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M-learning: an exploration of the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning

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M-LEARNING: AN EXPLORATION OF THE ATTITUDES AND PERCEPTIONS OF HIGH SCHOOL STUDENTS VERSUS TEACHERS REGARDING THE CURRENT AND FUTURE USE OF MOBILE DEVICES FOR LEARNING

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by

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DEDICATION

This dissertation is dedicated to my family, who have stood by my side through thick and through thin to ensure that I accomplished this monumental task. My wife, my stepsons, and my son have been an inspiration to me along the way. My parents and grandparents have always supported my decisions in life and constantly provide the necessary support and encouragement needed to achieve at high levels. Thank you for being there for me. Thank you for believing in me. Thank you all for being part of my life.

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with such an outstanding group of scholars, and I look forward to continuing my relationships with all of you.

Thank you, everybody!

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ABSTRACT

Despite rapid growth and use of mobile Internet devices, schools have remained resistant to the adoption of the devices. The cost of the devices, the distractibility of the devices to the learning environment, and safety and privacy issues that come with the devices are all reasons that schools have used against the implementation of the devices. Nevertheless, studies have shown that students become more motivated when technology and social media are allowed for their learning (Kozma, 2005).

To better understand the usage gap, teachers and students at a high school underwent an online survey and follow up focus group. The study yielded differences in the perceptions of students and teachers regarding the potential implementation of the devices into high schools as current or future learning tools.

The findings of the research indicate that students and teachers at the subject high school are ready to adopt mobile learning. Students feel that teachers need further training and education regarding the uses of mobile devices for education. Teachers, while aware that students use mobile devices to socialize, were unaware of the frequency by which students use the devices for learning opportunities. Finally, students and teachers both agree that the use of mobile devices in schools, albeit a difficult transition, will help increase student motivation, improve overall achievement levels, and create a more positive school culture.

The conclusions are: (a) students have near ubiquitous access to mobile devices outside of school, yet teachers remain reluctant to accept these devices as learning tools because teachers feel the need for additional support and training before they are comfortable using the devices with students; (b) teachers are unaware of the everyday

dependency of students on these devices for communication, collaboration, and learning; therefore teachers have not made the necessary efforts to integrate the devices into their curricula; and (c) teachers and students agree about the potential for mobile devices to spark the creativity of learners, create a more positive classroom learning environment, and increase student motivation. However, students will need to understand proper mobile device etiquette in school, whereas teachers need additional training to effectively manage a mobile learning environment.

Chapter 1: The Problem

Introduction

The following three scenarios will shed some light on the direction that education has and can continue to move as technologies become more affordable, more prevalent, and more useful in the everyday lifestyles of teenagers nationwide. The transgression of education from traditional classroom settings to online learning and now to mobile learning environments is further evidenced through the following scenarios. John is a traditional education student who sits in a classroom taking notes and listening as the teacher instructs the lesson. Kayla is an online student engaging in learning via the computer and an Internet connection. Meanwhile, Jessica partakes in a newer modality of learning with the use of mobile devices that can accommodate the learner anyplace, anytime.

Traditional education. John sits down in his calculus class and awaits the tardy bell. He rustles through his disorganized backpack and pulls out his math textbook, a notebook filled with college-ruled paper, a mechanical pencil, and a clickable eraser. The bell finally rings, indicating the start of class. Mrs. Henderson walks to her podium near the front center of the classroom, scans the classroom for empty desks, records attendance in her grade book, and then proceeds to teach the lesson. The lesson of the day is finding the derivative of a function. Mrs. Henderson uses the whiteboard to discuss the concept of the day as students frantically take notes. There are no overhead projectors, LCD displays, or document cameras present. Nor are there any video or audio files that the teacher can use to enhance the lesson.

Mrs. Henderson is done with the lesson and assigns homework for the evening. The dismissal bell rings shortly thereafter, at which time John moves onto his next class, world history. The process of sitting down in class, removing a text book, notebook, pen or pencil, and an eraser from his backpack continues throughout the school day in each one of his classes. Teachers stand in front of each class and primarily lecture for the entire period. If students have questions, they may ask. Should John need to seek help outside of class, he does not have access to technology at his fingertips to Google or ChaCha his question. The library is available and so too is the help of any of his teachers, but only during school hours. John goes home from school, but cannot speak to anyone until he gets home. His parents cannot do calculus, he no longer has the help of the teacher, and there are no other resources through which he can seek further instruction. The following day in class will be John's first opportunity to ask questions.

Online education. Many colleges and universities have increased their offerings of online courses to their students during the past 10 years. Some of these colleges now even offer degrees that are completely online or hybrid, a combination of face-to-face and online instruction. Within the confines of her own home or from a computer that offers Internet access, Kayla can take part in online education. Online courses can range from *asynchronous*, meaning that every person taking the course does not need to be physically logged into the course at the same time, or *synchronous*, in which every person is logged in at the same time.

Asynchronous courses are typically conducted through forums or discussion boards on which students share thoughts and ideas and respond to threads posted by their classmates or their instructors. Often times, the instructor will require the reading of a

chapter or a unit and then have students respond to these questions. If they desire, students who are already online can use the Internet to research additional information on a topic, concept, or idea before posting to a discussion board.

Synchronous classes are more akin to the traditional classroom setting; however, the instruction is occurring online in the form of a real-time lecture or a live-chat session. There are many different options that colleges, universities, and even K-12 institutions are capable of using to conduct these courses. Kayla is an advanced high school student who was seeking the challenge of a college-level chemistry course. Because her high school did not offer that course, she enrolled in an online course in which she could fulfill her desire of completing college-level chemistry while receiving high school credit for the course. Kayla can access the course from any home or school computer that has access to the Internet. She can participate in all class activities, complete the required assignments at her leisure (within reason), contribute to discussion boards, watch live or pre-recorded lessons or tutorials, and communicate with other classmates or her instructor through email or live chat (if they are available).

Mobile education. Jessica is on vacation on the island of Mallorca, Spain. Considering it is her first time in the region, she is very intrigued by the people, the weather, and her surroundings. She hopes that her high school Spanish courses have prepared her well enough to converse with some of the natives. Jessica has been waiting for this vacation for quite some time now. But the problem is that the vacation is right in the middle of an important college semester.

Jessica is feeling lost and somewhat out of place in a foreign location. However, she always carries technology with her wherever she goes. This time is no different. She

reaches into her beach tote, sifts through the suntan lotion, some towels, and a change of clothes, and finds her smartphone. Jessica has some upcoming tests once she returns from vacation and also has a huge project that needs to be turned in while she is vacationing. It is a group project; therefore, her collaboration with her group members is very important.

With the use of some smartphone applications, Jessica begins to study for her tests. She makes flashcards through one of the applications to study for her history exam. And she takes advantage of the practice problems offered through a science application to study her biology. For the group project, Jessica iss able to communicate by conference call, submit and receive documents via email, and upload and submit audio files, photos, and videos taken with her phone to her fellow group members. The project happens to deal with Spanish culture, so Jessica's location and timing are rather convenient.

Jessica is taking advantage of a small, powerful, and ubiquitous communication device that can be used for instant, anyplace learning. Outside the context of a traditional classroom, Jessica not only has access to a wealth of information at her disposal in the palm of her hand, but she can also use the phone for learning. She can study for an upcoming test, communicate with group members to complete a project or portfolio, and can accomplish these tasks anywhere at anytime.

Practicality of Mobile Technologies

Mobile technologies, such as smartphones, tablet PCs, and slates, have the ability to combine all of the capabilities of previous technologies into a single integrated, collaborative device that can be connected to the Internet. These new media devices come in an array of styles and sizes, many of which will fit in one's pocket. Although these mobile devices and technologies may not specifically be creating learning, the devices

have created a platform on which learning can be grounded. Mobile technologies have thus created affordances for students, teachers, and laypersons to engage in learning activities from anyplace at anytime. Because one-to-one initiatives have already proven to demonstrate effective instances of learning within the classroom (Gulek & Demirtas, 2005; Lowther, Ross, & Morrison, 2003; Roschelle, Sharples, & Chan, 2005; Russell, Bebell, & Higgins, 2004) and the research on the use of smartphones and slates within educational settings is bound to surface, it only makes sense to use these powerful mobile devices that combine mobility with a multitude of other technologies that have preceded them. Mobile devices contain all previous media upon which rich learning can be supported.

Mobile Learning Devices

With the creation of newer, more powerful cell phones, smartphones, and WiFi devices (e.g., iPod) with upgraded operating systems (e.g., Android), people have access to more information at their own fingertips with which they can learn anywhere at anytime than ever before. The advances in higher resolution screens and faster Internet connectivity make the larger mobile devices (e.g., tablet PCs, slates, and laptops/netbooks) intriguing choices in mobile technology. With all the technology that now exists, technology users have tools at their disposal with which to create their own mobile learning opportunities. This concept of mobile learning, or *m-learning*, has a variety of definitions. Some researchers focus their definitions on the technology being used (Alexander, 2004; Wang, Wu, & Wang, 2009), whereas others focus more on the location in which the learning is taking place (Wagner, 2005), whereas others consider the blend of the technology and the location to be the instrumental factor in defining

mobile learning (Motiwalla, 2005; Traxler, 2007). Based upon findings from the literature, the definition of m-learning for this study will be the following: a process of education for a learner positioned in any random location with the assistance of a handheld, portable device that can connect wirelessly to the Internet in an effort to support or extend classroom learning or create new, intentional or unintentional learning opportunities (Motiwalla, 2005; Roschelle, et al., 2005; Traxler, 2007; Wagner, 2005).

The use of mobile devices worldwide has shown tremendous growth during the past 10 years (Sharples, Sanchez, Milrad, & Vavoula, 2008). But although these powerful, handheld technologies have continued to undergo modification and advancement during this period of time, their use in classrooms has been impeded due to reasons such as distractibility and equity. In today's society, however, high school students rely on these devices for their everyday social interactions. Thus, the devices are becoming part of the day-to-day wardrobe for students everywhere (Roschelle et al., 2005).

There are many reasons why mobile devices have become so popular—they are ubiquitous, compact, relatively inexpensive, convenient, and profound in their connectedness with the world. In a recent study conducted by the Pew Internet & American Life Project, nearly half of 18 to 29 year-olds have accessed the Internet wirelessly on a laptop (55%) or on a cell phone or smartphone (55%), and about one quarter (28%) have accessed the Internet wirelessly on another mobile device, such as an e-book reader or gaming device. The same study also investigated wireless Internet usage among adults. Accordingly, 81% of 18 to 29 year olds are wireless Internet users. Compare that to 63% of 30 to 49 year-olds and 34% of those 50 and older who access the

Internet wirelessly (Lenhart, Purcell, Smith, & Zickuhr, 2011). This research implies that wireless Internet usage is trending upward, which signals a positive sign for the use of wireless mobile devices to access information and potentially as effective learning tools.

The Pew Internet & American Life Project also discovered that nearly 4 in every 5 teenagers own an iPod or some other form of mp3 player, and three quarters (75%) of all teenagers own a cell phone. Aside from cell phone and smartphone usage, teenage use of other mobile devices also continues to rise (Lenhart et al., 2011). However, when it comes to accessing the Internet through mobile devices, laptop computers remain the number one choice among teenagers (Lenhart et al., 2011). Nearly 27% of teenagers using cell phones will use their phones to access the Internet, whereas only 19% of those who own portable gaming devices use the devices to go online. For the proposed study, several mobile devices will be investigated. These include: (a) cell phones and smartphones; (b) mp3 players (e.g., Apple's iPod); (c) personal digital assistants (PDA) and e-book readers; (d) laptop computers; and (e) tablet computers or slates, such as Apple's iPad or Motorola's XOOM.

m-learning

Mobile learning has been around for years, but not until the past 10 years have the technological advances in the design and creation of mobile devices and applications popularized m-learning (Bakia, Mitchell, & Yang, 2007). Limited research has been conducted thus far on the uses of mobile devices to promote informal learning; therefore, a real need exists to understand the way that consumers are taking advantage of mobile technologies for their own learning. This information will allow schools to create a curriculum that engages a variety of learners, while emphasizing the 21st-century skills

required of high school graduates. Additionally, understanding the ways in which high school teachers and students currently use mobile devices to create learning opportunities in informal learning situations can help school districts nationwide recognize the interests of students and thus provide the foundation for adapting the curriculum to better suit the interests of all learners.

Recent Trends

Impact of m-learning on informal learning. To become successful adults, today's youth must rely on a newer and "more demanding intellectual skillset" (p. 9) than their parents (Bakia et al., 2007). The ability to use a mobile device to access information anywhere and anytime heightens the potential for the use of these devices as tools for learning. The idea of mobile learning is not restricted solely to the use of the handheld or wireless technology. Instead, an advantage to mobile learning is that the learning is received and processed in an environment in which the learner is situated. The context of learning is individualized by the learner, thus, the horizons of education are heightened beyond the traditional classroom or computer lab (Walker, 2007). Taylor (2006) contends that students are more apt to wander around to investigate concepts that they feel are interesting, according to their own agendas and timetables regardless of consistency, than they are to use the devices to support the context and curriculum of a classroom.

Background of the Problem

During the past 10 years, mobile learning has become a more significant part of educational institutions, workplaces, and museums around the world (Sharples et al., 2008). Tools that at one time only existed for desktop computers are becoming more readily available on handheld devices (Roschelle, 2003). The use of mobile devices to

encourage and support learning through informal settings, such as museums via interactive guidebooks (Hsu, Ke, & Yang, 2006), as relevant forms of access to information for medical students (Smordal & Gregory, 2003), or as tools for assessment for nursing students (Kneebone, Nestel, Ratnasothy, Kidd, & Darzi, 2003) has already proved to be effective.

