a positive attitude towards mobile learning is the highest ranking strategy of the four needed to overcome mobile learning

challenges (87%). This is followed by increased awareness of mobile digital citizenship in the high school setting (77%). Having a strong need for professional development in mobile learning integration (65%), and the need to be early adopters of mobile learning (51%) were suggested as the least effective strategies for overcoming mobile learning.

Interview data revealed four themes regarding overcoming mobile learning integration challenges: piloting mobile learning integration, using polls and surveys, creating "ungoogleable" tasks, becoming technologically self-sufficient, and the institution of training for professional development.

Piloting mobile learning integration. Some teachers noted that pilot projects made the integration process easier. For example one teacher said:

> *Well, one of the things we did was a pilot project last year where we had just seniors try out Chromebooks and it was a steep learning curve. We find that we need to spend much time teaching kids digital citizenship.*

Another teacher noted that polls and survey were often used in the class to check for student understanding when learning with new mobile learning technologies. This can also be a form of piloting for mobile learning integration.

> *We can do polls and surveys and try to get their attention, try to relate the materials to their own experiences especially when we use new technology.*

Creating ungoogleable tasks. Other teachers suggested creating tasks that will make the students do it themselves and be creative to avoid the challenge of cheating by copying and pasting from the Internet. One teacher said:

So we really need to start creating assignments that are "ungoogleable", in other

words that they can think and not just look something up.

Another teacher said:

So I just let them find things on their own using the internet. I won't really give

them particular sites to go to. I am like "find this", "find that" I think in the real

world, and they are going to have to sort through a whole bunch of crap in order

to get to what they want.

Becoming technologically self-sufficient. Some teachers suggested that because

some of the challenges of mobile learning integration cannot be overcome, teachers need

to become technologically self-sufficient. Teachers should be encouraged to try new

things or move to the next task when problems arise. One teacher said:

A lot of challenges are not overcome. We simply turn the computer off and try

new things. I call the information technology person here at the school district to

try to come solve the problems on the computers. Sometimes that works,

sometimes it doesn't. Sometimes the students solve the problems. Sometimes I can.

Sometimes I cannot.

Another teacher said:

I Google the solution to the problem myself. That is what the IT guy does anyway.

The institution of training for professional development. The interviews

revealed that although professional development is much talked about in schools, most

school districts do not have specific training when it comes to mobile learning

integration. One teacher who had attended some professional development training shared his experience:

> *The professional development taught me that though I am pressured to teach in a way that focuses on test scores, and integrating smartphones, my true motivation as a teacher should be to think about the futures of my kids.*

Research Question 6: What are the Experiences of High School Teachers with Mobile Learning Integration in their Classrooms?

To obtain information about the teachers' experiences with mobile learning, the researcher in the interviews specifically asked about success stories, failures, first day of mobile learning integration, and their persistence in continuing with mobile learning integration in their classrooms.

Success Stories (Interview Question 5). Several themes emerged from analyzing the success stories, including student creativity, student engagement, support of special needs students, and managing learning for different types of learners. The teachers' perceive that mobile learning and the use of mobile devices enhance students' creativity as they learn. Teachers pointed out that students really enjoyed learning new techniques and new tools that they can implement in other areas.

> For instance, one teacher said:
>
> *We have done some assignments in class where I make them to use technology, use their creativity to express what they have learned. One of the things we did was I had the kids create infographics and they really enjoyed that. And so maybe a month later after we had finished with that assignment, and I was looking at a*

kid doing another assignment and I asked "what is this?" and they said "This is my Spanish assignment" and I said "it looks like an infographic" and she said "yeah! I am using this to illustrate this and that and the other". And I asked if their teacher asked them to do it that way. And they said "No, I am going to show it off."

Another teacher said:

Students can create high-quality videos that show off their creativity *as well as their understanding of a topic.*

Another teacher said:

I used to just lecture on the urinary system, and kidneys and so there are about six things you could really do to kill your kidney and I will lecture on them. You know diabetes is the number one killer of kidneys, salts, hypertension…There is like six things you could do to kill your kidneys. I used to talk about it and then lecture on it and the kids will just sit there and listen to me. But now, I have made an activity where it's called "Let's go kill a Kidney" and they are the ones that have to find out all of the information and they have to get on the internet and they have to find out what could kill a kidney. I actually have to give them pieces of information and they have to find the evidence of what happened to the kidney. So, it's kind of a shift in the learning skew it's not me telling them everything and they are just sitting there listening. It's more them doing the research, them doing the learning and me just kind of setting it up for them to be able to learn.

Two teachers indicated that mobile learning technology based on mobile devices supports students with special education needs.

One teacher added:

There is one student who has an IED (Intermittent Explosive Disorder) and so he ... I also indulge in ELL, so, I know how to present vocabulary. He was able to learn the vocabulary and have a really good grade on subsequent tests. I was pretty happy that online flash cards helped him concentrate.

Another teacher affirmed:

I have had a lot of success stories at the school I am at now, because the population I work with,.... I teach quiet science for students with IED's. They have struggled where they were before. Like struggling in a regular school. Sometimes it's because of dependence, sometimes it's because they are bored with the material. Other times it's behavior in general, and so using mobile learning...Quite a few students have told me that they have trouble in science at schools, some say it was boring but using mobile devices and computers, technology, it is very easy for me to make an entertaining lesson because I am able to incorporate things like videos and online testing which students at least, initially find very invigorating and interesting. A lot of times, that's all it takes is a light spot that gives something more attention.

Most of the teachers indicated that having pedagogical knowledge helped most in the integration of mobile learning. One teacher confirmed:

Pedagogical knowledge has contributed most to me integrating mobile learning in my classroom. Just recognizing different learning styles. How they can learn better makes me decide on what curriculum to use.

Failures (Interview Question 6). Most of the failures cited by teachers were due to external elements, such as technology breakdowns and outdated websites. One common theme that arose from analyzing the interview data for this question was the challenge of Internet connectivity. Most of the teachers complained that one of the greatest challenges that they face with mobile learning integration was unreliable internet connections, For example, one teacher affirmed:

My greatest challenge is internet connectivity and anywhere capability. Having enough resources so that my students are not reading around on or internet access to get them to the website to get working. There has been maybe one day that Khan Academy has been.., that the servers for their website has been down. Virtually every other problem and time we have had any other problems, has been our own access.

Teachers indicated that certain websites and applications sometimes do not work when they need them or they are not updated. Thus giving rise to frustration and failures when adding a website as part of the classroom lesson. One teacher complained:

In the past, I check for certain websites that I wanted the kids to go to and understand those websites. Certain times the websites don't work, or they don't come up or they weren't updated. That kind of stuff is frustrating.

First day of mobile learning integration (Interview Question 7). Some teachers had a very successful first day of mobile learning integration. Their success made them want to continue integrating mobile learning. For example, one teacher reported:

The kids just got their Chromebooks and they had no idea the kids of things they can do with it. Here I am teaching a science class and one of the things we want the kids to know is where the safety equipment is how to use them so I created a bunch of QR codes and put them all over the room and they took their Chromebooks and had to scan it and when they scanned it, it came up with what the item was, how it was used and what instance that will be used. Then they had to create a document that recorded all that information and so it was a scavenger hunt and it was also a way to learn about the equipment that is in the lab and also is a way of learning how to use Chromebooks.

Another teacher reported:

I had them logged on in about five minutes. I showed them around the website, Khan Academy for another five minutes and then I got them started and they were doing problems the first day about half way through the period. So it was very positive. We went into it right away and got started right away.

The findings also suggested that some teachers did not succeed on the first day they integrated mobile learning. Most of the teachers indicated that they experienced technical issues but it was their willingness and positive attitude towards technology in learning that made them continue with the lesson. One teacher complained:

I would say that the first time I used mobile technology, there were a lot of bugs that I didn't foresee and so it took a lot of energy and scrambling to get it to work the first time and obviously we figured it out as they went but I could see that being a problem for someone who is not technologically savvy. They might not try it again but it was the willingness to get through them like I did. Definitely, the first time I used technology they were some tough scenarios I had to get through some bumps in the road but it was a blast when we figured it out.

Persistence (Interview Question 8). Most of the teachers interviewed confirmed that their students loved to learn with mobile devices. The students' motivation and excitement motivates the teachers in to continue integrating mobile learning in their classrooms. Teachers also indicated that they felt accomplished when their students learnt.