Statement of the Problem

During the past decade, a surge in the use of mobile devices as educational tools has led to an increased number of educational institutions exploring the possibilities of the use of these ubiquitous devices by teens in the classroom (Engel & Green, 2011). However, many schools and school districts have long been concerned about the negative aspects of technology use in the classroom, including the distractibility of certain devices, the security of the devices, the increased ability for students to cheat, and equity and access issues that come along with the cost of some of these devices (Traxler, 2007). But experts claim that students become more motivated and more interested in school when positive affordances for their learning are put in place (Kozma, 2005). Students may truly sense the need to use mobile devices; however, teachers may be the biggest obstacle to the integration of mobile technologies into schools. As of now, the devices are either not being used or being used improperly in schools despite their widespread use outside of the classroom. Because teachers are the gateway for what happens in the classroom, it is important to investigate the attitudes of the teacher. Discovering where students and teachers are coming from and their attitudes toward mobile technologies and m-learning can help bridge the gap between the uses of mobile devices inside and outside of schools.

Exploring the differences between how students and teachers currently use mobile devices for learning and looking at the possible future uses of mobile technologies in the learning environment may help schools better understand the usefulness of these devices that may result in future change. Moreover, the sparse amount of recent research on the topic of mobile learning in high schools provides further evidence of the need for this type of research.

Purpose of the Study

This study will investigate the perceptions and attitudes of high school students and teachers regarding the use of mobile devices to enhance learning that takes place inside the classroom and also to create opportunities to broaden learning outside the classroom. Collecting data on the perceptions and attitudes of teachers helped elucidate some of the misconceptions teachers have about mobile technologies in the classroom and has given way to a better understanding of the shift in teacher attitudes that will be necessary for mobile devices to make their way into high school classrooms.

The research problem addresses factors regarding the best and most practical uses of mobile devices to support m-learning inside and outside the classroom. Many teachers have long criticized the use of mobile technologies in the classroom, citing the distractions caused by the devices and the inability of teachers to efficiently manage a technological classroom learning environment. Although many teachers may subscribe to these impressions, the research aimed to discover the types of mobile technologies teachers and students are using outside the classroom to determine if there is potential for their use inside and outside the traditional classroom to support the content taught in the

classroom as a byproduct of what students are already doing with the devices outside the classroom informally to learn.

To better understand the types of mobile technology and the mobile applications and games that teachers and students may find beneficial for future learning opportunities, research that pertains to the current uses of these devices by teachers and students was first explored. As such, the researcher conducted a survey of teachers and students at one Southern California high school to determine how each group was taking advantage of mobile devices to support their learning inside and outside the classroom and how each group perceived the devices as current or future learning tools. Collecting data on the attitudes and perceptions of teachers and students helped clarify whether teachers act as a large impediment to the diffusion of mobile devices into schools and/or if students act as potential barriers to the integration of the devices into classrooms.

Research Questions

The following three research questions were used to determine attitudes of students and teachers that affect the future use of mobile devices for learning:

1. In what ways are students currently using mobile devices for learning inside and outside of the classroom? How do students perceive the future use of mobile devices as tools for learning?
2. In what ways are teachers currently using mobile devices with their students inside and outside of the classroom? How do teachers perceive the future of mobile devices as tools for learning?

3. Do high school students and high school teachers have similar or different perceptions and attitudes regarding the best practices and acceptable uses of mobile devices as learning tools now and in the future?

Implications

Although mobile learning is gaining popularity and the ownership of mobile devices continues to increase, rules and regulations prohibiting the use of many mobile technologies in schools have adversely affected the learning potential of American high school students (Koole, 2009). This research project illustrates the potential of mobile technologies to become an extension of human thought and ongoing learning inside and outside the classroom. Additionally, the study aimed to determine the future implications for the use of mobile devices inside the classroom, outside the classroom to support material that was taught in class, and outside the classroom to allow learners to create their own opportunities to learn. This study also provides further information that can be used by designers and programmers to create more effective learning tools and applications that can be brought into the traditional classroom to better support the types of information that students find useful outside the classroom.

Potential impact of m-learning on education. Most school subject areas can benefit from the power of mobile learning technologies, which can be used to complement existing courses in an effort to convert a student's dead-time to productive activities while the student is in transit and does not have access to a computer or the Internet (Motiwalla, 2005). An additional factor that should be considered is the need to memorize facts, which is downplayed by the ability of a mobile technology user to access information on the go from anywhere, anytime. Mobile devices are also becoming more

tailored to learning, which allows students to engage in exploratory activities that can be performed outside the confines of the traditional classroom. For instance, the devices can be used on field trips in which students can transcribe electronic notes or retrieve a variety of information on the go (Hoppe, Joiner, Milrad, & Sharples, 2003). The information gathered in such projects can be tied directly to classroom instruction or can be the result of an unintentional learning opportunity in an informal setting that can be supported by the convenience of using a handheld, wireless device to access information.

Summary

Mobile handheld technologies continue to expand at an exponential rate. The mobile devices that now exist have given way to new discussion regarding the effectiveness of the devices not only for the purposes for which they were originally designed, but for learning purposes as well. Meanwhile, for these mobile technologies to be most effectively used inside classrooms, more information on how students and teachers perceive the devices as learning tools was needed. Thus, the research aimed to elucidate the best and most practical uses of these mobile devices to support m-learning inside the classroom through the collection of data representing the attitudes and perceptions of high school students and their teachers. The researcher conducted a survey of teachers and students at one Southern California high school to determine how each group was taking advantage of mobile devices to support their learning inside the classroom and how they were learning material outside of the traditional classroom that supports that which was taught in class. An exploratory approach was used to determine the similarities and differences that were evident between the perceptions of students and teachers with regards to m-learning. The results of this research may be useful not only to

enhance the use of current mobile technologies in the learning environment, but to allow for newer, more efficient and innovative applications, games, and interfaces to be created by mobile device manufacturers, programmers, and designers. These devices can assist mobile learners in their quest to access information and will afford learners the opportunity to create their own learning from anywhere at anytime. Three research questions pertaining to the attitudes and perceptions of high school students and high school teachers were investigated in an effort to address the aforementioned issues regarding mobile handheld technologies and their potential for use as learning tools in schools.

Chapter 2: Review of Literature

Introduction

Mobile technologies are continuing to evolve as the world becomes more dependent upon handheld communication devices to complete everyday tasks. Many educational institutions are also beginning to embrace these mobile devices as learning tools outside the classroom. Other schools, at varying levels, are even incorporating the use of these devices into the curriculum to enhance student understanding and improve student motivation. Mobile devices are being used for learning inside classrooms, outside classrooms to support in-class instruction, and informally outside classrooms. The use of mobile devices as learning tools has thus given way to a new concept of learning called m-learning. The following review of literature aims to address the changing roles of mobile technologies, provide a workable definition for m-learning that can be used at all levels of academia, identify characteristics of an m-learning environment, explain the barriers to implementing m-learning, and offer actual examples of the practical uses of mobile devices as learning tools in a variety of settings.

Changing Roles of Mobile Technology

The recent advancements in new technology have transformed the world in which we live (Bakia et al., 2007). Mobile phones and other handheld devices (e.g., iPods, iPads, and PDAs) have become more and more commonplace in society. By 2004, the ownership of mobile phones in China exceeded ownership of landline phones. Other countries worldwide have continued to follow in this pattern, a sign of a changing dynamic worldwide. As the popularity of mobile devices has risen, so too has the role of researchers and educators to explore the potential for these handheld devices as learning

tools to support and enhance the learning environment (Clough, Jones, McAndrew, & Scanlon, 2008). The use of mobile devices to encourage and support learning opportunities in museums via interactive guidebooks (Hsu et al., 2006), as relevant forms of access to information for medical students (Smordal & Gregory, 2003), and as tools for assessment for nursing students (Kneebone et al., 2003) has already proved effective.

During the past 10 years, mobile learning has become a more significant part of schools, workplaces, and museums around the world (Sharples et al., 2008). Tools that at one time only existed for desktop computers are becoming more readily available on handheld devices (Roschelle, 2003). For instance, there are more than 60,000 mobile phone applications for 3G phones (Caverly, Ward, & Caverly, 2009). Yet despite these staggering statistics and the consistent increases in mobile phone usage throughout the world, many college professors are discouraging their use, citing their tendency to cause distractions. A majority of college students in Japan (71%) prefer the use of text messaging to email, and 93% of these students saw value in receiving English lessons sent to their mobile devices.

To become successful adults, today's youth must rely on a newer and "more demanding intellectual skillset" (p. 9) than their parents (Bakia et al., 2007). The ability to use a mobile device to access information anywhere and anytime heightens the potential for the use of these devices as tools for learning. However, arriving at a common definition of m-learning may be an important first step. The literature provides several variations of the definition of mobile learning with some definitions emphasizing the actual technology being used, whereas others focus on the learning that can be achieved through mobility with the assistance of a technological tool. The implications

for the future use of mobile technologies to provide learning opportunities both inside and outside of the classroom may rely heavily on an agreed upon definition of mobile learning, along with a change in the attitudes of students and teachers when it comes to enhancing or creating new learning with the use of these tools.

Understanding Mobile Learning

Mobile learning carries a variety of meanings, depending upon who you ask. *Mobile* can refer to the actual technology being used in the learning process or to learning that is not fixed in one location. Students have been participating in mobile learning as part of their regular schooling for centuries. However, with the advent of new technological devices that have become increasingly more portable and mobile in nature, a massive shift in mobility has occurred. The mobile activities of students once consisted of carrying textbooks, pencils, and paper from classroom to classroom. Nowadays, mobile learning has been updated as a result of the electronic information and communication devices that are now capable of allowing students to engage in meaningful learning scenarios inside and outside of school.

Although the first case in which the term mobile learning was used could not be determined from the literature, the practice of mobile learning can be rooted back to the pan-European mobile learning projects in the late 1990s (Keegan, 2002). As a relatively new concept, the literature on the subject remains rather sparse. However, increases in the number of studies that have been performed in the clinical setting and within the classroom indicate a growing interest among researchers attempting to understand the benefits of mobile technology inside and outside the classroom. Despite the

documentation, research, and field testing, there is still no single, clear-cut, recognized definition of mobile learning.

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). Therefore, in an effort to better understand mobile learning, researchers and theorists must arrive at an agreed-upon definition that takes into account all aspects of the learning process (El-Hussein & Cronje, 2010). A significant reason why an agreed-upon definition of mobile technology has not yet surfaced is that many definitions and understandings of mobile technology only take into account the technologies and hardware being used, rather than emphasizing the experience of the learner while using the mobile devices (Traxler, 2007).

"Clark Quinn . . . defines mobile learning as the intersection of mobile computing (the application of small, portable, and wireless computing and communication devices) and e-learning (learning facilitated and supported through the use of information and communication technology)" (Corbeil & Valdes-Corbeil, 2007, p. 52). Sharples (2000) argues that the focus on the devices themselves does not help in understanding the nature of the learning that occurs as a result of using the technology. Instead, a process that involves communication and collaboration emerges as a result of using mobile technology, which provides the actual learning opportunities for students. Attewell (2005) suggests that mobile learning is a unique process that affords students the opportunity to personalize their learning anywhere at anytime.

Peng et al. (2009) describe mobile learning as a process of learning through the use of mobile devices and wireless transmission. This definition focuses on the functional

components and communication style and is thereby more suited for use with computer scientists who seek to connect the development of mobile devices with wireless networks, whereas other definitions of mobile learning focus on the aspects of mobility and ubiquity (Peng et al., 2009). Mobility offers slight variations to the learning process by which students can explore, research, and guide their own learning at their convenience. Ubiquity gives students the power to access technologies through devices with which they are comfortable whenever and wherever they are needed.

Alexander (2004) sees mobile learning as any type of learning that takes place with the use of a mobile device. He also proclaims that mobile learning is comprised of any form of learning in which the legitimacy of nomadic learners is established. Wang et al. (2009) define mobile learning as the anytime and anywhere delivery of content to students through WiFi connections and/or mobile devices. The one caveat they attribute to mobile learning is that users are enabled to utilize educational resources while away from their typical places of learning. Unlike the mobility of learning from home, at a library, or in an after-school program, the technological devices used by learners in these settings are what differentiate learning in a mobile location from the concept of mobile learning.

Wagner (2005) claims that the evidence of mobile technology penetration is irrefutable. People of all ages and ethnicities are staying connected through cell phones, PDAs, MP3 players, portable gaming devices, handheld units, tablet PCs, and laptops (Corbeil & Valdes-Corbeil, 2007). As a result of this mass penetration of technology, just about everywhere one looks the implications for the future use of these devices to assist and enhance education for everyone is inevitable. However, Sharples et al. (2008)

contend that focusing strictly on the technology does not clarify the elements that will be learned as a result of mobile learning. Furthermore, Sharples et al. (2008) define the research of mobile learning as a process that investigates how the mobility of learners assisted by personal (and public) technologies can lead to individuals gaining knowledge, expertise, skills, and experience.

The learning environment does not need to be adapted to the specific technology being used. Instead, developers of the technology need to begin adapting the devices intended for use by mobile learners with the hope that better technology will serve learners more efficiently (Hoppe et al., 2003). El-Hussein and Cronje (2010) feel that mobile learning, as an educational activity, only makes sense when the technology that is being used is fully mobile and when the users of the technology are exhibiting mobility while they learn.

Mobile technologies allow users access to media anywhere and allow users interactivity through communication or collaboration. Mobile devices themselves present a complex system of mobility, games, and different modalities packed into a single technology that has become more affordable and easier to use. Richard Clark (1994) explains that the media that are being used should not be brought to the forefront of the issue; instead, the methodology is of utmost importance. Conversely, in a rebuttal to Clark's argument, Robert Kozma (1994) explains that the choice of media does have a small effect; however, the affordances that result from the use of the media are really what cause learning to occur.

Dimensions and Characteristics of Mobile Learning

For quite some time now, schools across the country have used educational technologies to enhance their curriculums (Bakia et al., 2007). When used appropriately, mobile technologies have been shown to "enrich learning environments and enhance students' conceptual understanding" (Bakia et al., 2007, p. 9). Mobile learning can add value and enhance existing learning models; however, the likelihood that learning on mobile devices will replace classroom or other electronic learning approaches is rather far-fetched (Mottiwalla, 2007).

Over time, learning and technology have advanced, which has set the stage for the successful convergence of learning and technology in a mobile format (Sharples, 2000). But to maximize learning opportunities as a result of this convergence of learning and technology, teachers must become familiar with a new digital language possessed by their students (Corbeil & Valdes-Corbeil, 2007). While teachers are attempting to come to grips with the technical skills of their students, students must also learn to craft their own learning and educational experiences outside the classroom walls with the assistance of the Internet and/or mobile technologies to develop the necessary 21st-century skills required to survive in today's society.

Ozdemir (2010) describes mobile devices as technologies that are with us whenever and wherever we are. People cannot be expected to carry distance learning items, such as a radio, television, or computer, with them at all times. Furthermore, the radio and the television only allow for one-way communication, which hinders the interactions that are inherent in a typical learning environment between the teacher and student. Characteristics that make mobile learning unique and effective are

personalization of learning and the capability of these devices to extend beyond the traditional modes of education. As a result, mobile devices have the potential to change the way in which students conduct themselves and interact with one another (Motiwalla, 2005).

Mobile learning does not necessarily take place in a fixed location, such as a classroom, over a predetermined amount of time; instead, learning flows across locations, topics, and technologies (Sharples et al., 2008). The use of mobile or handheld devices for learning provides a learner with ubiquitous access to information and remote resources (Liaw, Hatala, & Huang, 2010). This ubiquitous access to information and resources has some compelling implications for informal learning due to the fact that students can use mobile devices to peruse information in substantially less time with greater efficiency than ever before. The opportunity for unintentional learning (i.e., learning that was not planned ahead of time) is also much more likely with a powerful handheld tool that can retrieve information from the Internet, through applications, and through collaboration and communication among classmates, friends, family, or even social networks (i.e., Facebook).

When removed from the context of a formal, externally imposed learning environment, informal learners predominantly take advantage of technologies, resources, or tools that best suit their learning needs and personal preferences (Clough et al., 2008). In the palm of her hand, a cell phone user, an iPad user, or even a netbook user has instant access to the Internet and other educational resources. Learning opportunities continue to present themselves just about anywhere one goes. With this in mind, the mobility of the learner and the use of a mobile device by the learner should not take away

from the fact that actual learning may be taking place. Liaw, Hatala, and Huang (2010) suggest that learning as a mobile activity should not be portrayed separately from other forms of education.

Mobile learning can be characterized by the personal and public processes of the acquisition of knowledge through exploration and conversation with the assistance of various interactive technologies (Sharples et al., 2008). To make meaning of concepts, students predominantly use the processes of conversation (Pask, 1976) and exploration (Dewey, 1916). Mobile learning provides an avenue that allows students to communicate with each other to further improve their educational experiences inside and outside the classroom. In addition to communication, Sharples et al. (2008) contend that mobile learning draws upon the conception that knowledge is constructed through activity. Therefore, through conversation and exploration, people are able to learn where they want, when they want, and what they want. The informal learning opportunities that are created when using mobile devices allow learners to negotiate with content and subject matter they never may have planned or envisioned.

The practice of mobile learning is composed of a tripartite system in which the learner, the technology, and the learning process itself operate in an "uninterrupted continuum within the social context of education" (El-Hussein & Cronje, 2010, p. 17). In this sense, Hussein and Cronje believe that the mobile learning environment is based on the mobility of learners, the mobility of technology, and the mobility of learning that broadens the scope of the educational landscape. As technology becomes more embedded in the daily lives of people, learners become more dependent on creating educational opportunities through social exchanges with the assistance of mobile devices. Moreover,

the blending of the learner, the technology, and the learning process helps blur the definitive lines that once isolated these three events. Technology is being used ubiquitously by learners who have learned to create learning opportunities and to access information because of the mobility of the technology itself, the mobility of the learner, and the mobility of the learning process.

The actual mobile devices that are being used by learners share a set of common characteristics: (a) portability, (b) social interactivity, (c) context sensitivity, (d) connectivity, and (e) individuality (Klopfer & Squire, 2008). The devices are powerful and easily transportable. Communication and collaboration are facilitated with the use of mobile devices. Mobile devices are sensitive to the context in which they are used in the sense that the devices can take advantage of GPS, data networks, or even audio or video capture to collect and respond to data in a particular area. Connectivity provides the devices with the ability to connect to a network. Lastly, individuality paves the way for the users of the devices to tailor the devices to meet their specific needs.

Handheld mobile devices are becoming more relevant technologies to help support collaborative learning scenarios. Because of their potential for enhancing learning, mobile devices have undergone a number of studies by not only researchers but academic and industrial practitioners as well (Hoppe et al., 2003). In the next sections, examples of the specific uses of mobile devices, including the specific mobile devices that will be investigated in this study, will be examined. A definition of mobile learning in its simplest form must be derived from the literature. For purposes of this paper, based on the previous definitions and descriptions of mobile learning, mobile learning will now be referred to as a process of education for a learner positioned in any random location

with the assistance of a handheld, portable device that can connect wirelessly to the Internet in an effort to support or extend classroom learning or create new, intentional or unintentional learning opportunities.

Using Mobile Devices in the Classroom

According to Kukulska-Hulme (2007), the three main motivations for the use of mobile technology in education are improved accessibility to information, the potential for future changes in teaching and learning, and the goals and aims of businesses and institutions. When examining the changes in teaching and learning, "Researchers are interested in collaborative learning, students' appreciation of their own learning process, consolidation of learning, and ways of helping learners to see a subject differently than they would have without the use of mobile devices" (p. 4). When multimedia content is well-designed, a learner's cognition can be activated even if the content being studied is mundane or the learner is disinterested in that which is being taught. When efficiently designed, the result of multimedia on learning is a more meaningful, deeper level of understanding exhibited by the student (Ozdemir, 2010).

Mobile learning systems and applications have consistently garnered positive praise among learners who contend that using handheld devices for learning increases the overall satisfaction and motivation of its users. Likewise, mobile learning has the potential to alter student behaviors, interactions, and overall attitudes toward learning (Homan & Wood, 2003). The significance of using mobile devices to create learning opportunities can be advantageous to students of all ages and academic achievement levels, especially as these students move on to tackle the imminent changes in the consistently evolving 21st century.

> Students need to leave school with a deeper understanding of school subjects, particularly science, mathematics, and technology, and with the skills needed to respond to an unbounded but uncertain 21st century skills to use their knowledge to think critically, to collaborate, to communicate, to solve problems, to create, and to continue to learn. (Kozma, 2005, p. 1)

Most school subject areas can benefit from the power of mobile learning technologies, which can be used to complement existing courses in an effort to convert a student's dead-time to productive activities while the student is in transit and does not have access to a computer or the Internet (Motiwalla, 2005). An additional factor that should be considered is the need to memorize facts, which is downplayed by the ability of a mobile technology user to access information on the go from anywhere, anytime. Mobile devices are also becoming more tailored to learning, which allows students to engage in exploratory activities that can be performed outside the confines of the traditional classroom. For instance, the devices can be used on field trips, during which students can transcribe electronic notes or retrieve a variety of information on the go (Hoppe et al., 2003). The information gathered in such projects can be tied directly to classroom instruction or can be the result of an unintentional learning opportunity in an informal setting that can be supported by the convenience of using a handheld, wireless device to access information.

In a study by Wyatt et al. (2009) on the potential use of mobile devices (PDAs) with nurse practitioner students, the findings indicated that a favorable characteristic of using mobile devices was the inherent collaboration between students and teachers, which promoted the sharing of knowledge and resources. Nurse practitioner students in the study also favored the short, bulleted text presented on their PDAs as opposed to narrative text. Additionally, students found the classroom environment to be a less

competitive and a more collaborative environment in which to learn. Compared to the pretest, which indicated that 66% of students believed that PDAs would facilitate learning, the posttest yielded an 88% rate of students who felt that mobile devices facilitated learning. This particular study reinforced that mobile devices can serve the purpose as reliable and useful reference tools, especially in the clinical setting.

Instances of higher education institutions that are taking advantage of mobile computing and e-learning are Duke University, which provides all incoming freshmen with their own iPods, and Virginia Tech University's College of Engineering, which requires all students (as of 2006) to purchase tablet PCs. Through myriad representation methods—text, audio, video, and images—mobile learning achieves the goal of reaching a multitude of learning styles. In addition, mobile devices, such as mobile phones or PDAs, can promote cooperative learning (Wyatt et al., 2009). Cooperative learning has undergone some serious changes as a result of the development of newer, more efficient mobile devices. Coupled with the advent of these new technologies, learning theories may also need to be explored to shed light on the potential future use of mobile devices inside the classroom, outside the classroom, and through informal learning situations.

The theory of constructivism emphasizes the notion that learning is highly individualized, giving way to the ability of the learner to construct his or her own meaning or representation of content based on his or her own prior experiences. Social constructivism, on the other hand, contends to the notion that learning takes place through collaboration, communication, and the negotiation of meaning within the learning community. The future implications of the conversations inherent in learning through social constructivism may pave the way for the potentiality of using mobile

devices to enhance the school curriculum and to promote informal learning opportunities for people in the real world.

Sharples (2000) created a framework based on the concept of conversation theory that provides five approaches for using technology in education: (a) computer-based teacher and tutor, whose purpose is to create a dialogue between the teacher and student in which the teacher can communicate a task to a student and relate the concept to general principals while engaging in meta-level dialogue to clarify or help elucidate any student misunderstandings; (b) life-long learning agents, whose purpose is to serve as a wizard (i.e., Microsoft's wizard tool) to assist a user of technology and to provide alternative guidance to effectively or creatively use the device; (c) computer-based tools and resources, whose goal is to provide tools for learning that can help a student organize knowledge within a conceptual framework (e.g., dictionaries, graphic organizers, concept maps, timelines); (d) communications aid, which can provide alternative methods of communication for students based on their level of comfort and patterns of knowledge (i.e., websites that can provide information differently than a classroom instructor); and (e) computer-based learning environments, which can help mediate learning by providing virtual worlds, simulated labs, and online classrooms or lecture halls that are all an extension of the real world classroom or laboratory.

Seven key factors for creating an intrinsically motivating instructional environment are proposed by Malone and Lepper (1987). These researchers identify the key factors as: (a) challenge, (b) curiosity, (c) control, (d) cooperation, (e) fantasy, (f) competition, and (g) recognition. Games can be used for learning because they raise efficiency levels of students in a classroom by linking the goals of "winning the game"

and "learning the material" (Schwabe & Goth, 2005, p. 207). Prensky (2001) also suggests that six structural elements of games are rules; goals and objectives; outcomes and feedback; conflict, competition, challenge, and opposition; interaction; and the representation/story. To create a fun and engaging game, Prensky suggests that all these factors be combined.

Using Mobile Devices Informally for Learning

Informal learning, like mobile learning, can be defined in a number of different ways, depending upon who you ask. Livingston (2000) describes informal learning as any intentional or tacit learning that takes place in the absence of a classroom, an instructor, or an externally organized curriculum. Schugurensky (2006) contends that informal learning is a broad category that consists of any type of learning that is not formal or nonformal (e.g., workshops, seminars), whereas Cross (2007) describes informal learning as "the unofficial, unscheduled, impromptu way people learn to do their jobs" (p. 236).

Learning can happen anywhere and anytime. Furthermore, informal learning can be enhanced through collaboration and interaction with others. Within organizations, a great deal of what is learned is informal, such as asking a colleague for assistance, searching the Internet, or basic trial and error (Cavus & Ibrahim, 2009). The idea of mobile learning is not restricted solely to the use of the handheld or wireless technology. Instead, an advantage to mobile learning is that the learning is received and processed in an environment in which the learner is situated. The context of learning is individualized by the learner; thus, the horizons of education are heightened beyond the traditional classroom or computer lab (Walker, 2007).

Attewell (2005) suggests that mobile learning is unique because it allows anywhere, anytime, personalized learning to take place. “Mobile learning offers new ways to extend education outside the classroom into the conversations and interactions of everyday life” (Sharples et al., 2008, p. 5). The use of portable technological tools engages students and promotes learning. Using these mobile devices as learning aides has resulted in evidence of measurable improvement of student achievement (Hlodan, 2010). Even further, students’ digital cultures are constantly being shaped by the interactions the students have with mobile games and technologies on their mobile devices outside of school (Facer et al., 2004).

Students have always been able to bring assignments into the classroom to be assessed. Likewise, students have brought in objects to share with their classmates in order to further investigate a lesson. With the use of mobile technologies, however, students can now systematically capture their experiences outside the classroom through the use of images, audio recordings, and video clips (Sharples et al., 2008). Seymour Papert is a firm believer that technology should be used to reform and extend that which is learned in the classroom, which provides a rationale for using mobile technologies to help support learning outside the classroom. Also, a student’s ability to communicate and interact is vital in the educational process (Dewey, 1916).

El-Hussein and Cronje (2010) contend that “certain unintended developments in the social lifestyles of those who regularly use mobile technologies have opened up new possibilities for mobile interactions that are not confined to social situations” (p. 15). Rather than converse through face-to-face interactions, students are able to use their mobile devices to communicate through text messaging due to the increasing technical

developments and designs in text-based applications. Within the e-learning environment, a student is typically restricted to the use of a PC and/or Internet at an immobile location. However, wireless mobile devices have the potential to allow interaction between the student and instructor, interaction between other students in the same or similar courses, and instant access to course information anywhere and anytime a WiFi connection is available (Motiwalla, 2005).

Many learning activities that are taking place with the use of mobile devices continue to take place on devices that were not specifically designed to accommodate educational applications (Kukulska-Hulme, 2007). Usability issues are often brought to the forefront when speaking of mobile technology. However, when mobile devices are personally owned by their users, the user's level of familiarity with the device helps avoid many potential usability problems. Taylor (2006) claims that the mobile environment is not very well suited to support learning that takes place in the classroom, within the context of the curricula and the institution. Instead, students are more apt to wander around to investigate concepts that they feel are interesting, according to their own agendas and timetables, with little or no regard for consistency.