One teacher affirmed:

I think the kids like it, I think they learn from it, and I honestly don't really have to go check out the classes that have iPads anymore or check out the several devices they have. Most of the time I can just say "Ok kids get your phones out or get your iPads out", and most of them already have it in my class. So that is very handy and I have a couple of computers that's even better for some kids to use.

Another teacher added:

The kids love it. When I use it, they learn and when they learn more I have accomplished my goals as a teacher.

However, teachers cited several challenges that may affect their persistence with mobile learning. The lack of finances to purchase mobile devices and time needed to set up lessons that integrate mobile learning were the two main themes that arose as reasons for not wanting to integrate mobile technology in the future. One teacher asserted:

The financial aspect. You have to get them. If you have to check them out. That's a hassle and if you do check them out, you have to share them with other people and you do have to worry that one will go missing. You have to keep track of all of them.

Another teacher said:

I would say probably TIME it does take a little bit of time to get the students to do what you want them to do with the technology and if you want to include technology in every lesson that would take a considerable amount of time of the year when you could use it

Summary of Results

Chapter IV presented results from the survey instrument and findings from the follow up interviews done to fill in the gaps from the survey. Included in this chapter was an analysis of the data collected in the quantitative and qualitative phases to investigate the six research questions. Research Question 1 asked teachers to define mobile learning. Using the inductive approach for qualitative data analysis, it was determined that teachers define mobile learning based on three concepts: making use of internet resources to enhance/guide/facilitate instruction, learning assisted by personal electronic devices (iPads, cellphones, Chromebook, and laptops), and anywhere, anytime learning using 21st

century technology. Research Question 2 investigated the effective mobile learning integration strategies used in the classroom. Using descriptive statistics (mean) of the quantitative data, it was determined that individual/group collaboration was the strategy regarded as most effective for mobile learning integration, followed by note taking, and communication through homework reminders. The interpretive analysis of qualitative data supported the quantitative results that mobile learning is usually integrated as research tools, for homework reminders, and for formative feedback. Research Question 3 asked Likert scale questions to find out the benefits of mobile learning. Using the mean, it was determined that teachers benefited most from mobile learning when they integrated mobile devices as research tools in their lessons, to stay connected with other teachers, and for formative evaluation during lessons. This result suggests that teachers may regard benefits and effective strategies for mobile learning integration as the same thing. The results of Research Question 4 on the challenges of mobile learning indicated that student distraction, limited connectivity, and lack of technology training were the most common. This was determined by the mean of the quantitative data. From the interpretation of interview data, I was found out that another major challenge of mobile learning integration was the lack of support from experienced teachers and the lack of awareness of digital citizenship. Research Question 5 investigated possible ways of overcoming mobile learning challenges. Using the mean of the quantitative data collected it was determined that the most effective ways of overcoming mobile learning challenges included having a positive attitude towards technology integration and being aware of digital citizenship. Interpretive analysis of the qualitative data indicated that by increasing

the quality of professional development of teachers in mobile learning integration, creating tasks that are "ungoogleable", creating teachers awareness of digital citizenship in the classroom, becoming technologically self-sufficient, and pilot testing would enhance mobile learning ~~integration~~. Research Question 6 investigated the extent of the experiences of teachers with mobile learning. Through inductive analysis of interview data, it was found out that teachers had varied experiences with mobile learning integration ranging from success stories to failures during the first day of mobile learning integration. The findings also indicated that teachers persisted with mobile learning integration because of increase in their students' motivation to learn. Chapter V discusses the findings, implications, conclusions, and recommendations of the study.

CHAPTER V

Discussion of Findings, Conclusions, and Recommendations

This chapter provides a discussion of the findings, their implications, conclusions, and recommendations. Chapter V begins with an overview of the study, followed by a discussion of the findings and implications in view of the research questions, and ends with conclusions and recommendations drawn from the study.

Overview of the Study

This explanatory study examined the experiences of high school teachers from Idaho and Wyoming with the aim of assessing the effective integration of mobile learning in their classrooms. An exhaustive review of the literature indicated that there is limited research on high school teachers' integration of mobile learning in their teaching. In addition, the literature pointed to the kind of knowledge teachers need to effectively integrate mobile learning technologies in their classroom. Specifically, it pointed to technological, pedagogical, and content knowledge, as modeled by the TPACK framework (Koehler & Mishra, 2007). Pedagogical knowledge refers to an understanding of teaching practices and methods, such as student learning, classroom management, lesson planning and implementation, and student assessment. Content knowledge refers to the knowledge about the subject matter that is to be learned or taught (Mishra & Koehler, 2008). Technological knowledge refers to knowledge about various digital technologies that could be used in teaching and learning. Technological Pedagogical knowledge includes an understanding of how technology is used to teach in different ways according to the students learning needs (Harris, Mishra, & Koehler, 2009).

Technological Content knowledge refers to an understanding of how technology can be used to support the learning of specific subject area curriculum (Mishra & Koehler, 2006). Pedagogical Content knowledge refers understanding teaching strategies appropriate to specific content areas (Harris, Mishra, & Koehler, 2009). At the intersection of all three lies Technological Pedagogical Content Knowledge; that is, the integration of appropriate technologies with specific teaching strategies for the teaching of given content areas. In this study, the Technological Pedagogical Content Knowledge Framework (TPACK) provided some guidance on the type of knowledge teachers need to effectively integrate mobile learning.

By examining the experiences of 104 survey respondents and eight interviewees, the researcher identified some common threads of mobile learning instructional strategies, effective strategies for mobile learning integration, benefits, challenges, and some strategies of overcoming mobile learning integration in high school classrooms.

The data were collected in two phases. In the first phase, data were collected using a survey instrument which included both open-ended and closed-ended questions. Quantitative and qualitative methods were used to analyze the data from the survey instrument. In the second phase, qualitative data were collected by way of interviews, and the data were analyzed using interpretive categorization (Gall, Gall, & Borg, 2010). The findings are discussed with respect to the research questions.

Discussion of Findings

Research Question 1

Research Question 1 investigated how high school teachers define mobile learning. The findings from the study indicate that high school teachers do not have a common nor consistent definition of mobile learning across disciplines. This supports past literature which suggested that mobile learning is defined differently by both researchers and educators (Pozzi, 2007; Traxler, 2009b; Brown-Martin, 2008). From the study, the researcher found out that some definitions given in the interview were different from those given on the surveys by the same individuals. This was in line with the literature about inconsistency in the definition of mobile learning. Peng et al. (2009) suggested that there is no common definition of m-learning in the literature yet, because it is a new concept.

Teachers also confirmed that mobile learning was not a term they used often. It was a new concept to them and was thus difficult to define. The findings support previous studies (Traxler, 2009b; Winters, 2006; Peng et al., 2009). More recent studies suggest that in spite of the fact that "mobile technologies have been used in teaching and learning for over a decade, there is yet no consensus on how mobile learning should be conceptualized" (Khaddage, et al., 2015, p. 2).

In the present study, teachers who had experience with mobile learning indicated that the definition of mobile learning must include a mobile learner and a facilitator interacting together. This finding suggests that a definition of mobile learning should

emphasize the cognitive and social aspects of mobile learning as suggested by Pachler (2009) and Sharpes et al. (2007).

The findings of the study also suggested that teachers define mobile learning based on three contexts:

- Making use of internet resources to enhance/guide/facilitate instruction

- Learning assisted by personal electronic devices (iPads, cellphones, Chromebook, and laptops).

- Anywhere, anytime learning using 21st century technology

The result indicating that the definitions of mobile learning by teachers emphasize the use of the internet is consistent with a common definition of mobile learning in scholarly literature as "the use of portable devices with Internet connection capability in education contexts" (Kinash, Brand & Mathew, 2012, p. 639). Another study suggested that mobile learning was an extension of e-learning, a step toward making the educational process "just in time, just enough and just for me" (Peters, 2007, p. 15) which is in line with theme three. A majority of the interviewed teachers stated that mobile learning took place online and the technology piece is just the medium for learning.

From the review, analysis, and synthesis of responses from the survey and interviews, the researcher proposes this definition of mobile learning: *Making use of up to date internet resources by a teacher as facilitator and a student to interact for learning purposes assisted by personal electronic devices anywhere and anytime.* This definition differs from previous mobile learning by O'Malley et al. (2006) because of the additional criterion that internet resources be up to date. This addition is needed because the internet

has a variety of resources which are outdated and many websites are not frequently updated.

Research Question 2

Research Question 2 investigated the mobile learning integration strategies. The strategies were identified by responses to the survey and interviews. The findings of the survey reveal that high school teachers do not have one common strategy for integrating mobile learning in the classroom. Teachers agreed that having a positive attitude is a necessary condition for integration, not a cause. The acceptance by teachers to use mobile technology in and out of the classroom has the greatest influence on the successful integration of mobile learning. In addition, teachers reported that the integration of mobile technology into teaching and learning has had a great influence on the experience and performance of learners because they are more motivated to learn when they use technology they are familiar with.

The findings from interviews suggested that the most effective ways of integrating mobile learning in the classroom are through incorporating mobile learning technologies as research tools during lessons, as homework reminders, and as tools for combining class response systems with peer learning. Most of the teachers in the interviews agreed that the internet is now a K-12 research tool, and that mobile learning technologies have made looking for information in the classroom easier. The findings are in line with previous literature which supports teachers' use of mobile technology to gather, analyze, and act upon student feedback more efficiently (Caldwell, 2007; Kay & LeSage, 2009). Similarly, Huffling et al. (2014) concluded that using mobile devices

made data collection more current, authentic, efficient, and engaging. Teachers in the study said that most schools have provided clickers to each classroom and that students without clickers used their smartphones to respond immediately to multiple choice questions.

Most teachers interviewed agreed that sending homework reminders via text messaging was an effective strategy for mobile learning integration. This is supported by previous literature by Mayer (2002) that crucial homework reminders could be sent via text messaging on phones. Mayer concluded that using text messaging improved student organization and motivation.

Some teachers noted that understanding the use of technologies for mobile learning affects its full integration in the curriculum. Most of the teachers in this study, especially those who were interviewed, were integrating mobile learning in their class curriculum. However, teachers strongly agreed that having a positive attitude alone without technological, pedagogical and content knowledge (TPACK) did not help teachers to integrate mobile learning effectively. For teachers to gain the technological, pedagogical, and content knowledge required to integrate mobile learning effectively, it would be necessary for the school district to organize professional development for them. Some of the teachers who were interviewed indicated that most school districts did not have professional development programs geared towards mobile learning integration.

Research Question 3

Research Question 3 investigated the benefits of mobile learning in high school classrooms. The results of the study suggest that mobile devices are mostly owned and

distributed by school districts. This might be seen as a benefit to mobile learning since the mobile devices will be available to all students and schools do not have to worry about students who do not have their own mobile devices. This result is not consistent with recent trends in mobile learning that most school districts encourage both teachers and students to bring their own device (BYOD) to the classroom. BYOD is a recent trend in learning with technology where students bring a personally owned mobile device with various apps and embedded features to use anywhere, anytime for the purpose of learning (Song, 2014).

The results from the study are however consistent with the findings in the literature review that teachers' benefit from mobile learning in many ways including increasing student engagement with content, encouraging collaboration, and communicating quickly and individually when learning.

The findings of the study suggest that the mobile learning approach can encourage student engagement with content. For example, students can answer polls, tweet questions, and look up information during lessons. This can help a teachers check for understanding. This study's finding of encouraging student engagement is in line with previous qualitative research finding by Milman, Carlson-Bancroft and Vanden- Boogart (2012) who concluded that when teachers use iPads during lessons in high school classrooms, high levels of student engagement in learning were recorded. Another study by Chou, Block and Jesness (2012), reported that teachers use mobile applications (Apps) to engage students in activities in which they would normally be distracted. Some

teachers in the Chou, Block and Jesness study acknowledged using Apps in their classroom for learning specific content and not for engagement.

Interview data indicate that teachers find students are more creative and genuinely engaged when mobile learning is integrated into lessons. Teachers reported that, when collaboration was encouraged, students think critically and work together to solve problems, thus enhancing their creativity. Some teachers indicated that mobile learning has broadened the scope of resources for them as teachers. However, teachers indicated that not all lessons can be taught using mobile devices or technology.

Three themes emerged from the interview data concerning the benefits of mobile learning integration: research, through social media, and assessment.

Teachers indicated that mobile learning was most beneficial when doing research in the classroom. Enhanced research productivity was a new finding from the study since it was not addressed in the literature reviewed. However, most of the teachers in the current study indicated that gathering research using mobile devices is an active and valid learning activity during class time, because students must engage in the real world in which they are absorbed, using their mobile phones or tablets to record and send back information. Previous research suggested that smartphones and other mobile learning technologies are prevalent in high school classrooms today (Project Tomorrow, 2012) and the current study indicated that students use them to find information quickly in the classroom.

Most of the teachers brace the use of social media like *Facebook* or *Twitter* to stay connected with other teachers as a benefit to mobile learning. This finding is

consistent with research by Rinaldo, Tapp and Laverie (2011) which suggests that *Twitter* can be used as an educational tool. The way information within *Twitter* is organized maybe one reason why it can be used in the classroom for things like research. Learning how to filter through tweets, organized using hashtags, could bring clarity and meaning to *Twitter* and its use for finding information that is related. This finding suggests that educators need to learn to appreciate the power of a social media tool such as *Twitter* for providing information and for global communication. The role and knowledge of the educator is more important than ever before.

Examinations and tests are known to be typical ways of evaluating student progress and are vital to the accountability of many schools. These vastly evident forms of tracking student growth, known as summative evaluation might not be truly effective. Instead, assessments should be formative whereby the teacher can frequently check, identify, and respond to students learning needs during lessons. Mobile technology makes this possible because students have devices like smartphones that teachers can make use of to adjust their teaching to meet individual needs, and to better help students reach high standards. Most of the teachers interviewed in this study had access to school-owned mobile devices like Chromebooks, clickers, and iPads that they could use to get formative feedback. Research by Oigara and Keengwe (2011) supports this finding that students enjoyed the use of clickers during lessons and recommend their use in the classroom. The researchers also concluded that using mobile devices like clickers during lessons increased students' participation and engagement.

Research Question 4

Research Question 4 investigated the challenges of mobile learning in high school classrooms. The challenges to mobile learning integration reported by teachers in this study fall under four distinct categories: teacher-centered challenges (classroom management, lack of training, time factor in preparing lessons), student-centered challenges (distraction and cheating), administrative challenges (limited IT support), and technical challenges (connectivity, constant changes, and out dated information). The lack of training (a teacher-centered challenge) and students getting distracted when using mobile devices (teacher-centered/classroom management challenge) were the most significant challenges to mobile learning integration revealed by the study.

The lack of training may explain why some teachers are skeptical about integrating mobile learning. The findings from the interviews also suggests that some teachers may be uncomfortable and insecure with the technology. Some teachers indicated in interviews that often the students are more knowledgeable with the technology than they are. The lack of professional development for mobile learning integration is not a new challenge; some studies of K-12 teachers and pre-service teachers (Kukulska-Hulme et al., 2009; Schuck et al., 2013) indicate that teachers are not effectively prepared to investigate the advantages or make informed decisions in mobile learning adoption.

Some teachers indicated that students get distracted by mobile devices when learning. The challenge may lie in developing engagement that truly makes use of the internet connected electronic device's capabilities. This is why it is critical for teachers to

have pedagogical knowledge which is part of the TPACK conceptual framework

(Koehler & Mishra, 2006). Pedagogical knowledge refers to having an understanding

about teaching practices and methods, such as differences in learning styles, classroom

management, lesson planning and implementation, and student assessment. A teacher

with deep pedagogical knowledge understands how his/her students learn and will

acquire teaching skills to present materials to students so they can successfully learn

irrespective of the subject taught (Mishra & Koehler, 2008). According to Mishne (2012),

pedagogical knowledge will help teachers examine and understand the process of

teaching with or without technology.

Teachers need to be aware of the fact that by merely converting and packaging

existing course material for mobile consumption does not qualify as effective mobile

learning. Instead, the learning content and tasks need to be designed with a mobile device

focus. Interview data revealed that what worked on a desktop computer does not

necessarily work on a portable mobile device (like using a smartphone to edit a Word

document). In addition, the content needs to be interactive enough to keep the students

engaged because if the content is boring, the students will get distracted.