"Game-based learning may more adequately address the manner in which [teens] learn nowadays and engage . . . more successfully in meaningful learning than traditional learning methods" (Huizenga, Admiraal, Akkerman, & ten Dam, 2009, p. 333). Garris, Ahlers, and Driskell (2002) describe motivated learners as those learners who show a clear interest in the task at hand, enjoy what they are doing, try hard, and persist over time. Implementing game-based learning programs tends to further engage learners, because when playing games people become totally immersed in the game and can play

uninterrupted, paying little, if any, attention to the world around them (Huizenga et al., 2009).

Adult learners can benefit greatly from using handheld devices to help support their learning because it enables them to incorporate study time around other daily activities and events (Power & Thomas, 2007). An empirical study performed by Kitsantas and Chow found that students felt less threatened and embarrassed to seek help in the traditional classroom when using electronic components to assist in the learning process (Rau, Gao, & Wu, 2008).

Motiwalla (2005) conducted a study of a group of undergraduate students to determine the effectiveness of a mobile learning system (MLS). The results of the study indicated that more than 60% of participants agreed that the MLS added value to the instruction and was also a useful learning tool. Students were pleased with the convenience, ease-of-use, frequent reminders provided by the system, and the fact that the technology was mobile. These results provide further evidence that the use of mobile devices to support academic instruction may be better as an extension to the devices that are currently being used in classrooms, as opposed to their replacement (Rau et al., 2008).

Types of Mobile Technologies

There are a variety of mobile devices that exist that have the potential for future use or are already being used to help support learning opportunities in the classroom and/or within informal learning scenarios. The most frequently used devices for mobile learning include the iPod, MP3 player, personal digital assistant (PDA), e-book reader, smartphone, and the laptop or tablet PC (including Apple's iPad and Motorola's XOOM). To better understand each device and its potential use by mobile learners, a description of

each device follows. In the future, a device may be produced that represents a convergence of several technologies into one powerful, handheld, wireless device that can allow for consistent interaction and create opportunities for learning anywhere, anytime.

iPod. The iPod is a portable media player created by Apple, Inc. The device allows users to download music, audio books, photos, videos, and podcasts. The iPod can also serve as a mass storage device. The benefits of the iPod for learning situations include: (a) the devices have proven to be popular with students, given their unrivaled 87% market share; (b) lectures can be posted at no cost; (c) the impressive number of applications available enhance the overall effectiveness of the device; and (d) digital natives are in favor of these devices due to the ability of a user to have instantaneous access to information. The noteworthy detractors of the device are (a) small screen size; (b) the devices are not affordable for all students; and (c) the devices provide only one-way communication, which eliminates the collaborative feature that has proven to be important in education.

mp3 player. A digital audio player that plays audio and music files is the mp3 player. The mp3 player can be an important tool for mobile learning because the devices allow instructors to record lectures that students can later playback as podcasts. The potential advantages of the mp3 player as a device to support learning include: (a) the compact and lightweight nature of the devices, (b) the devices are upgradeable and expandable, and (c) a long battery life can allow a learner to engage in numerous hours with the device before it needs to be recharged. The negative characteristics of the device are (a) encoding and the transfer of information can be time consuming; (b) the devices,

like the iPod, only provide one-way communication; and (c) an mp3 player can be easily replaced by a device that can perform similar functions.

Personal digital assistant (PDA). The PDA features a notepad, calendar and address book, as well as additional productivity tools. Generally the devices are equipped with WiFi and are operated with a stylus/pen. These devices will playback audio, video, and Flash movies, and allow for editing of text documents. Users have access to email, IM, text messaging, and the Internet. The advantages of the PDA are the presence of a large screen for a portable device and the ability of learners to enter text and data through the on-screen keyboard or with the use of a pen-like tool, known as a stylus. There are, however, some disadvantages of using PDAs to support learning, which include the bulky nature of the devices, making them difficult to fit in a person's pocket, and the lack of peripheral input devices, which makes entering long emails or text messages cumbersome.

e-book reader (e-reader). The e-book reader can be used to download text-based materials, such as e-books, newspapers, and magazines. Additionally, these devices can be used by students to conduct research, read resources on-demand, and access textbooks. e-book readers can be advantageous to a mobile learner due to several characteristics that the devices have. The devices typically feature (a) large screens, (b) backlighting or the ability to purchase adapters that allow for reading in dark places, and (c) ample storage for novels, reference books, and textbooks that can be accessed from one device. The drawbacks of using e-book readers as mobile learning technologies are the limited computing capabilities of the devices and the fact that many textbooks and other

reference material have not yet been converted to a digital format, meaning they are not yet available to be stored on an e-reader.

Smartphone. The smartphone is an all-in-one device that combines telephone capabilities with a PDA, digital camera, and mp3 player. Smartphones allow its users to access the Internet, including email, IM, and text messaging. These devices support the interactive component of learning. The advantages of using a smartphone to engage in mobile learning in a classroom setting or informally are: (a) they are compact, lightweight, and easy to carry in a pocket; (b) a plethora of communication and computing technologies are combined in a single device; (c) the phones are Internet accessible; (d) new applications are being created on a daily basis to help support learning environments; (e) they are ubiquitous; and (e) the common operability of the devices improves overall efficiency. Although there are advantages to using smartphones to support mobile learning, the disadvantages should also be noted: (a) the small screens can make reading text messages and browsing the Internet somewhat challenging, (b) text and data entry can be more time consuming as a result of the size of the keyboard, and (c) considering the cost of the devices, the monthly service charges, and data usage fees, smartphones are not as cost-effective when compared to more powerful technologies, such as personal computers. However, smartphones are much more portable.

Laptop/tablet PC (including Apple's iPad and Motorola's XOOM). Laptop computers, the tablet PC, and more recent creations such as Apple's iPad or Motorola's XOOM feature Bluetooth and WiFi capabilities and provide interactivity for collaboration and research. These devices are the epitome of information accessibility from anyplace at anytime. Laptop/tablet computers are advantageous in the sense that (a)

they are extremely portable, (b) they are easy to operate due to their commonalities with the operational systems of a standard personal computer, (c) they are capable of storing volumes of information because of their large hard drive capacities, and (d) they provide users with unrivaled interactivity. The disadvantages of laptops and tablet PCs include the fact that they are relatively expensive when compared to other devices and they are significantly larger than other commonly used mobile devices, including those described in this section. The larger size of these devices, however, provide users with full keyboards, larger screens, faster and more efficient processor speeds, and extended battery lives, which are additional advantages.

Barriers to Mobile Technology Implementation in Schools and Informal Learning Situations

One challenge facing educators is the ability of teachers to manage a learning environment that uses an array of powerful communication devices that students are bringing into the classroom while also managing other aspects of the classroom, such as informal collaboration and networked learning (Sharples et al., 2008). Even though students may be very familiar with the use of mobile technologies, especially their own cell phone or iPod, teachers often are not. Consequently, teachers must begin to recognize the academic value associated with these tools to effectively incorporate them into the curriculum. Aside from teachers needing to manage their technological learning environment, education in general faces a variety of hurdles to successfully implement mobile technology plans in the classroom and to create further learning opportunities for learners who want to take their education beyond the classroom walls. The following barriers must be circumvented before the efficient use of mobile technologies in classrooms can be achieved.

Lack of empirical evidence of effective use in classrooms. Studies have documented the use of mobile devices in the clinical setting (Scordo & Yeager, 2003), which provides great potential for the use of mobile learning with nurse practitioner students, but mobile technology for learning still lacks empirical evidence to support its use in classrooms (Wyatt et al., 2009). Although mobile technologies afford students and teachers more flexibility and freedom, "new pedagogies and approaches to delivering and facilitating instruction" (p. 54) need to result from the implementation of these devices (Corbeil & Valdes-Corbeil, 2007). Within schools, the actual learning practices continue to undergo significant changes; however, the learning theories that support educational practices are not (El-Hussein & Cronje, 2010).

Lack of effective design of mobile learning tools. Sharples et al. (2008) feel that the design of mobile learning activities should be driven by specific learning objectives. The technology should be used as a means to further engage students and promote activities that would not have been possible without the use of the technology. Schwabe and Goth (2005) investigated the motivational values of mobile learning as a result of the use of mobile games. In their experiment using the MobileGame system, Schwabe and Goth discovered four technical design issues that need to be addressed to create an effective learning game: accuracy of positioning, play on the move, offline area and response time, and interface design. As the demands for mobile technologies that support learning continue to increase, the need for the creation of quality applications and tools for mobile learning devices must also be acknowledged. Well-designed mobile learning games and other applications can be used outside of the classroom in an effort to spark discussions when the students return to class (Klopfer, Osterweil, & Salen, 2009).

Distractions. A barrier to the use of mobile devices to support learning in informal settings, such as a train station or airport, is the distractions caused in this type of environment (Motiwalla, 2005). Issues are also bound to result from the use of mobile devices in the classroom, such as privacy, security, and disruptiveness. In addition, the cost of these mobile technologies may also have an influence on the potential future use of these devices in formal learning settings. Small screen sizes and keypads are often the biggest disadvantages that researchers cite regarding the use of mobile devices for learning (Ozdemir, 2010).

Lack of a generalizable theory of mobile learning. A significant amount of literature pertaining to mobile learning currently exists; however, most of the research is techno-centric and overlooks the pedagogical issues associated with integrating mobile technology into the classroom (Ozdemir, 2010). Schools continue to remain hesitant about adopting mobile learning as a form of classroom instruction. Instead, a mobile learning theory needs to be established that embraces learning that occurs outside classrooms and lecture halls by people performing basic learning activities (Liaw et al., 2010). This mobile learning theory should investigate the ubiquitous nature of these personal and knowledge sharing devices. Moreover, further research is needed to elucidate the advantages, challenges, and limitations of using mobile devices as learning tools and to create appropriate learning pedagogies (Ozdemir, 2010).

Speed of adoption. Schools are notoriously slow to adopt programs and/or innovations, for instance: kindergartens took nearly 50 years (1900 to 1950) to be completely adopted by all schools in the United States (Mort, 1953); driver's education/training programs took nearly 18 years (1935 to 1953) to reach full adoption

(Allen, 1956); and the adoption of modern math took 5 years (Carlson, 1965). Technology adoption, as described in the literature, is a complex, social, developmental process in which individuals develop unique perceptions about certain technologies that may influence the adoption of these technologies. The successful adoption of these technologies is often based on an individual's own cognitive, emotional, and contextual beliefs (Straub, 2009).

Lack of accessibility. "Access to technology and the need to invest substantial time hinder its adoption in schools" (Sharples et al., 2008, p. 14). Therefore, accessibility can be the biggest strength of mobile technology use in the classroom, yet at the same time, accessibility can also serve as the greatest deterrent. According to media critic John Katz, rather than focus exclusively on censorship, educators are better off teaching students how to use the Internet, how to evaluate websites, and how to safely navigate the Internet (Tell, 1999-2000). Motiwalla (2005) tends to agree with Katz, claiming that an array of problems in classrooms for teachers and students may be evident because of the widespread ownership and applicative character of mobile technologies. He cites that these problems can be rooted from a lack of teacher experience in the management of a technological classroom and the lack of student knowledge and etiquette when it comes to using mobile devices for learning.

Other Factors

A number of studies have been conducted to test the role of mobile devices for learning in a variety of settings. One such example is MOOsburg, a wireless handheld application intended for use with community education students studying the environment and ecology to discuss findings from remote field trips (Farooq, Shafer,

Rosson, & Carroll, 2002). Additional studies have focused on short message service (SMS), or text messaging, as a collaboration tool for mobile learning. Stone, Briggs, and Smith (2002) studied the effects of text messaging to determine whether the conversational aspects associated with SMS produced more effective mobile teaching and learning environments. The Mobile Author was a project designed to afford instructors the opportunity to create an intelligent tutoring system (ITS) in a variety of subject areas, which would allow instructors to assess, record, and access reports on student performance (Virvou & Alepis, 2005). Both instructors and students who have assessed the Mobile Author system have valued its usefulness in teaching. Motiwalla (2005) asserts that for mobile learning to be effective, it must complement an existing learning environment. As such, developers of mobile applications for education should understand the limitations of the devices and also take into account aspects of SMS that support the conversational model of learning (Motiwalla, 2005).

Attewell (2005) performed a study in which she noted eight distinct characteristics that were advantageous to using mobile devices for learning. The purpose of these studies were to shed light on the potential of mobile devices to support, enhance, and improve access to learning for young adults who were experiencing difficulties with literacy and/or numeracy. The results of the research indicate that mobile learning (a) helps learners improve their literacy and numeracy skills, (b) encourages independence and collaboration, (c) helps learners identify areas where they need assistance and support, (d) can help bridge the gap between ICT and mobile phone literacy, (e) helps engage reluctant learners, (f) helps learners remain focused for longer periods, (g) helps raise self-esteem, and (h) helps raise self-confidence.

The MacArthur Foundation's (n.d.a) "Living and Learning with New Media" study concluded that online access can provide a springboard for student learning opportunities. The study also determined that a great disconnect exists between that which is learned in school and the learning that takes place in informal settings outside the traditional classroom or beyond the personal computer. These findings can have a favorable potential effect on the use of the Internet and collaboration using mobile devices in informal situations. Moreover, although the use of mobile devices in the classroom is being carried out by many high schools throughout the country, these devices may be better suited for use outside the classroom either to support that which was taught in class or to provide additional learning opportunities for students.

Roschelle et al. (2005) indicate that usage patterns of mobile devices by students during a prolonged period of time may result in a favorable perception of the device as a learning tool or the device may fall out of favor with the student as the initial interest level of the tool begins to wear off. Furthermore, the researchers assert that no single mobile device was an overwhelming choice among students to manage their learning, which indicates that learning management may be enhanced by combining mobile technologies and human assistance (Roschelle et al., 2005). By combining mobile technologies and teacher support, students may be able to recognize innovative features on their phones, iPods, netbooks, or PDAs that they never realized could assist in the learning process. Because many of the applications that are created for these mobile, handheld devices are not explicitly designed to accommodate students, users of these devices can still craft their own learning opportunities with their use.

Diffusion of Innovations

Everett Rogers (2003) has completed myriad studies on the adoption of new methods, procedures, and tools in organizations and schools. According to Rogers, the process of a newly adopted form of equipment, tool, or procedure by an organization or school for a purpose other than that which it was initially intended is known as Diffusion of Innovations. The theory, first coined by Rogers in the 1950s, is still referenced readily in today's increasingly mobile and ever-changing society. The predominant discussions regarding diffusion of innovations in schools relate to the adoption of modern math in Pittsburgh high schools and the full adoption of kindergarten worldwide.

In a 1965 study, Richard O. Carlson investigated the diffusion of the innovation of modern math into the Pittsburgh area schools by contacting superintendents who were instrumental in the widespread adoption of modern math in the 5-year period spanning from 1958 to 1963. His main objective was to determine the variables that led to the full adoption of the modern math program in the Pennsylvania schools. He sought answers regarding innovativeness of the superintendents, perceived characteristics of innovations and the rate at which they were adopted, and the consequences of the innovation. The innovation in this case being the induction of modern math into the schooling system, or "programmed instruction" (Rogers, 2003, p. 62).

Around 1850, a German educator, Friedrich Froebel, had a vision of a special place in which small children, removed from the influences of their parents, would engage in meaningful learning situations through playful activities. By the early 1870s his idea had spread to parts of Western Europe and the United States, but it was not until

around 1900 that kindergartens began operating in the United States. And it was not until 1950 that full adoption throughout the United States was achieved (Rogers, 2003).

According to Rogers (2003), the diffusion of technology differs slightly from other typical innovations in the sense that technology is often shaped by social factors. At times, the technology selected for use may not be the most advantageous to all groups, but will be the most profitable. Thus, economic factors can drive the diffusion of technology. Military demands, such as nuclear power, jet aircraft, and the Internet, can also shape demand. Meanwhile, government regulations are yet another factor that can play a role in the diffusion of innovations. A school's decision to adopt mobile technologies as learning tools within the traditional classroom may also be shaped by some of the factors mentioned by Rogers: social (i.e., word of mouth), economic (i.e., profitability), and governmental (i.e., policy). However, the diffusion process also requires a significant amount of time. And the process is not instantaneous, even when an organization's leaders may be in strong support of a new technology or plan (Rogers, 2003).

Specific Instances of the Use of Learning Using the Internet and/or Mobile Devices

Hanging out, messing around, and geeking out. According to a study performed by the MacArthur Foundation (n.d.c), the main reason that teenagers in today's society go online is for social reasons. Mimi Ito considers this social behavior to be friendship-driven participation. Within this same study, teens were also found to engage in interest-driven participation by participating in online activities that require a set of more sophisticated skills. Ito describes the three levels of participation teens will engage in when using the Internet as: (a) *hanging out*, or tinkering with new media; (b)

messing around, or developing and sharing media; and (c) *geeking out*, or developing skills to participate in online learning communities. The implication of Ito's study paves the way for the future use of mobile devices in education, namely in the informal learning community through which schools can take advantage of these new media and informal learning opportunities to support curriculum and better prepare students for the 21st century. However, transforming the way that society views learning may be a critical first step to implementation.

Use of GPS systems to teach English. At a Taiwanese University, instructors piloted a system called Student Partner, which would alter the way that English instruction took place on campus. Instead of guiding English instruction through a passive classroom context, which can often result in decreased levels of interest and achievement, the system combined a map of the campus with various global positioning system (GPS) functions in handheld devices in an effort to "support two-stage campus-based English learning activities" (Cheng, Hwang, Wu, Shadiev, & Xie, 2010, p. 93). Aside from the GPS features on the devices, the devices were also capable of multimedia posting, information synchronization with content on the server through a WiFi or Internet connection, and a system backup feature to prevent the permanent loss of information on the handhelds. The interface of the Student Partner was broken down into three categories: eating, living, and transportation. Students enhance their ability to learn English by forging connections between their own familiarity of the campus, the visual representations of the campus on their mobile devices, and the appropriate English words that describe what they see.

Mobi-Learn Project. Schwabe and Goth (2005) created a project that would bring mobile learning outside the confines of the traditional classroom. The Mobi-learn project set out to research the potential for and the design of mobile learning both in the classroom and outside the classroom, informally. In their research, three application scenarios were included: (a) health, (b) museum, and (c) executive education. The main area of focus was on executive education. The project aimed to look at the use of mobile devices as orientation tools for university students. Mobi-Learn is designed as a game that provides orientation students with tasks related to specific people, places, and events on campus. The activities involved in the project were done collaboratively, within groups of one to three persons. Groups were encouraged to create Post-Its to inform groups and provide hints to other groups who may need assistance. At the conclusion of each task, students were given a question on their mobile device(s) that must be answered correctly before they were allowed to proceed with another task.

One-to-one computing initiatives. Numerous studies have been conducted on the effectiveness of one-to-one laptop initiatives at varying levels of education. Maninger and Holden (2009) conducted a study which investigated the effects of a one-to-one laptop/tablet initiative on teachers and students in grades 5 through 8. The study specifically targeted: (a) teacher and student perceptions and attitudes about technology and its use in the classroom; (b) how the attitudes and perceptions translated into actual practice, as determined by both student achievement levels and teacher integration of technology into the curriculum; and (c) the role of technology leadership in successful integration of the program in the private K-8 school.

The findings of the research indicate that teachers were pleased with the fact that students could work more efficiently on their own. In addition, students were more willing to help one another and collaborate without being told or asked to so by the teacher. Other significant findings of their research include increases in accessibility to information by students in a variety of forms. Teachers indicated that this increased accessibility was relevant because it not only pertinent to the existing world in which the students lived, but was also helping students better prepare for their future. As a result of the pilot tests conducted by the teachers in the study, a majority of teachers who initially had reservations about the one-to-one plan began to become more acclimated to the use of the technology for instruction. Last, teachers recognized that the impact of the integration of the mobile technologies in their instruction were being realized inside and outside of their classrooms (Maninger & Holden, 2009).

YouMedia program. The YouMedia program in Chicago, which began in the summer of 2009, serves the purpose of connecting youth with books, media, and institutions around the city to help promote a higher level of engagements in learning in the classroom and informally outside the classroom. As long as a student has a library card he or she is allowed access to the 100 laptops and video game consoles at the state-of-the-art library. Additionally, there are flat-screen monitors adorning every wall, a recording studio, performance space, and an area where teenagers can geek out, learning about new media with the assistance of adult mentors (MacArthur Foundation, n.d.b).

Living and Learning with New Media initiative. Another research venture sponsored by the MacArthur Foundation, called the Living and Learning with New Media study was a report that found that time spent online was connected directly with

learning as students are able to negotiate meaning from their work online and ultimately establish a broader set of technical skills while being motivated by both their peers and their personal interests (MacArthur Foundation, n.d.a). Teens who partake in the program move along a continuum from students who socialize with friends, to students who engage in learning with games and music, to students who learn current digital media skills to spark their creativity to create greater learning opportunities (i.e., geeking out).

Quest to Learn. New York City's Quest to Learn, which opened in the fall of 2009, is the first public school to offer a curriculum based on game design. The school, also sponsored in part by the MacArthur Foundation along with several other organizations, aims to help students acquire 21st-century skills, such as teamwork, systems thinking, creative problem solving, and time management (MacArthur Foundation, n.d.b). The classes offered are set up as five integrated domains in which applied knowledge and conceptual thinking are requisite for success. The domains include: (a) The Way Things Work*,* which integrates mathematics and science using ideas from engineering and design; (b) Codeworlds, which integrates math, English language arts, and computer programming, providing students with rich learning opportunities to solve cases of missing persons by cracking codes and learning syntax, grammar, and language in the process; (c) Being, Space and Place, which integrates English language arts and social studies to enable students to forge the connections between themselves and the sociocultural world around them; (d) Wellness, which integrates physical education, nutrition, health, and socioemotional learning; and (e) Sports and the Mind, which integrates game design and media tools. This school is

making efforts to redirect its teaching methods and strategies to meet the interests and needs of the students.

Emails as a form of learning. Japanese university students have been using mobile devices to learn by sending email and text messages (upward of 200 messages per week) to their teachers and other students to intensify learning (Roschelle et al., 2005). The study of these Japanese students indicated that those who received emails learned more than those who did not. The design of this system helped link the casual activity of reading email in an informal, asynchronous manner with formal classroom instruction (Roschelle et al., 2005).

Summary

The changing role of mobile technologies as we progress further into the 21st century has created different affordances for learners as mobile devices begin to take on a variety of forms. Mobile devices are being used in a number of settings for learning purposes, including informally within schools and outside of schools to help support that which was taught in school. m-learning can be characterized by the personal and public process of the acquisition of knowledge through exploration and conversation with the assistance of mobile devices. Furthermore, m-learning helps enrich learning environments and enhance the conceptual understanding of students.

Although m-learning has great potential in educational settings, there are a number of barriers that are affecting its rapid widespread adoption. Included as barriers to the successful integration of mobile devices into schools are (a) the distractions that the devices can create within a traditional classroom, (b) the effective design of the devices to accommodate a number of learning styles and multiple subjects, (c) empirical evidence

of effective classroom use to increase the likelihood that other teachers may be in favor of using mobile devices in their own classrooms, (d) the diffusion of innovations and the speed of adoption of the devices in schools, (e) the ease of access students may have in acquiring their own devices, (f) the effective design of mobile technologies to meet the needs of the 21st-century learner, and (g) the resistance of teachers to educational innovations.

There are, however, a number of practical situations in which mobile technologies have been studied or have been effectively implemented in learning scenarios, including: (a) Mimi Ito's ethnographic study on the three levels (hanging out, messing around, and geeking out) of teenage computer use (MacArthur Foundation, n.d.b); (b) the use of GPS systems in Taiwan to teach English to university students (Cheng et al., 2010); (c) the Mobi-Learn Project, which served as an orientation tool for university students (Schwabe & Goth, 2005); (d) one-to-one computing initiatives (Maninger & Holden, 2009); (e) Chicago's YouMedia program, which connects youth with books, media, and institutions across the city to promote higher levels of engagement in classroom or informal learning (MacArthur Foundation, n.d.b); (f) Living and Learning with New Media's study on the time students spend online and the correlation time spent online has with establishing broader technical skills and increased motivation from peers and as a result of personal interests (MacArthur Foundation, n.d.a); (g) Quest to Learn opening its doors as the first public school to offer a curriculum based around game design to help students acquire and refine 21st-century skills (MacArthur Foundation, n.d.b); and (h) Japanese university students using emails to intensify learning (Roschelle et al, 2005), which has helped establish links between informal learning and actual classroom learning.

The literature herein gives way to the potential future use of mobile devices by students everywhere to support learning anytime and anyplace. However, whether high schools wish to adopt mobile technologies as staples in their curricula, based on the current use of mobile devices as learning tools in a variety of studies and in a number of different settings, may be heavily reliant on the attitudes and perceptions of high school students and teachers included in the subsequent research. How teachers perceive the use of mobile devices in schools and the reputation of teachers who have notoriously resisted innovations in education are also factors that have an effect on the implementation of mobile devices into classrooms.

Chapter 3: Methodology

Overview

This study compared the perceptions and attitudes of high school students versus their teachers regarding the current and future uses of handheld, Internet-capable mobile devices, including iPods, e-book readers, PDAs, tablet PCs, laptops, smartphones, and slates, to mediate learning inside the classroom. Mobile devices are becoming more prevalent and ubiquitous. Increases in student and teacher ownership of these devices and the advances in mobile technologies have given way to new discussions about the possible uses of mobile devices for learning. Designers and programmers of mobile device applications and programs, curriculum and technology coordinators at high schools, and students and teachers across the United States can, thus, use this research to better understand how students benefit from using mobile devices to support traditional classroom instruction based upon (a) how students perceive the devices, (b) their attitudes about mobile technologies, and (c) how students are currently using mobile devices to create their own learning experiences outside of the classroom.

This chapter outlines research design, data analysis, and data collection procedures for the investigation of the possible future use of mobile devices inside and outside the high school classroom as a support to the learning that takes place in the classroom. Much of what students are currently doing to create opportunities outside of the classroom to learn informally may be of great use to schools that wish to integrate the devices into the everyday operations of education. Many instances of the use of learning with mobile devices informally (Bradley, Haynes, & Boyle, 2005; Clough et al., 2008; MacArthur Foundation, n.d.a), online (Keegan, 2002; MacArthur Foundation, n.d.c) and

through games (Facer et al., 2004; Garris et al., 2002; Huizienga et al., 2009) have been cited, but teachers must be willing to accept mobile learning for there to be any chance of its adoption in schools. The attitudes and perceptions of teachers were measured against those of students in an effort to gain a clearer picture of the factors that may be influencing and/or hamstringing the diffusion of mobile technologies into classrooms.

Restatement of Research Questions

Research questions. The following three research questions were used to determine attitudes of students and teachers that affect future use of mobile devices:

1. In what ways are students currently using mobile devices for learning inside and outside of the classroom? How do students perceive the future use of mobile devices as tools for learning?
2. In what ways are teachers currently using mobile devices with their students inside and outside of the classroom? How do teachers perceive the future of mobile devices as tools for learning?
3. Do high school students and high school teachers have similar or different perceptions and attitudes regarding the best practices and acceptable uses of mobile devices as learning tools now and in the future?

Research Design

The nature of a research problem, along with the available resources for investigation of the topic, should determine the choice for a research approach (Gall, Gall, & Borg, 2003). Some of the information that needed to be gathered to properly address the research questions pertained to the perceptions of high school students and teachers regarding general mobile technology use to determine the potential advantages

and disadvantages of the use of mobile devices as learning tools by high school students and teachers both inside and outside the traditional classroom space. Collecting data through open-ended questions provided more in-depth results on the perceptions and attitudes of students and teachers. The open-ended responses were analyzed qualitatively.