Mobile learning technologies are constantly changing. This can be one of the

challenges faced by teachers unable to update their content and technology knowledge

(the T and C of TPACK). Other challenges voiced by the teachers included the time to

learn to use mobile devices effectively, to find updated online resources that would

support student learning and reduce the time spent preparing for lessons, technical issues

such as providing Internet and Wi-Fi access to student devices at school, overcrowding of

the network due to multiple device use at the same time, and the lack of same mobile technologies for all students. Teachers in this study also indicated that they had to constantly monitor students to prevent them from accessing inappropriate websites or getting distracted from the task at hand. This supports previous research by Crescente and Lee (2011) that students run the risk of getting distracted when learning with mobile technologies.

The findings also strongly point to the need for teachers to be supported and guided when they embark on integrating mobile learning into the classroom. Mostly, teachers need support to enable them learn how to use the technology for effective integration in their teaching environment. This supports previous research which has addressed the factors that impact teachers' integration of a variety of mobile learning technologies into the classroom, including; environment, policies, support, and beliefs (Hammond, Reynolds, & Ingram, 2011; Sang, Valcke, Braak, & Tondeur, 2010).

Research Question 5

Research Question 5 investigated the strategies for overcoming the challenges of mobile learning. The results of the survey suggests that the attitude of teachers towards the use of mobile learning technology in the classroom is an important and an often overlooked factor of successful curriculum integration. Hew and Brush (2007) argued that a teacher's attitude and belief towards technology can be a stumbling block to the effective integration of technology in the classroom. Having a positive attitude is necessary for any teacher to easily incorporate mobile devices for mobile learning. To develop a positive attitude a teacher may need to take some time off to learn how to use

the devices as suggested by MacCallum and Jeffrey (2009). When teachers are in touch

with new and upcoming mobile technologies that students are using, there is no

disconnection between school and daily life activities. A study by Spires, Lee, Turner,

and Johnson (2008) supports this finding that students usually regard their teachers as

being out of touch and not understanding that mobile technologies have become a

significant part of students' lives.

Having a positive attitude towards mobile learning integration isn't everything

needed for effective integration. Evidently, teachers need to rethink their teaching

strategies, learning theories, and methodologies to smoothly transition to mobile learning.

Being an early adopter of mobile learning could be one way of helping teachers become

more familiar with mobile technology. One interview participant indicated that their high

school started a pilot project with Chromebooks in her classroom before Chromebooks

were introduced into other classrooms. The early adoption of the Chromebooks proved

successful in this case and seemingly aided the integration of mobile learning.

The findings of the interviews revealed five themes regarding overcoming mobile

learning challenges: pilot projects, creating ungoogleable tasks, being technically savvy,

engaging in professional development, and digital citizenship.

The interviews revealed that most schools have done pilot projects before

embarking on mobile learning. One teacher specifically talked about Chromebooks being

piloted at their school district. According to this teacher, the Chromebooks were bought

because they were cheaper than iPads. Teachers have to figure out the Chromebooks and

record how they can be explored for mobile learning before using them. Another teacher

talked about iPads being piloted at their school district in a ninth grade classroom.

Piloting technology with a few, willing participants is a potential way of reducing

the challenge of teachers being out of their personal comfort level when using mobile

devices to teach. This finding supports literature about mobile learning pilot projects

done to avoid encountering mobile learning challenges. For example Chou, Block, and

Jesness (2012) piloted iPads in ninth grades classrooms in some Minneapolis public

schools and their findings revealed both promising opportunities and technical challenges

for teachers and students.

Interview data in this study suggests that teachers should create tasks that will

make students think critically rather than merely Googling an answer. This finding is

important because authentic learning environments provide real life tasks that provide the

learner with opportunities to connect directly with the real world. For example, one

science teacher suggested having teachers to create a lesson which requires students to

find information on their own about avoiding kidney failure and providing evidence of

what happens to the kidney. Creating tasks like this on mobile learning devices, where a

Google search does not easily give a fixed answer, could guide students toward tackling

real-world issues. One teacher suggested that students should be given tasks that make

them unable to cheat. To accomplish this, one teacher suggested creating "unGoogleable"

assignments which made students actually do the work and tasks that enhanced their

creativity. This finding suggests that the more authentic the task, the more engaged and

motivated students become, and is consistent with previous research by Herrington,

Reeves, and Oliver (2014) that mobile devices provide authentic learning experiences and improve students' critical thinking skills.

The findings of the study suggest that most mobile learning challenges can be overcome. Teachers need to learn about how to solve issues as they come and be proactive with researching on how to solve problems. One teacher noted that when she asked for technical support for help in her classroom, the IT staff Googled for the solution. Therefore, when teachers researched on their own on how to solve technical challenges they encounter in mobile learning, they could resolve some of the problems themselves. This might mean that becoming technologically self-sufficient can help teachers overcome some challenges they encounter with mobile learning. This supports literature that mobile learning challenges can be overcome by teachers themselves through having a positive attitude when integrating mobile learning for the first time (Fristchi & Wolf, 2012).

Attending professional development workshops and conferences can also help overcome mobile learning challenges. For this study, professional development for teachers was defined in Chapter I as learning opportunities for in-service teachers that include formal or informal instruction. Literature supports this finding that professional development geared towards using mobile technologies for instruction can help teachers increase student achievement and better meet students' needs (Hwang & Chang, 2011). Wei, et al. (2010) suggest that "professional development should be sustained, coherent, take place during the school day and become part of a teacher's professional responsibilities, and focus on student results" (p. 2). Wei, et al. (2010) reviewed survey

data about teaching practices and professional development and drew several

conclusions. One of the conclusions was that teachers in the United States generally spent

more time instructing students and less time in professional learning opportunities with

their peers than teachers in top-performing countries, such as China and Japan.

   With schools currently facing a collection of complex challenges from working

with an increasingly diverse population of students, to integrating new mobile technology

in the classroom, to meeting demanding academic standards and goals, it is important that

teachers enhance and build on their technical, pedagogical, and content knowledge.

Professional development should be geared more toward the use of the mobile learning

technologies, digital citizenship, specific subject area mobile learning integration

strategies, and mobile learning pedagogical strategies. These suggestions are in line with

the TPACK framework (Koehler & Mishra, 2006) which suggests that when teachers

have technological, content, and pedagogical knowledge, they are able to integrate

mobile technologies in their lessons easily. Figure 5 illustrates the suggested model.

Figure 5. Possible Professional Development Approach to Mobile Learning

The research findings suggests that during professional development, questions such as: what are the mobile learning technologies? what are the mobile learning pedagogical strategies? what is digital citizenship? and who are my experienced colleagues?, are addressed. Literature suggests that mobile learning is a common and accepted pedagogical strategy (Judge, Floyd, & Jeffs, 2015); therefore teachers need to be trained to embrace this new era. When teachers are also trained on conducting research on the internet and how to choose the right websites for content in conjunction with training on mobile technologies, they are more comfortable with integrating mobile learning lessons.

A lack of digital citizenship has been identified as one of the challenges to integrating mobile learning; both interviewees and previous literature suggest ways in which this challenge might be overcome. Digital citizenship in this study refers to the standards that teachers need to be aware of to ensure safe, legal, and ethical use of technology in the classroom (Ribble & Bailey, 2007). When teachers are digital citizens themselves, they become role models for their students. The National Educational Technology Standards for teachers (2012) suggests that during professional development, the nine elements of digital citizenship be discussed.

Research Question 6

To examine the experiences of the teachers, the researcher asked questions about successes, failures, first time integration of mobile learning, and their persistence with mobile learning integration in their classrooms. The findings of the study indicated that teachers' experiences were generally positive towards mobile learning integration, especially when they recorded success stories of their students becoming more motivated, creative, and interested in lessons. It is important to note that creativity has been proclaimed as one of the key 21st century skills according to the Framework for 21st Century learning (2008) which was developed with input from teachers, education experts' sand business leaders. The literature also suggests that mobile devices motivates students to learn and hence it increases their academic achievement (Rao, Gao & Wu, 2008).

The findings are also consistent with the findings in the literature review that mobile learning technology supports students with special education needs (Fernandez et

al., 2013). Two teachers indicated in their success stories that students with Intermittent Explosive Disorder (IED), "a behavioral disorder characterized by explosive outbursts of anger, often to the point of rage, that are disproportionate to the situation at hand (i.e., impulsive screaming triggered by relatively inconsequential events (McElroy (1999)", were making better grades in mobile learning lessons.

Those teachers who indicated that they had some failures when they first integrated mobile learning also said they did not give up completely on subsequent lessons. This suggests that persistence is an important characteristic of teachers who integrate mobile learning in their teaching. The findings also suggested that most teachers experience failures when they incorporated websites in their lessons that were not updated or had been discontinued.

In summary, the findings of the study suggest that successful integration of mobile learning in the classroom requires the continuous creation, maintenance, and re-establishment of an active balance between mobile technology, content, and pedagogy. Many factors influences reaching this balance including positive attitudes, persistence, and digital citizenship.

Implications of the Findings for Practice

The findings of the study have several implications for teachers, administrators, and teacher educators who are integrating or are thinking of integrating mobile learning in the teaching and learning process. First, research has shown that integrating mobile learning in the teaching and learning process appears to impact student learning in a positive way.

For teachers. The findings of this study suggest that mobile learning provides an exciting opportunity for teachers to explore the benefits and potentials of mobile learning. While acting as a support to classroom activities, mobile learning devices motivate students to learn and achieve more through research and creative use of the devices. With proper training on how to effectively integrate mobile learning, teachers will be able to support and instruct the use of mobile devices in the classroom on a regular basis. When teachers explore the benefits and potentials of mobile learning integration in high school classrooms they may become more motivated to incorporate mobile devices in their lessons.

The study also outlines a number of challenges that teachers may encounter in the process of integrating mobile learning in their classroom instruction. For instance, the need for the basics of technology and strategies to plan and implement technology integrated activities that support and enhance effective learning. Teachers may recognize their own challenges within this study and be prepared to face those challenges for the benefit of their students.

School administrators. School administrators may take the conclusions of this study to support high school teachers who are currently integrating or who are about to integrate mobile learning in their classroom. School administrators need to understand that when they ban rather than embrace real world technologies for teaching and learning, students are unprepared to connect the power of technology to learning, unprepared as digital citizens, and lack sufficient knowledge to safely navigate the internet. In addition,

this study argues the importance of professional development before and during the integration of mobile learning.

For teacher educators. Even though teacher educators are not addressed in this study, they play an important role in mobile learning integration. These educators should ground teacher candidates on mobile learning integration strategies discussed in this study. Teacher trainers need to be aware that mobile learning is a 21st century trend in education and therefore implement mobile learning modules when training high school teachers.

Digital citizenship as an element of future practice. Teachers need to also understand the importance of teaching digital citizenship skills to their students. These nine elements are organized into three primary categories by Ribble and Bailey (2007): Respect, Educate, and Protect.

Respect. *Digital Access* Teachers and students need to understand that everyone has the same opportunities when it comes to technology use.

Digital Etiquette Teachers and students need to learn about appropriate behavior online.

Digital law Teachers and students need to understand it is a crime to steal or damage another's digital work, identity or property online.

Educate. *Digital Communication* Teachers and students need to learn how to communicate appropriately online.

Digital Literacy Teachers and students need to be taught how to learn in a digital society.

Digital Commerce Teachers and students must understand how to be effective consumers in a digital economy.

Protect. *Digital rights and Responsibilities* Teachers and students need to be informed of their basic digital rights to privacy and freedom of speech.

Digital Safety and Security Teachers and students need to know how to protect their information from outside forces that might cause harm.

Digital Health and Wellness Teachers and students need to understand the health risks of technology such as psychological issues like repetitive stress syndrome, to psychological issues, such as internet addiction. Hollandsworth, Dowdy, and Donovan (2011) suggest digital citizenship skills be included and taught in the K-12 setting, this could encourage teachers to integrate mobile learning in their classrooms.

Recommendations for Future Research

From the data gathered for this study, the following recommendations are made for further research:

1. Review and update the survey to reflect recent trends in mobile learning integration in high schools.

2. Further research is needed in developing a universal mobile learning integration strategy for major content like science, mathematics, humanities, language learning, and social sciences.

3. Further research is needed on how each aspect TPACK framework contributes to mobile learning integration in all of K-12 teaching and learning environment.

4. Although this study was conducted with teachers, it would benefit the educational profession to survey school administrators because they are responsible for planning class curricula, setting school budgets and directing the teaching staff regarding proper new policy implementations.

5. Add Digital Citizenship as a separate element of study, as it appears to be a major impediment for teachers who might wish to integrate mobile learning and a continuing challenge for teachers who are integrating mobile learning.

Summary

This dissertation details the experiences of high school teachers with mobile learning integration. The researcher used a sequential explanatory mixed methods research procedure to get qualitative data (obtained through participant interviews) to help explain initial quantitative results (obtained through an online survey). This design was well suited for this study because the researcher used quantitative participant characteristics to guide purposeful sampling for the qualitative phase of the study.

The theoretical framework for this study was based in the TPACK framework proposed by Koehler and Mishra (2006). Teachers are expected to have pedagogical, content, and technological knowledge to be able to integrate mobile learning effectively in the classroom. The literature review also served as a pointer to pedagogical strategies needed for mobile learning integration.

The data analysis answered six research questions. All questions were answered by both survey and interviews. The interview data was explanatory, explaining, and enhancing the information obtained by survey. Individual/group collaboration was the

mobile strategy teachers regarded most effective for mobile learning integration, followed by note taking and communicating through homework reminders. Teachers most benefit from mobile learning when they integrate mobile devices as research tools in their lessons, to stay connected with other teachers, and for formative evaluation during lessons. Other findings supports literature that mobile learning comes with challenges like student distraction, limited connectivity, and lack of technology training. The teachers indicated that one major challenge was not getting enough support from other experienced teachers. Mobile learning challenges could be overcome by increasing the quality of professional development for mobile learning integration, creating tasks that are ungoogleable, teacher digital citizenship in the classroom, becoming technologically self-sufficient, and pilot testing mobile learning before integration. High school teachers have varied experiences with mobile learning including, success stories and failures on first day of mobile learning integration. Teachers also indicated that their persistence with integrating mobile learning depended on their positive attitude towards mobile technology integration in general.

Conclusions

The purpose of this explanatory study was to examine high school teachers' experiences with integrating mobile learning in their classrooms. The conclusions are based on integrating the findings from Phase One and Phase Two of the study. The following conclusions are yielded from the study;

- Teachers do not have a common or consistent definition for mobile learning.

- The challenges of mobile learning are unavoidable but solutions are available.

- Mobile learning has impacted teaching and learning in high schools in many positive ways such as classroom support, communication, collaboration, student engagement. Professional development in high schools should address the Technological, Pedagogical, and Content Knowledge as well as digital citizenship elements and their intersection, when training teachers for mobile learning.

Teachers do not have a consistent definition for mobile learning. From the study, it can be concluded that there is still no universal definition of mobile learning. However, teachers view mobile learning in many perspectives: as a component of a learning program, something that supports the learning process as an add-on-tool, rather than being the principal learning method, and learning that can take place anywhere and anytime with the use of portable electronic devices connected to the internet. Mobile learning is therefore defined as making use of up to date internet resources assisted by personal electronic devices to facilitate teaching and learning anywhere and anytime.

The challenges of mobile learning are unavoidable but solutions are available. Mobile learning is relatively new compared to online learning, therefore challenges are expected. The challenges mentioned in this study are not specific to this study alone. They have been explored in earlier studies of mobile learning integration. The challenges include: lack of training for teachers (Fritschi & Wolf, 2012), limited internet connectivity, distraction, limited resources (such as iPads, Chromebooks, laptops, etc.) (Barbour, Quinn, & Eye, 2014), lack of time (Liu, Navarrette & Wivagg, 2014), and inappropriate use of mobile devices by students like cheating and cyberbullying (End, Worthman, Mathews, & Wetterau, 2010).

The findings of the study also suggested that teachers need to become creative about working around insurmountable challenges like websites which are not updated or are no longer available, and mobile devices experiencing unexpected technical difficulties. For example, if a website is no longer available, a teacher should be able to find another website or create a task which requires students to collaborate. This study supports the finding that, although mobile learning faces some challenges which cannot be overcome, most of the challenges can be resolved. One suggestion supported by the literature is professional development geared towards mobile technology uses for instruction, and teaching about digital citizenship. Furthermore, school district administrators are encouraged to allow the use of mobile device in the classroom instead of limiting them because they have been proven to increase achievement (Fritschi & Wolf, 2012).