The research method was a nonexperimental exploratory study using a combination of quantitative and qualitative collection instruments. Bryman and Bell (2007) suggest descriptive research in studies that seek to "emphasize the importance of the contextual understanding of social behaviour [*sic*]" (p. 418). Additionally, behavior, values, attitudes, and perceptions must be understood in context. The behavior of members of a social group can only be examined in the particular environment in which they operate. Furthermore, the use of a descriptive design helped provide the "mapping of context in terms of which behavior is understood" (p. 418).

The information gathered came from surveys completed by high school students and teachers and a follow-up focus group. Separate surveys were used to investigate the attitudes, perceptions, and beliefs of high school teachers and students regarding the current and future use of mobile devices for learning. The focus groups followed the survey process and were also conducted independently. Teachers participated in one focus group, whereas students participated in a focus group of their own. The aim of these focus groups was to provide the researcher with a more in-depth analysis of the contents of the student surveys and the teacher surveys. A further analysis of the focus group contents was then undertaken to compare the results of the teacher group versus the student group to determine whether any similarities or differences in the data were significant.

Research Setting and Target Group

This research was conducted at a public high school located in Ventura County, which is the county directly west of Los Angeles County and directly east of Santa Barbara County in Southern California. The school has a population of just more than 2,400 students and employs approximately 100 teachers. Demographically, the composition of the school's student body is 63% Caucasian, 26% Hispanic/Latino, 6% Asian, 2% African-American, 1% Filipino, and the remaining 2% are American Indian/Alaska Native, Pacific Islander, or multiple or no response. The teachers at the school are 93.9% Caucasian, 5.1% Latino/Hispanic, and 1% Filipino. Nearly 24% of students attending the high school are on free/reduced school lunch, 4.8% of the students are English learners (EL), and 17% of all students have been deemed socioeconomically disadvantaged. This group was chosen for the study due to the principal researcher's accessibility and ties to the subject school. Additionally, the researcher investigated the attitudes and perceptions of high school teachers versus students (teenagers), making the subject school a nice fit.

Selection of Participants

Teacher participants. The invitation to participate in research on mobile technologies was emailed to all teachers who worked at the high school (see Appendix A). The emails were obtained by the principal researcher, who serves as a teacher at the subject school. Each teacher was invited to take the online survey, which was created with Survey Monkey. After 1 week had elapsed, an email was sent to all teachers at the school as a reminder to complete the survey (see Appendix B). A follow-up email was also sent to all eligible participants after another week had elapsed. Additionally, an

email was sent to all teachers asking for their participation in a teacher-only focus group (see Appendix C). As an incentive for teachers to participate and donate a portion of their time to the research, light snacks and refreshments were provided during the focus group.

Student participants. Because the majority of students attending the high school are younger than age 18, parental consent was necessary. All parents of students who wished to be included in the study who had an email address on file with the high school received an email (see Appendix D) describing the research that will be conducted, which served as a consent form when forwarded. The parental consent form in the email was deemed executed once the contents of the email had either been forwarded or shared with their child (high school student). Once the student was provided with a forward of the email or given the URL where the student survey resided, the student was then granted access to the survey. Once at the survey, the student was exposed once again to the parental consent form to which they needed to agree to the terms included on the survey's second page, which summarized the parental consent form (see Appendix B) and provided the student assent to take the survey (see Appendix A). A follow-up focus group for students only was held approximately 2 weeks after the initial emails to recruit students to participate in the research had been sent to the students' parents. An announcement was made, an email was sent, and signs were posted around school to solicit participation in the student focus group, as well. Students who attended the focus group also needed to have a signed parental consent form (see Appendix B) on file to participate in the research. As an incentive for students to participate and donate a portion of their time to the research, light snacks and refreshments were provided during the student focus group as well.

Description of Materials/Instruments

Survey. The survey instrument was designed to be as short as possible to achieve the maximum response rate from the teachers and students who participated. The survey consisted of questions ranging from multiple choice, Likert, and open-ended. Assent and consent forms were necessary for students and teachers to participate in the online survey (see Appendices E and F). The questions for both surveys (see Appendices G and H) were created based upon prior observations and the literature. The validity of the instrument had already been confirmed to be accurate by a team of expert reviewers and was determined by the participation of a usability group of students and teachers with whom the principal investigator was very familiar. The survey contained additional questions that pertained to gender and demographics, so as to analyze any significant findings in the research based on these factors. The majority of questions were Likert-scale, which were designed to be analyzed quantitatively. The final five questions of the survey were open-ended questions through which participants could more accurately express their attitudes and perceptions toward m-learning.

The teacher and student surveys were hosted online through www.surveymonkey.com. Once the specified survey time window of approximately two weeks had elapsed, all the survey data were transferred to an external hard drive and were only available to the researcher solely for use with this research. The information could be accessed exclusively by the principal researcher from the external hard drive. All contents of the hard drive remained and continue to remain confidential, and will be permanently erased 3 years after the data collection period ends (on August 27, 2014). The survey data of both the teacher and student populations were analyzed using the

built-in web features available through Survey Monkey and the results underwent further filtering by the researcher using SPSS.

Focus groups. The use of focus groups to collect data on beliefs, perceptions, and feelings cannot be captured through interviews like they can through focus groups (Gall et al., 2003). According to Gall et al. (2003), the facilitator can assume a more passive role in a focus group setting than he can in a personal interview, thereby extracting more accurate information regarding the perceptions, attitudes, and beliefs of the participants. With this in mind, research participants had the option in the survey to become part of a focus group sample. The use of focus groups has been beneficial in helping researchers define problems in new and innovative ways while stimulating creative ideas among like-minded individuals via group discussion (Bryman & Bell, 2007). The focus groups thus aimed to enhance the depth of the research and expand upon the responses recorded on the surveys. Questions that were used to help guide the discussions in the focus group are contained in Appendix I.

Student focus group. An email (see Appendix J) was distributed to all students to achieve a group of candidates from the initial survey pool who were willing and able to take part in a focus group at a specific time and date approximately two weeks from the end of the survey period. Students who did not complete a survey but who had a desire to participate in a focus group were able to do so as long as they had submitted a parental consent form prior to being involved in the focus group. Students who were selected for participation in a focus group were sent a confirmation email (see Appendix K), which provided details about the meeting time and place of the focus group. The focus group session was recorded. Questions that were used to guide the discussions in the focus

group are contained in Appendix E. The identities of all students who were recorded will remain in strict confidence, as letters and numbers (e.g., S1, S2, S3) in lieu of names were used to identify each student participant. The recordings were analyzed and coded to best represent the data with the most up to date software program for qualitative data analysis, NVivo: Version 9. The student recordings are also kept securely on a password-protected hard drive and will be erased after 3 years has elapsed (August 27, 2014).

Teacher focus group. An email was sent to all teachers (see Appendix C) to recruit their participation in a focus group. All teachers who agreed to participate were sent a return email (see Appendix K), which asked teachers to report to a specific location. Although the turnout at each focus group could not be predicted, the hope was that the teacher focus group contained around 10 members. The teacher focus group session was recorded. The consent form to participate in the research is contained in Appendix L. The identity of every teacher who was recorded will remain confidential, as the use of letters and numbers (e.g., T1, T2, T3) in place of names was used to identify participants. The recordings were analyzed and coded to best represent the data with the most up to date software program for qualitative data analysis, NVivo: Version 9. The recordings are currently kept secure on a password-protected hard drive and will be erased after 3 years has elapsed (August 27, 2014).

Procedures

Protecting the rights of minors. To ensure the protection of the rights of the student participants who were younger than age 18, strict guidelines were established between the researcher and the IRB of Pepperdine University regarding the procedures for accessing the online survey and for the participation of minors in a student-only focus

group. According to university regulations, all students who were younger than age 18 were required to get permission from their parent or guardian to take part in the survey process. Because the survey could be accessed online, parental permission could not be attained through hard-copy signatures. Instead, a waiver of the informed consent process was used in which each student was granted parental permission to take the online survey when the parent or guardian of the student shared an email link, contained in a descriptive email (see Appendix D), with his or her child. The parents provided consent for the student to take the survey once the student clicked on the link contained within the email, which also served as the parental consent form. The student was then asked to agree to the terms of the survey (see Appendix E) on a subsequent page, thus providing assent to participate in the study. No identifying information was collected from students at any point during the survey process, and all Internet protocol (IP) tracking was turned off. Therefore, all survey participants remained anonymous throughout the survey process.

Those students who wished to contribute to further research were given the opportunity to participate in a student-only focus group. Those students who wished to participate in the focus group were required to bring a hard-copy parental consent form (see Appendix F) signed by the student and parent as a prerequisite to participate in the focus group. The identity of all students who decided to take part in the focus group was kept completely confidential. When reporting the findings of the study, any data that were derived from the focus group were reported in such a way that would not reveal the identity of the student participant.

Strengthening the validity of the survey. The teacher and student surveys were examined by an expert review panel in the field of educational technology to strengthen

the validity of the instrument. According to Bryman and Bell (2007), the expert review panel need to ensure external validity by covering the following five questions: (a) Does the survey appeal to a variety of social and psychological groups?, (b) How confident are we that the survey will be effective in a variety of settings?, (c) Can the findings be generalized to the past and the future?, (d) Will those members who participate in the pretest become sensitized to the survey?, and (e) Will the fact that participants know that they are participating in a survey affect the way the questions are answered?

Usability tests of the survey and a general plan for focus groups. One way to refine a survey is to set up focus group tests (Alreck & Settle, 2004). Alternatively, to effectively refine a survey, a usability test of the survey could provide feedback regarding its validity and overall reliability (Gall et al., 2003). To ensure that the survey is effective, valid, and reliable, the researcher performed various usability tests, as suggested by Alreck and Settle (2004) and Gall et al. (2003). These usability tests included the refinement of assent forms, adaptation of electronic communication (i.e., emails to prospective participants), revising the electronic survey, plans for forming the focus groups, and the process of holding focus groups.

To conduct the usability tests, two separate groups consisting of five students and five teachers were asked to meet at the school library. The teachers and students were asked to attend different sessions, which lasted approximately 40 minutes each. Each teacher was required to provide assent through the survey (see Appendix E) and each student who participated was required to have a consent form (see Appendix F) signed by his/her parent before participating in the usability test. Each teacher and student involved in the usability test completed an online survey (see Appendix G or H). Every research

subject in attendance completed the survey. Once the survey was complete, the groups moved to a classroom to discuss the survey. Within the focus group of students or teachers, information was transcribed that ultimately led to a better understanding of the clarity of the survey instrument and the types of revisions that were necessary. After conducting the usability test, it was determined that each teacher and each student took about 12-15 minutes to complete the survey. The clarity and succinctness of the questions was deemed appropriate. The results also appeared to be reliable, although minor changes to the original instrument did require revision. In addition to preselected teachers and students testing out the survey, the advice of experts in the area of educational technology was also sought to ensure that the survey was valid. Moreover, after the Institutional Review Board (IRB) approval of the dissertation proposal, the experts' opinions were once again sought to ensure that each survey item on the teacher and student survey instruments accurately measured a research question. In the case that a survey question did not effectively measure a research question, the experts helped reword the problematic question to validate that the question did.

Reliability and Validity

The survey contained a variety of questions pertaining to the perceptions and attitudes of high school students versus teachers regarding the use of mobile devices for academic purposes both inside and outside of the classroom. Due to the fact that the survey was created by the researcher, the survey needed to undergo a variety of tests to ensure its validity and reliability. An expert review panel was assembled to investigate the quality of the survey, to ensure that the questions were clear and succinct, and to certify that the questions accurately measured what they intended. To establish validity of

the respondents, the first series of survey questions were asked in an attempt to poll the individuals taking the survey regarding their own current use of mobile devices. When the time came to select participants who were eligible to take the survey, the selection was not purposive; instead, every student and teacher at the high school in the study was offered the chance to complete the survey and contribute further to the research through participation in a focus group.

The reliability of data in a qualitative study can be determined by the consistency in coding. The coding should be accurate enough that any person outside the study who looks at the raw data could arrive at the same conclusions as the principal investigator (Rudestam & Newton, 2001). Therefore, a specific coding methodology was used to accurately represent the opinions of the participants of the study. Additionally, the researcher took part in a collaborative analysis of the data with an expert in the field of educational technology to further validate the data. The data gathered by the principal investigator and the expert in the field of educational technology were then compared to increase rater reliability. Based on the qualitative nature of the majority of the data, the coding helped the researcher properly draw conclusions pertaining to how students and teachers envisioned what the future use of mobile technologies for learning purposes may look like inside and outside the classroom as a support to that which was taught inside the classroom.

Assumptions, Delimitations, and Limitations

The information that was obtained through the research process was not of immediate benefit to any of the participants. In the future, the results of the research may be of benefit to teachers and students who use mobile devices for learning purposes.

Furthermore, the results can be used to provide programmers and application designers with pertinent information regarding the manner in which teachers and students use mobile technologies to create their own learning opportunities to develop programs and applications that better suit the needs of the mobile learner.

The research methodology was based on the assumptions that the teachers and students who responded to the survey items responded truthfully and accurately. The survey was created through unstructured collegial interviews and observations of students and teachers using mobile devices to support learning. This process helped ensure reliability and validity of the survey instrument. The data collected through researching one high school were applicable exclusively to that high school or high schools with similar demographic compositions of students and teachers. The limitations of the study essential to the data collection include: (a) the students and teachers selected are from one Southern California high school, (b) the students and teachers who had the opportunity to participate in the survey were self-selected, (c) the attitudes and perceptions of students and teachers could only be tied to the time the research took place, and (d) the follow-through of the number of participants who provided useful responses to the survey, particularly to the open-ended survey questions, was limited. Because the research was being conducted at one high school, the results of the survey were limited as they cannot be extrapolated to other environments.