Mobile learning has impacted teaching and learning in high schools in many positive ways such as classroom support, communication, and personal support. From this study, it can be concluded that mobile learning can be used to facilitate teachers' activities in the classroom through the use of updated mobile learning technologies like iPads with a variety of educational applications. Mobile applications and websites such as Khan Academy have been developed to support teachers' duties such as lecturing and the assessment of student work. Mobile learning can also facilitate teachers' communication with parents, students, and colleagues. Teachers have access to a world of ideas, lessons, and information at their fingertips with mobile learning. High

school students today can research more easily and faster because they now have the library at the tip of their fingers.

Technological, pedagogical, and content knowledge and the awareness of digital citizenship support mobile learning integration. For a teachers of integrate mobile learning in their classroom, they should have technological, pedagogical, and content knowledge. For the integration process to be effective, the digital citizenship piece needs to be added. In this study, digital citizenship referred to standards of which teachers need be aware to ensure a safe, legal, and ethical use of technology in the classroom. When teachers are aware of the nine defining elements (digital access, etiquette, law, communication, literacy, commerce, rights and responsibilities, safety and security, and health and wellness) of digital citizenship, they will understand how to best integrate mobile learning and in turn teach their students.

The findings of the study highlight the importance of mobile learning integration in high school classrooms today. Mobile learning can support teachers and improve their teaching practices in high school. For mobile learning to be effectively integrated in the classrooms teachers need to start by having a positive attitude towards mobile learning integration. In addition, administrative support and professional development in the technological, pedagogical, and content elements of mobile learning are crucial to its effective integration. When teachers are exposed to information and developing knowledge about mobile learning integration, they will effectively integrate it in the classroom. Teachers however, need to rethink their teaching strategies, learning theories, and methodologies to smoothly transition to mobile learning.

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APPENDICES

APPENDIX A: Survey Instrument

Research Study: An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning.

By

Sylvia M. Suh, Doctoral Candidate,

Department of Instructional Design

Idaho State University

Purpose of the research: The purpose of this explanatory study is to examine high school teachers' experiences with integrating mobile learning in their classrooms. This mixed methods study will include a quantitative phase one where data will be collected through an anonymous online survey and a qualitative phase two where data will be collected through phone interviews. Phase one of the study will be anonymous but participants can identify themselves by providing their email address if they are willing to participate in the interviews. The study will identify some demographic information, benefits, challenges, remediate challenges, teacher experiences, and integration strategies for mobile learning in high school settings.

Who is eligible? All in-service high school teachers in Idaho and Wyoming who own a mobile device(s) and have used it at least once in their classroom for teaching or learning purposes or teachers who are interested in mobile learning. Participation is voluntary and you can withdraw at any time.

What will participants be asked to do?

Participants will be expected to complete a 10 minutes online survey. Participants will indicate their interest in participating in interviews by providing their email address at the end of the survey. A 20 minutes phone interview will be conducted at the participants' convenience.

How will participants benefit from the study?

This study will be beneficial to teachers, superintendents, and their students as effective strategies for integrating mobile learning and suggested practices for overcoming the challenges faced with mobile learning integration will be explored.

If you have any questions or are interested in participating, please contact:

Sylvia Suh at (208) 705-1440 or Email: suhsylv@isu.edu

Title: An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

Dear High School teacher/ mobile learning integrator,
The purpose of this explanatory study is to examine high school teachers' experiences with integrating mobile devices like tablets, smartphones, laptops, and their applications in teaching. The study specifically aims at revealing the experiences of teachers with the integration of mobile learning in the classroom. By examining the experiences of these educators of the 21st century, the researcher will identify some common threads of instructional strategies, effective strategies for mobile learning integration, and benefits, and challenges to implementing mobile technology in high school education. It should take you about 10 minutes to complete the survey.
Thank you

Thank you for participating in this survey.
By clicking **Next** you give your consent to participate in this study.

There are 20 questions in this survey.

I. Demographic
Demographic data collected in this study will include their gender, age range, type of mobile device integrated in classroom, number of years of teaching experience, and the subject area taught. Data that will be collected at the end the study will be divided into various data groups based on demographic information gathered from the survey. Please select the the response that best answers the question.

*
Have you ever integrated mobile learning in your classroom?
If No.
Thank you for your time. You can log out of the survey.
If Yes please move to the next question.

○ Yes   ○ No

* **What is your gender?**

○ Female   ○ Male

What is your highest level of education? (check only one)

☐ Bachelors
☐ Masters
☐ Doctorate
☐ Other: _____

What grade level do you teach? (check all that apply)

☐ 9th grade
☐ 10th grade
☐ 11th grade
☐ 12th grade
☐ Other: _____

I teach the following subjects.
Check any that apply

☐ Business
☐ Foreign Language
☐ Health and/or Physical Education
☐ History and/or Social studies
☐ Mathematics
☐ Music
☐ Reading
☐ Science
☐ Special Education
☐ Other: _____

Indicate the number of years you have been teaching. (check only one)

☐ 1-5 years
☐ 6-10 years
☐ 11-15 years
☐ Over 15 years

I have the following experience with mobile learning with students. (check only one)

☐ This is my first year
☐ More than a year
☐ More than three years

As a high school teacher, I regard my mobile learning skills as; (check only one)

☐ Beginner with support
☐ Confident on my own
☐ Capable of teaching others
☐ Other: _____

Are you in a rural or an Urban School District?
Check any that apply

☐ Rural
☐ Urban
☐ Other: _____

In what state is your school district located?
Check any that apply

☐ Idaho
☐ Wyoming

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Thank you

0% [   ] 100%

II. Defining Mobile Learning

In this section, the researcher wants to know how you as a K-12 teacher defines mobile learning. Research shows that there is no universal definition of mobile learning, especially in K-12 settings. Please provide your definition of mobile learning with examples to make your definition clear.

In your own words, what is mobile learning?

III. Integrating Mobile Learning

Mobile Learning acceptance in K-12 schools is on the rise, and most school districts are looking to integrate mobile learning to make learning more engaging and personalized for students. However, research shows that mobile learning is not being effectively integrated in high schools. This section of the survey will ask questions about how you as a teacher are integrating mobile learning in your classroom.

Please respond to the following questions by checking the appropriate response.

As an integrator of mobile learning in your classroom, do you own the mobile device or the school district owns it? Please check only one

☐ I own it

☐ The school/district owns it

☐ N/A

How often do you use the mobile device(s) with your students in the classroom? (Please check one)

☐ Never

☐ Rarely (<5 times a year)

☐ Sometimes (5-10 times a year)

☐ Frequently (weekly)

☐ Always (daily)

☐ Other: [   ]

I use the following mobile device(s) with my students' in the classroom? (Please check all that apply)

☐ iPads

☐ iPods

☐ Smartphones (iPhones and Andriods)

☐ Tablets

☐ Chromebook

☐ Probes

☐ Other: [   ]

Please provide your level of agreement regarding the following statements about integrating mobile learning in your classsroom. Use the scale 5=strongly agree, 4= agree, 3=uncertain, 2=disagree, 1=strongly disagree).

	1	2	3	4	5
I have a positive attitude towards integrating mobile learning.	○	○	○	○	○
I like integrating mobile learning in my lesson.	○	○	○	○	○
Mobile learning integration is complex.	○	○	○	○	○
I have enough training to help me effectively integrate mobile learning.	○	○	○	○	○
I have technical knowledge to integrate mobile learning into my lessons.	○	○	○	○	○
I have the pedagogical knowledge to integrate mobile learning into my lessons.	○	○	○	○	○
I have the content knowledge to integrate mobile learning into my lessons.	○	○	○	○	○

Please indicate some of the effective mobile learning integration strategies you are using in the classroom. Please check all that apply.

- ☐ Individual/Group Collaboration
- ☐ Gaming
- ☐ Communication (Homework reminders)
- ☐ Note Taking (taking pictures/videos/recording)
- ☐ Texting
- ☐ Formative Feedback (e.g Clickers)
- ☐ Podcasting /Blogging
- ☐ Virtual Field trips
- ☐ Webquests
- ☐ Simulations
- ☐ Learning Organizer
- ☐ Guided Reading
- ☐ Other: _____

An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

Dear High School teacher/ mobile learning integrator,

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Thank you

0% [   ] 100%

IV. Benefits of Mobile Learning in High Schools

Research indicates that mobile learning has been integrated by many high school teachers in the past decade and these teachers report that mobile learning increases student's engagement and motivation, and also support teachers in the instructional process.

*

Please provide your level of agreement regarding the following statements about the benefits of mobile learning in the K-12 setting. Use the scale 5=strongly agree, 4= agree, 3=uncertain, 2=disagree, 1=strongly disagree).
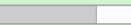
	1	2	3	4	5
Mobile learning increases student motivation and engagement.	⊙	⊙	⊙	⊙	⊙
Mobile learning increases communication.	⊙	⊙	⊙	⊙	⊙
Mobile learning improves collaboration skills.	⊙	⊙	⊙	⊙	⊙
Mobile learning fosters classroom support.	⊙	⊙	⊙	⊙	⊙
Mobile learning improves real time feedback .	⊙	⊙	⊙	⊙	⊙
Mobile learning encourages self-directed learning.	⊙	⊙	⊙	⊙	⊙
Mobile learning makes grading of student work easier.	⊙	⊙	⊙	⊙	⊙

An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

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Thank you

0% [   ] 100%

V. Challenges of Mobile Learning in high schools

Mobile learning in the classroom has shown some benefits, but legitimate concerns have been raised. Although there are currently no federal or state laws that prohibit using mobile devices in the classroom or for learning, many schools have policies against even bringing them to school. This section of the survey will help answer the question about challenges high school teachers' face when integrating mobile learning.

Please provide your level of agreement regarding the following statements about the challenges of mobile learning in the K-12 setting. Use the scale 5=strongly agree, 4= agree, 3=uncertain, 2=disagree, 1=strongly disagree)

	1	2	3	4	5
There is a lack of training.	○	○	○	○	○
I am out of my personal comfort level when using mobile devices to teach.	○	○	○	○	○
My students are not digitally literate enough.	○	○	○	○	○
We have limited internet connectivity at our school/problems with accessing the internet.	○	○	○	○	○
My students get distracted when using mobile devices.	○	○	○	○	○
There are too many mobile devices to choose from.	○	○	○	○	○
I have to focus on preparing for testing hence no time to integrate mobile learning/There is a lack of time for planning mobile learning integration.	○	○	○	○	○
Student use the mobile devices inappropriately (like cheating or cyberbullying).	○	○	○	○	○

An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

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Thank you

0% |_____| 100%

VI. Overcoming the Challenges of Mobile Learning
Mobile learning is faced with challenges as explored by the literature of this study but the benefits outweigh the challenges. Research shows professional development, learning about digital citizenship, having a positive attitude, and being an early adopter of mobile learning are some ways of overcoming these challenges. In this section you will indicate by agreeing or disagreeing to statements about how teachers' can overcome the challenges of mobile learning.

Please provide your level of agreement regarding the following statements about the overcoming the hurdles of mobile learning in the K-12 setting. Use the scale 5=strongly agree, 4= agree, 3=uncertain, 2=disagree, 1=Strong disagree).
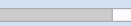
	1	2	3	4	5	No answer
There is a strong need for professional development in mobile learning integration at my school	○	○	○	○	○	●
The teacher needs to be an early adopter of mobile learning	○	○	○	○	○	●
The teacher needs to have a positive attitude towards mobile learning	○	○	○	○	○	●
There is a need for increased awareness of mobile digital citizenship in the K-12 setting	○	○	○	○	○	●

VII. Interview participation
Please indicate if you will like to be contacted for a phone interview

Would you consider a one-on-one phone interview with the researcher? Please indicate by entering your email address if you select "yes" or simply select "No".
Check any that apply

☐ [_____]
Yes
☐ [_____]
No

APPENDIX B: Contact Letter to Interviewee and Interview Protocol

Dear Sir/Madam,

Thank you for agreeing to be interviewed for the study titled "An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning". Your participation is highly appreciated and will be beneficial to the study. Please indicate on the provided Doodle document, what time and date is convenient for the interview (hyperlink to Doodle document will be provided) or simply reply to what date and time works for you. I have also included a link to Collaborate and a phone number and pin for the interview and an informed consent letter.
Please, provide your consent by printing your name and initials on the document and returning it to me.

I look forward to talking to you.

Sincerely,

Sylvia Suh

Interview Protocol Form

Title: An Explanatory Study of High School In-service Teachers' Integration of Mobile Learning

Date _____

Time _____

Location _____

Interviewer _Sylvia Suh_____

Interviewee ___ Will use pseudonyms in place of email addresses_____

Informed consent form signed? ____

Notes to interviewee:

> Thank you for your participation. I believe your input will be valuable to this research.

> Confidentiality of responses is guaranteed

> Approximate length of interview: 45 minutes, 8 major questions

> **Purpose of research:** The purpose of this sequential explanatory study is to examine high school teachers' experiences with integrating mobile devices like smartphones, tablets, and their applications in teaching.

The main focus of our interview today is to understand more about your experiences with integrating mobile learning in your classroom. I consider you the expert at your work so there are no wrong answers to any of the questions. While you answer questions, please focus on the details of how you actually use your technological, pedagogical, and content knowledge (TPACK) to help you integrate mobile learning. Please feel free to be honest and critical even if the way you integrate mobile learning is not one of the listed strategies in the survey. The interview will focus on some probing questions based on your survey responses and other questions will be about your experiences with integrating mobile learning in your classroom.

Any questions before we begin?

Probing Questions

1. How do you define mobile learning? How does your knowledge of this ML

   definition help you to become more effective in your classroom?

Response from Interviewee:

Reflection by Interviewer:

2. Please talk more about how your:

   a.) Pedagogical knowledge contributes to your integration of Mobile learning in

   your classroom?

   b.) Content knowledge contributes to your integration of Mobile learning in your

   classroom?

   c.) Technological knowledge contributes to your integration of Mobile learning

   in your classroom?

Response from Interviewee:

Reflection by Interviewer:

3. Why did you select this mobile device(s) for teaching your content area?

Response from Interviewee:

Reflection by Interviewer:

4. How have you overcome the challenges of mobile learning in the classroom?

Response from Interviewee:

Reflection by Interviewer:

5. Think about your big success stories in terms of integrating in your classroom? What kind of knowledge would you say contributed to this?

Response from Interviewee:

Reflection by Interviewer:

6. Think about any failures you experienced with integrating mobile learning in your classroom. What kind of knowledge would you say you lacked that caused this failure?

Response from Interviewee:

Reflection by Interviewer:

7. Please describe your first day integrating mobile learning in your classroom?

Response from Interviewee:

Reflection by Interviewer:

8. a. What makes you want to continue integrating mobile devices in your classroom?

b. What might cause you not to integrate mobile devices in your classroom in the future?

Response from Interviewee:

Reflection by Interviewer

- Closure
  - Thank you to interviewee
  - reassure confidentiality
  - ask permission to follow-up _____

APPENDIX C: Interview Participant Demographics

Interview Participant Demographics

n	(M/F)	Age	Education	School District	State	Teaching Experience	Subject	ML Experience
JR	M	50	Masters	Rural	WY	Over 15 years	History	>3 years
JK	M	40	Masters	Suburban	WY	Over 15 years	Science	>3 years
TR	F	35	Bachelors	Urban	WY	6-10 years	Chemistry	>1 year
WY	F	45	Bachelors	Rural	ID	6-10 years	Social studies	>1 year
ER	M	40	Bachelors	Rural	ID	Over 15 years	Social studies	>1 year
MG	F	40	Masters	Rural	ID	Over 15 years	Science	Beginner with support
CR	F	37	Masters	Rural	WY	Over 15 years	Science	>3 years
PL	M	41	Masters	Rural	ID	11-15 years	Math	>3 years

APPENDIX D: Definitions

Definitions

1. Communication between students and teachers using their mobile devices to incorporate technology as a convenience into their learning.

2. Enhancing learning using mobile computing devices. I have access to a classroom set of Chromebooks I use regularly in my classroom.