Ethical Considerations

Every student or teacher who wished to participate in the research was doing so on a voluntary basis. Participants in either survey (teachers or students) were required to provide assent located on the first page of the survey. The assent form was located online

for both the teacher and student surveys. Regardless of age, every survey respondent needed to agree to the assent form before continuing with the survey. In addition to assent, student participants were allowed access to the survey only if their parents decided to forward or share the email which described the research, provided parental consent, and contained the link to the online survey with their child. Should a person who started to take the survey or already completed the survey wish to withdraw from participation from either the survey pool or from their future obligation to a focus group, there was no risk or negative consequence as a result. The principal researcher was the only person who had access to any identifying information (e.g., email addresses), if provided. There was absolutely no risk of physical harm to any respondent. There was a very small likelihood that any participant would develop any mental distress as a result of completing the survey or participating in a focus group. Teachers needed to devote their own time to provide information for the research. Also, teachers may develop negative attitudes toward other teachers who are Luddite or simply oppose the concept of mobile learning. The requirements of the IRB of Pepperdine University were stringently followed.

In this study, every teacher and student at the participating high school was afforded the opportunity to partake in the study. The questioning was nonthreatening. In no way was any respondent treated unfairly. Those participants who took the survey or agreed to be involved in the focus groups were not purposive or self-selected. Although every student and teacher was afforded an equitable opportunity to participate in the research if they agreed to be included, the fact that the research was conducted at only

one school created some bias concerning the selection of students and teachers at that one high school.

Summary

The integration of technology will be largely determined by teachers and students and how they negotiate differing ideas in schools or avoid them in informal settings. The research shows that the diffusion of innovations in the educational setting notoriously takes a long time (Mort, 1953). However, when assisted by awareness, the likelihood of a more rapid diffusion of an innovation is heightened. The following research will address issues related to the current and future use of mobile devices for academic purposes inside the classroom, outside the classroom to support that which was taught in the classroom, and in informal situations (including libraries, museums, and other locations where learning may or may not have been planned) where intentional or unintentional learning might occur. Through a survey instrument, data were collected and analyzed to determine tendencies among high school students and teachers who use mobile devices for learning purposes (see Appendices G and H for surveys). Students and teachers who wished to be included in further research had the opportunity to be included in small focus groups (see Appendix I).

For purposes of this study, the mobile devices addressed were portable, handheld devices such as: iPods, mp3 players, PDAs, e-book readers, smartphones, and laptops/tablet PCs, most of which are capable of browsing the Internet and/or sending and receiving text messages or emails. Data were gathered and analyzed through surveys and focus groups to measure (a) the manner in which and the extent to which high school students are using mobile devices, (b) the manner in which and the extent to which high

school teachers are using mobile devices, and (c) the attitudes and perceptions of high school students and high school teachers when it comes to using mobile devices to help support the learning environment or to create additional learning situations that either complement classroom instruction or become intentional or unintentional learning at anytime and anyplace beyond the classroom walls.

A nonexperimental exploratory approach was used to represent the information gathered through the surveys and focus groups in response to the research questions. The high school students and teachers who were included in the study came from one Southern California high school with a population of approximately 2,400 students and 100 teachers. The data may be significant to policymakers, school districts, mobile game and application developers, as well as computer programmers and designers. By investigating the manners in which these mobile technologies are being used by high school students and teachers and how students and teachers perceive the future with these technologies, policymakers, school districts, and game and application designers/developers may gain a clearer understanding of the motivational factors that drive high school students to create learning for themselves anytime and anyplace. The principal findings of this research are included in Chapter 4.

Chapter 4: Results

The purpose of this study was to compare the perceptions and attitudes of high school students versus their teachers regarding the current and future uses of mobile devices for learning. The qualitative data from an online survey (108 students and 50 teachers) and quantitative data from two separate focus groups of students only and teachers only from a traditional Southern California high school (2,400 students and 100 teachers) were used to address the following three research questions:

1. In what ways are students currently using mobile devices for learning inside and outside of the classroom? How do students perceive the future use of mobile devices as tools for learning?
2. In what ways are teachers currently using mobile devices with their students inside and outside of the classroom? How do teachers perceive the future of mobile devices as tools for learning?
3. Do high school students and high school teachers have similar or different perceptions and attitudes regarding the best practices and acceptable uses of mobile devices as learning tools now and in the future?

Organization of the Chapter

The results are organized by research question. The first research question pertains to the attitudes and perceptions of high school students; therefore, the results of the Likert-style student survey questions will be presented first. An analysis of the Likert-style survey responses by teachers, the open-ended teacher responses, and the responses from the teacher focus group will follow. The third and final section, in response to the third research question, will compare the attitudes and perceptions of students versus

their teachers when it comes to the current and future use of mobile devices in high school classrooms, citing any similarities or differences that were evident in the responses.

Overview

The data collection process for this study was conducted in two phases. The first phase of the data collection involved two separate, but similar, online surveys that were taken by high school students and high school teachers at one Southern California high school in August 2011. The surveys were designed to collect both quantitative and qualitative data. Although a preliminary set of questions were already created for the second phase of the data collection (the focus group), the information gathered during the initial phase of research (the survey) was used to refine some of the final focus group questions. Specific modification to the word choice occurred for those focus group questions that appeared to not provide enough direction to the participants. For instance, the first question initially read, "How do you feel about the future of mobile devices in the classroom?" After consideration of the ambiguity of the question, the question was reworded as, "As mobile devices become more accessible to students and as the devices become more useful tools for learning, what are your thoughts on mobile devices entering high school classrooms in the near future?"

The data collected in the second phase of the research were entirely qualitative in nature, transcribed from audio recordings. The data for this phase came directly from the focus group transcriptions by lifting themes from the audio transcripts at the conclusion of the focus group sessions. The results of the survey responses and the focus group responses were coded so that themes could be extracted and then analyzed by specific

theme. By breaking the data into themes, the researcher could more easily identify the similarities and differences in the perceptions of teachers and students.

The questions posed to teachers and students in their respective focus groups and on the open ended questions of the survey were identical in nature. The Likert-style items on both the teacher and student surveys differed slightly to represent the point of view of the teacher or student. For example, Item 21 on the teacher survey read, "If mobile devices were permitted in school, students in my classes would engage in planned activities that involve the use of these devices to solve real-world problems or issues." Meanwhile, the same item on the student survey read, "If mobile devices were permitted in school, I would use them to engage in learning activities to solve real-world problems or issues." See Appendices C, D, and E for each survey in its entirety and the list of focus group questions with both groups. For a graphical representation of each individual survey question summarized in this chapter, see Appendix M.

The survey was emailed to approximately 1,400 parents of students attending the subject high school. A total of 106 students completed the online survey for an 8% overall response rate. The results of the survey were analyzed using frequency distributions and cross-tabulation. The information gathered from the first 30 questions on the survey measured three areas: (a) demographic information and typical usage patterns (questions 1 through 9), (b) current use of mobile learning in classes at school (questions 10 through 20), and (c) the future of mobile devices for learning in schools (questions 21 through 30).

RQ 1: Student Use of Mobile Devices Inside and Outside of the Classroom

Quantitative student survey responses. There were a total of 35 questions on the online student survey (see Appendix H) of which 30 were quantitative in nature. The first series of questions requested demographic information, including gender, nationality, grade level, and grade point average (GPA). These first series of questions also asked students about their typical usage of mobile technologies in general, which mobile devices they currently own, and which devices, if any, they use for learning purposes.

Demographic Information

A total of 106 students participated in the online survey. Of these 106 students, 58 students were female (55%) and 48 students were male (45%). Overall, the school is composed of 48% females and 52% males.

The average grade point average (GPA) of the students who responded to the survey was 3.29. Table 1 shows the distribution of the 105 responses to the GPA question and a comparison to the overall average GPA of students at the subject high school.

Table 1

Student Participant GPA Versus School-Wide Average GPA

GPA	Student Participants (%)	School Averages (%)
4.0 or above	27.6	7.2
3.5 to 3.9	43.8	37.8
2.5 to 3.4	22.9	34.1
1.5 to 2.4	3.8	15.3
1.4 or below	1.9	5.6

A total of 22 freshmen (21%), 42 sophomores (40%), 20 juniors (19%), and 21 seniors (20%) took the survey from the traditional high school. The school is naturally comprised of 24% freshmen, 26% sophomore, 25% juniors, and 26% seniors.

The nationalities of the students who took the survey are illustrated in Table 2.

Table 2

Nationalities of Student Participants Versus Actual School Population

Nationality	Surveyed (%)	Actual (%)
African American	2.9	2.0
Asian	2.9	6.0
Caucasian/White	70.5	63.0
Filipino/Pacific Islander	8.6	1.0
Hispanic	7.6	26.0
Other	6.7	2.0
Decline to state	1.0	2.0

Computers/Vocational Education was the favorite subject of two students (1.9%), English was the favorite subject of 11 students (10.5%), Mathematics was the favorite subject of 28 respondents (27%), Fine/Performing Arts was favored by 18 students (17%), 16 students (15%) enjoyed History/Social Science best, eight students (8%) favored Physical Education, 17 students (16%) liked Science best, whereas five students (5%) enjoyed a subject other than those listed.

Typical Usage Patterns

Students who took the survey were asked about their comfort level with technology. Students could respond five ways to this question regarding comfort level with technology: (a) If you give me instructions, I am still unable to figure it out; (b) I am okay, but often ask for assistance; (c) I can get by and rarely ask for assistance; (d) I am able to work independently and can usually figure problems out on my own; and last, (e)

I am very proficient, so much so that others often seek my advice. Table 3 shows the results of the student responses regarding comfort level with technology.

Table 3

Comfort Level With Technology of Student Survey Participants

Categories of Comfort	Students (%)
If you give me instructions, I am still unable to figure it out.	0.9
I am okay, but often ask for assistance.	8.5
I can get by and rarely ask for assistance.	16.0
I am able to work independently and can usually figure problems out on my own.	48.1
I am very proficient, so much so that others often seek my advice.	26.4

The next three survey items asked students: (a) which mobile devices (choices: cell phone, mp3 player, e-book reader, PDA, laptop computer, tablet computer, or slate) they had operated more than one time; (b) which mobile devices they currently own; and (c) which mobile devices they use for learning or for creating learning opportunities. Table 4 shows a more detailed representation of the student ownership rates and usage of mobile devices.

Table 4

Student Mobile Device Usage, Ownership, and Uses for Learning

Mobile Device	Cell Phone or Smartphone (%)	mp3 Player (%)	PDA (%)	e-book Reader (%)	Laptop (%)	Tablet PC (including iPad or XOOM; %)	None (%)
Used by Students	100	97.2	21.7	27.4	100	53.8	0
Owned by Students	99.1	93.4	3.8	7.5	77.4	14.2	0
Used by Students For Learning Purposes	65.4	35.6	1	6.7	85.6	11.5	4.8

Of even greater importance to this study was the third question in this sequence of questioning, also displayed in Table 4, which asked students which mobile device(s), if any, they use for learning purposes. The responses suggest that every student has used a laptop or cell phone and most have used an mp3 player at least one time in the past. Student ownership of these devices is also extremely high, especially the ownership of cell phones, mp3 players, and laptops. Far fewer students, however, are using cell phones, mp3 players, and/or laptops for learning purposes.

Current Use of Mobile Learning in Classes at School

Questions 10 through 20 on the student survey asked students about their current use of mobile technologies in their classes at school. According to the results of survey items 10, 11, and 17, a majority of students are not using mobile devices for learning purposes such as: (a) solving real-world problems in the classroom (57.5%), (b) studying classroom content while in school (77.5%), and/or (c) sparking their creativity in the classroom (85%). Figure 1 illustrates the responses to these three survey items regarding student use of mobile devices for learning in school.

Meanwhile, students are showing even greater use of mobile devices outside of the classroom for reasons other than communication. According to the student responses, large percentages of students are using these devices outside of the classroom to (a) research classroom content (69%), (b) collaborate and communicate with others (93%), (c) learn and spark their own creativity (85.5%), and/or (d) engage in collaborative problem-solving opportunities (69%). See Figure 2 for a visual representation of this data on student use of mobile devices outside of school.