3. Good Question: I have no idea what mobile learning is.

4. Having my students use google Chromebooks and iPads to learn.

5. I am not familiar with it at all. I'm assuming it deals with constructing lessons that can be completed outside of the classroom and perhaps without the direct supervision of the teacher.

6. I believe mobile learning is anytime an electronics device is used to access information or complete tasks related to the students educational goal.

7. I believe that mobile learning is any learning using personal electronic devices. I would also add it is distance learning that is accessed at the learners convenience.

8. I understand mobile learning as a setting for instruction that is not limited to, and otherwise augmenting the traditional classroom through use of teaching techniques that are movable, outside of the classroom where the education in based.

9. I would define mobile learning as learning across multiple disciplines, through social and content interactions, using a personal electronic device.

10 Integration of technology for learning through portable devices I.e cell phones, IPads/Notebooks, etc.

11 It is learning using different social media and technological sources.

12 Labtops and iPhones use technology and applications that applicable to students and their learning styles.

13 Learning that is assisted by the use of mobile devices and which addresses the responsible use of technology in learning.

14 Making use of internet resources to enhance and/or guide instruction and performance tasks.

15 mobile learning (m-learning) is using a personal electronic device to access their educational materials. It could be as simple as using a smart phone to listen to a podcast of the day's lecture to using a computer to listen to lessons, complete assessments and communicate with teachers.

16 Mobile learning allows students the opportunity to learn login, email correspondence, use supplemental educational websites, iPad apps, Chromebook functions, typing, job completion, educational games to supplement learning, device can be utilized in various settings for familiarity that will lead to real life experience they can take with them when they leave school.

17 Mobile learning can be defined as having anytime/anywhere access to classroom information. It can be students in a 1-to-1 set up, with students having their own computer device throughout the school year and an online learning management system.

18 Mobile learning during my private English tutoring meant that I used my laptop to access websites and deliver presentations. Now, as an English teacher in a public virtual school, I use laptops and desktops to access all the course material and interact with students.

19 Mobile learning includes using devices such as laptops, cell phones, ipads, and tablets.

20 Mobile learning incorporates technology such as smartphones, ipads, and laptops into the process of learning.

21 Mobile learning involves students using portable internet capable devices to assist in their learning. For example, using a tablet or a phone to conduct research, using a laptop to write a paper, etc.

22 Mobile learning is a 21st Century skill mandated by

23 Mobile learning is any education that takes place on a mobile device particularly on cell phones or Ipads.

24 Mobile learning is any learning that can be taken out of the classroom through technology.

25 Mobile Learning is learning that takes place outside of the traditional classroom and involves the use of technology.

26 Mobile learning is primarily the use of cell phones, laptops from a mobile computer lab and tablets.

27 Mobile learning is providing access to content and learning activities beyond the classroom. This can include use of an LMS or Google Classroom, incorporating resources from YouTube and other online sites, and developing activities that involve community interactions.

28 Mobile learning is providing the ability for students to access and learn material outside of the usual classroom environment. I have made videos of all of my chemistry lessons and they are accessible online. I have had students access them from Wyoming to Indonesia to Mexico. I've seen my students access them on laptop computers, tablets and smartphones. Our district also uses the CANVAS LMS and so all of the worksheets are online accessible as well. Except for the quizzes, tests and laboratory experiments, a student could complete my class without ever coming to school.

29 Mobile learning is the ability to acquire specific information at the appropriate time with the resources and technology available in the field.

30 Mobile learning is the use of mobile device to gather and critically analyze information in the classroom.

31 Mobile learning is the use of technology available from a mobile device to assist and expand student knowledge

32 Mobile Learning is the use of technology, such as laptops and other devices, in the classroom.

33 Mobile learning is using commonplace technological tools (smartphones, Ipads, tablets, etc.) in the classroom for commonplace practices. If all students had some kind of access to technological devices, they could easily define vocabulary terms, create visual representations and flashcards, take quizzes with instant feedback, etc. They could easily gather sources supporting both sides of an issue, collaborate in discussion boards, etc. There is nothing innovative about these practices because it's merely what educated people do when using the WWW, which is why I feel mobile learning is a necessity today as it enhances current studies and teaches students to utilize available resources. Students should be equipped with the ability to access and/or create tools that will assist them in college or career because that is the expectation for today.

34 Mobile learning is using devices such as cell phones, tablets, and laptops as tools for learning.

35 Mobile learning is using the available 21st century technology to improve and expand educational learning opportunities.

36 Mobile learning is using tools to connect to current information, blurring the lines between the school building and learning.

37 Mobile learning means be able to take parts of the classroom outside of the class through technology. This could be through the use of cell phone technology or LMS.

38 Mobile learning means that there is no fixed learning atmosphere or device not does it mean that a teacher has to be present. It is a student learning on location and giving evidence of that learning.

39 Mobile learning uses a portable electronic device to increase a person's understanding and apply knowledge.

40 My perception of mobile learning is using technology in the classroom to help students learn content and become technologically literate. I also think that using technology in the classroom provides a high interest, and easily up-datable means of presenting and interacting with information.

41 Portable interactive devices

42 Students participate in and complete assignments that are accessed on a computer device that has a keyboarding attachment or virtual keyboard.

43 Students use cell phones, mobile labs, etc.

44 students using their own devices as tools to enhance access to information in the classroom

45 The ability to actively progress in your academics while on the go. Being able to communicate and give the help needed on a students level of understanding.

46 The ability to take the teaching/learning with me and continue the learning process.

47 The ability to use a variety of electronic media and devices to facilitate learning on multiple levels to allow the student the most capability to meet their individual learning styles.

48 The integration of learning devices in an effort to incorporate technology in innovative and engaging ways.

49 The integration of mobile devices into the high school mathematics curriculum.

50 The use of a portable electronic device that is connected to the Internet or network for the purpose of researching, gathering, and sharing data for the purpose of gaining and demonstrating knowledge.

51 the use of any device that is mobile

52 Using a cellular device to aid the learning or assessing process.

53 Using a mobile device to aid in the learning process in a variety of ways.

54 Using a mobile device to extend or enrich learning.

55 Using an electronic device that is mobile to enhance learning.

56 using any mobile device to extend a physical classroom

57 using handheld devices or tablets to access and process information and create material.

58 using mobile devices (smartphones) as tools for finding information.

59 Using mobile technology (smartphones, tablets, and e-readers) to engage students in learning in and out of the classroom. I also think laptops can be used as well. I have a facebook-like website I use for my students where they access quizzes on their smartphones but can also use a computer if needs be. I have my students download GPS software and we measure the accuracy of global positioning technology. They also do a plant and insect collection where they use their smartphones to take a digital picture of the sample, and tag it with a location.

60 Using mobile technology for learning.

61 Using personal devices to facilitate and aid classroom learning.

62 Using personal electronics, video shared classrooms, and community experiences to learn

63 Using technological learning devices (cell phones, computers, Ipads) to gain information.

64 Using technology to enhance the classroom.

65 Utilizing mobile devices for research, writing papers, and creating presentations. I'm especially partial to google apps for education.

66 For me mobile learning is connecting students to resources that they normally will have…For me, how should I say this, its breaking down the walls when they learn so it's not only within the climate of whether they are in my classroom, but also learning outside the classroom.

67 Eeeem I have never thought about coming up with a definition. It's not a term I use. But I guess I can say allowing a person to learn in different places. I guess I can say that it is allowing my students to use computers in different locations.

68 When I think about it I think about how they are accessing the material and the device they are using it. But I don't see how a person could be a mobile learner without using the mobile devices.

69 The advent of the internet and the portable devices that allows students to be able to do their own research very quickly in a classroom setting

70 For me mobile learning in a classroom is bringing in technology in the classroom.

71 Mobile learning! I guess I wouldn't call it mobile learning, I am just trying to use technology in my class.

72 I feel like teenagers today are so wrapped around their technology that if they can bring it into the classroom in any way it can go along with whatever subject you are teaching. It helps learning in many ways.

73 When I think of mobile learning I think of there is some kind of teaching in terms of. ..there is the teacher, there is the student and some sort of technology which is not limited to a specific place.

74 Engaging, sharing, connecting and sharing our learning through the unlimited use of the world wide web

75 Any activity used to support learning that requires or gives the option for students to use a device such as a tablet or smart phone.

76 Any learning that can be done using a mobile device such as a laptop, smartphone, etc...