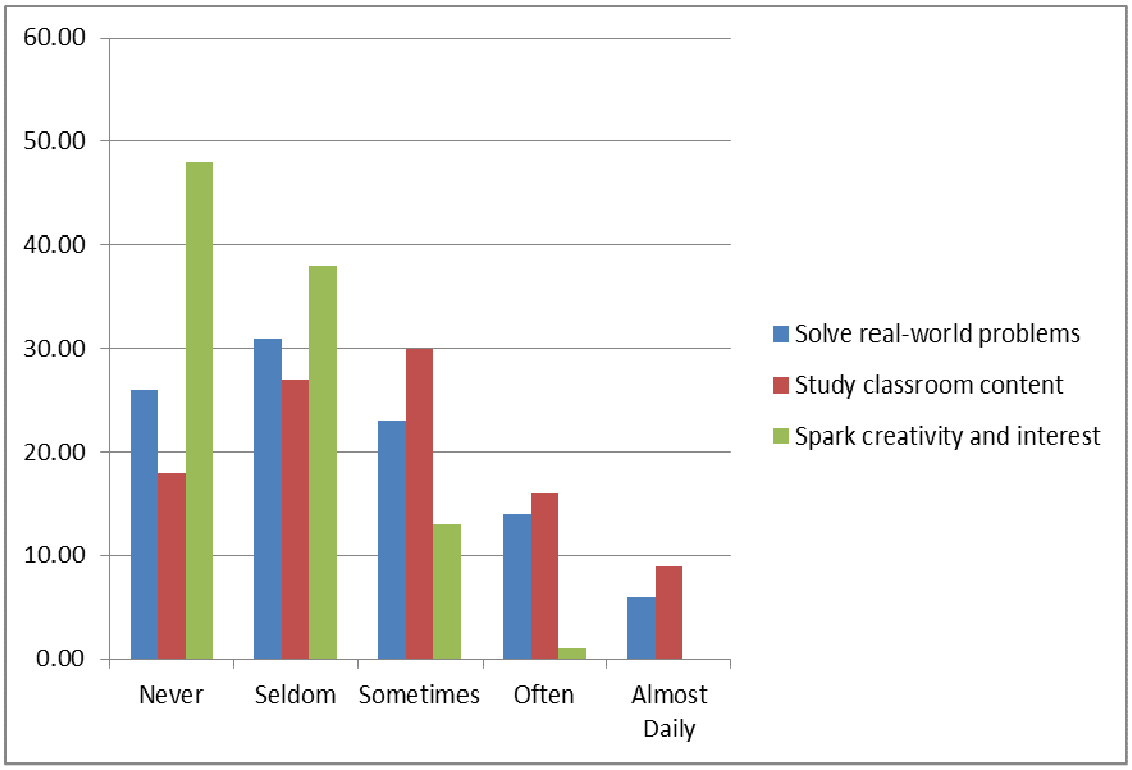

Figure 1. How students are currently using mobile devices in school (%)

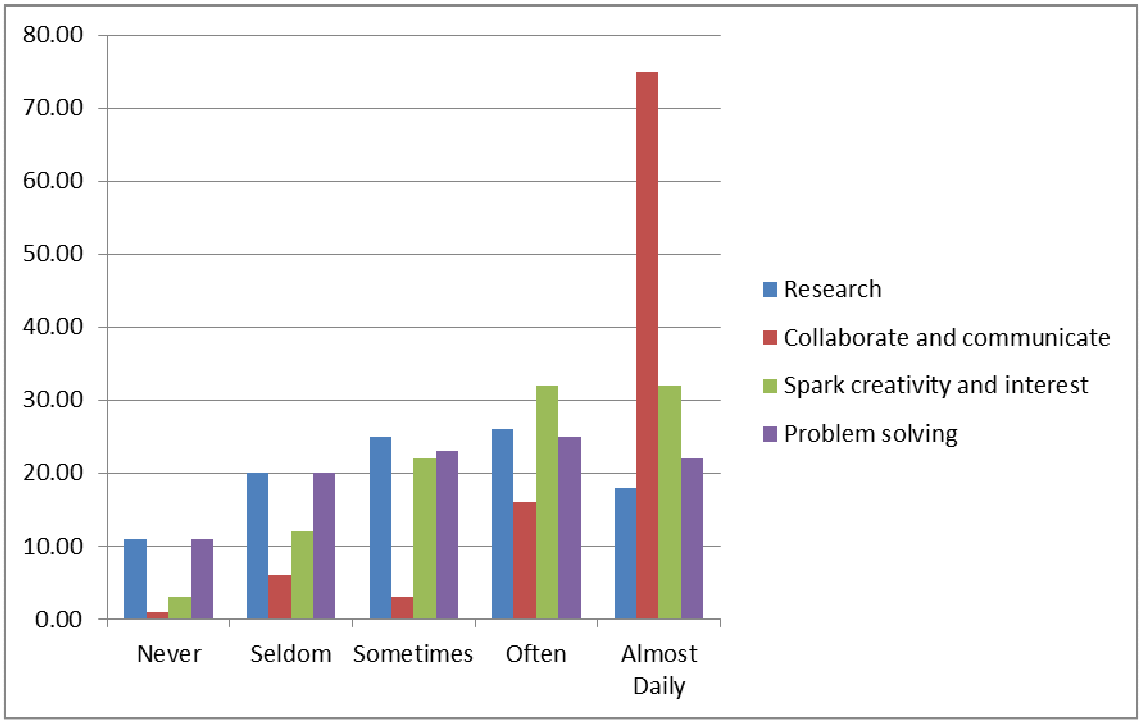

Figure 2. How students are using mobile devices for learning outside school (%)

When students answered questions concerning the current role of the teacher in the process of allowing students to use mobile devices in school, the responses were quite negative. According to survey Items 14, 16, and 20, a large number of students feel their teachers are (a) prohibiting the use of mobile devices in the classroom (86%), (b) not promoting or monitoring the ethical use of mobile devices in their classrooms (48%), and (c) not modeling and facilitating the effective use of current and emerging mobile devices, applications, and programs to support teaching and learning in their classrooms (57%). Figure 3 illustrates how students perceive their teachers' use of mobile devices in the classroom.

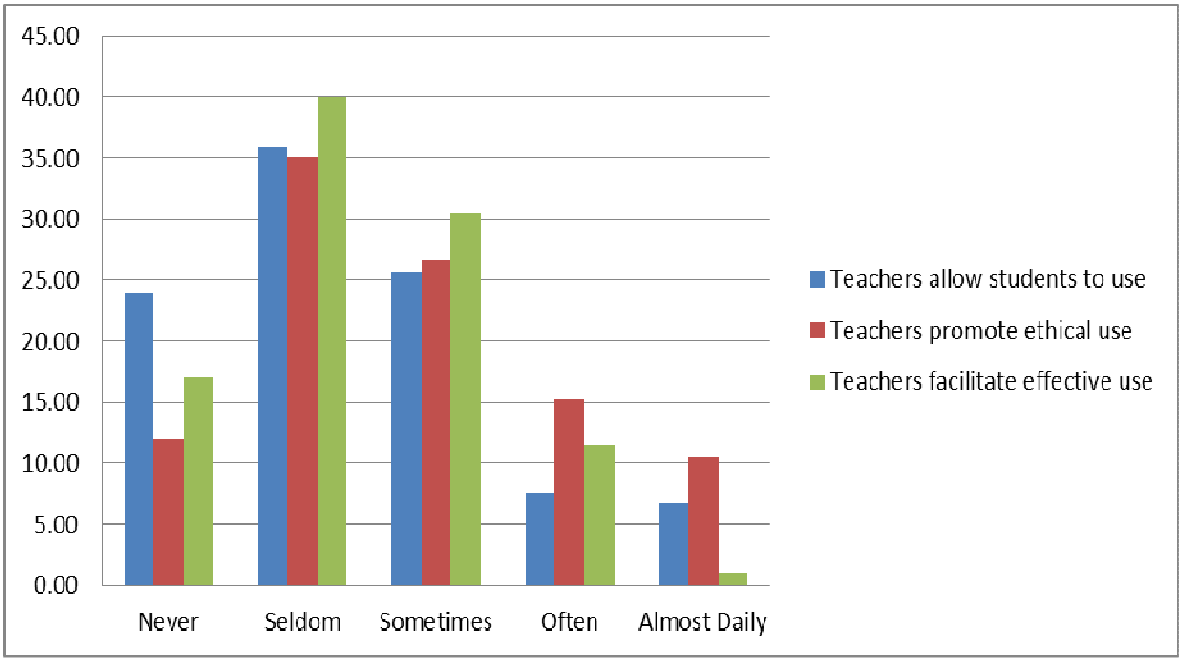

Figure 3. How students perceive their teachers' use of mobile devices in the classroom (%)

Future of Mobile Devices for Learning in Schools

Items 21 through 30 on the student survey posed questions pertaining to the future use of mobile devices by students for learning in schools. Within this range of survey items, four particular items (21, 22, 24, and 28) related to the manners in which mobile devices may be used by students in schools to support learning. According to the results

of the survey, a large percentage of students who participated in the survey would in fact use mobile devices for the following reasons if they were permitted in schools: (a) to solve or investigate problems (94%), (b) to supplement or enrich the content learned in class (86.5%), (c) to conduct research on classroom topics (92%), and/or d) to promote or spark creativity (92%).

Students were also asked to respond to three survey items (27, 29, and 30) regarding the role of the teacher in the process of allowing mobile devices to become effective learning tools in high schools. As a result of mobile devices becoming permissible in schools, students were asked to respond to questions to determine whether they felt that teachers would (a) promote and monitor the ethical use of mobile devices in the classroom (89.5%), (b) be more willing to model and facilitate the effective use of mobile device in schools (92%), and (c) create lessons that involved the use of mobile devices to spark creativity (91%). The favorable responses of the students indicate that students feel that the majority of their teachers would promote the use of mobile devices if they were allowed in school.

Summary of Student Responses

There were 106 students from the subject high school who took the online survey based on mobile learning. Of these 106 students, 45% were male and 55% were female. Of the students who took the survey, 70% were Caucasian, and 40% of those taking the survey in the traditional 9-12 high school were sophomores. The technological capabilities of 48% of those students taking the survey were Category 4 (able to work independently and usually can figure out problems on their own). Every student who took the survey had operated both a laptop and a cell phone or smartphone, whereas 97% of

those who were surveyed had used an mp3 player (such as an iPod). Students are also using these mobile devices for learning purposes, as 85% of students claimed to have used laptops to assist in their learning and 65% had engaged in some type of learning activity via a cell phone or smartphone.

Of those students surveyed, 54% are using mobile devices to study actual classroom content and approximately 69% of students are using their mobile devices for research purposes sometimes or even more frequently. In school, only 40% of teachers are occasionally allowing students to engage in mobile learning activities. As collaborative learning tools, 75% of students are taking advantage of mobile devices, yet according to the student survey results, only 14% of the teachers at the high school are encouraging students to use the devices to learn.

If allowed in schools, only 5% of students feel that they would seldom or never use mobile devices to supplement their learning. Of the students who were surveyed, 85% feel that their teachers would not regularly use mobile devices in their classrooms for teaching even if they were allowed in schools, even though more than 92% of students claim that they would use mobile devices for research purposes. Additionally, 88% of students suggested they would be comfortable using mobile devices in class, whereas more than 92% of the students in the survey see the use of mobile devices as a great tool to promote creativity and innovative thought. Overall, approximately 77% of students were in favor of using mobile devices in school compared to 15% of students who were against the concept of mobile devices in the classroom.

Regarding the potential future uses of mobile technologies in schools, 28% of students who were surveyed feel that mobile devices help foster a more fun and inviting

learning environment, 24% agree that the most practical use of mobile devices is the ability of the devices to provide instant access to information, and 17% of students suggest that the ubiquitous presence of mobile devices can be their biggest strength. The most common use of mobile devices for students, according to 72% of the students who were surveyed, was to facilitate research and to provide instant access to information.

The results of the survey clearly show that students are very comfortable with the use of mobile devices for social interaction and are also comfortable using the devices for learning opportunities. Students are under the impression, however, that their teachers' nonuse of the devices may influence the future potential for integration of mobile devices into regular classroom learning. On the other hand, very few students (less than 15%) felt that they would never use mobile devices in the future for learning.

RQ 2: Teacher Use of Mobile Devices Inside and Outside of the Classroom

Quantitative teacher survey responses. There were also a total of 35 questions on the online teacher survey (Appendix G), of which 30 were quantitative in nature. The first series of questions on the teacher survey asked for demographic information, including gender, nationality, age, number of years teaching, and subjects taught. These first series of questions also asked teachers about their typical personal and professional usage of mobile technologies in general, which mobile devices they currently own, and which devices, if any, they use for learning purposes. The survey link was emailed to all 98 teachers who worked at the subject high school. A total of 50 teachers completed the online survey for a 51% overall response rate. The results of the survey were analyzed using frequency distributions and cross-tabulation. The information gathered from the first 30 questions on the survey measured three areas: (a) demographic information and

typical technology usage patterns (questions 1 through 9), (b) current use of mobile devices for learning in classes at school (questions 10 through 20), and (c) the future of mobile devices for learning in schools (questions 21 through 30).

Demographic Information

A total of 50 teachers participated in the online survey. Of these 50 teachers, 32 teachers were female (64%) and 18 teachers were male (36%). Of the 100 teachers at the subject high school, 60% are female and 40% are male.

The median age range of the teachers who responded to the survey was 41 to 50, and the mode of the responses was the 31 to 40 age range. The overall breakdown of the ages of the teachers who participated in the research is included in Table 5.

Table 5

Ages of Teachers Who Participated in the Study

Age Range (Years)	Teachers (%)
20 to 30	12
31 to 40	32
41 to 50	30
51 to 60	16
61 to 70	6
70 and older	4

The number of years that each teacher who participated in the survey has spent working in the field of education was most commonly 6 to 10 years, selected by 17 teachers (34%) who responded to the survey. Teachers who have been in education from 11 to 15 years represent the median of the data and were the second most prevalent group, with 10 teachers (20%) selecting this range. Both the 0 to 5 years teaching and the 16 to 20 years teaching categories were selected by five teachers (10%) of the teachers who participated in the survey. The teachers who have spent 20 to 25 years in education

accounted for 12% of the overall responses, whereas seven teachers who have been involved in education for 25 years or longer took the survey (14% of the total). The actual number of years worked by the teaching staff at the high school is very consistent with the overall rate of those who participated in the study.

The nationalities of the teachers who took the survey are included in Table 6.

Table 6

Nationalities of Teacher Participants Versus Actual School Population

Nationality	Teacher Participants (%)	Actual School Populations (%)
Caucasian/White	84.0	93.9
Filipino/Pacific Islander	2.0	< 1
Hispanic	4.0	5.1
Other	2.0	1.0
Decline to State	8.0	0

The English Department was the most represented subject, with 15 teachers (30%). Of the teachers taking the survey, 11 (22%) reported History/Social Science as their primary subject taught, Mathematics was taught by eight respondents (16%), four teachers (8%) were from the Science Department, Computers/Vocational Education was taught by four teachers (8%), Fine/Performing Arts was taught by two teachers (4%), one teacher (2%) was a Physical Education instructor, and five teachers (10%) taught a subject other than those listed.

Typical Usage Patterns

Teachers who took the survey were also asked about their comfort level with technology. Teachers were able to respond five ways to this question regarding their level of comfort with technology: (a) If you give me instructions I am still unable to figure it out; (b) I am okay, but often ask for assistance; (c) I can get by and rarely ask for

assistance; (d) I am able to work independently and can usually figure problems out on my own; and last; (e) I am very proficient, so much so that others often seek my advice. Table 7 shows the teacher responses pertaining to comfort level with technology.

Table 7

Comfort Level With Technology of Teacher Survey Participants

Categories of Comfort	Teachers (%)
If you give me instructions, I am still unable to figure it out.	0
I am okay, but often ask for assistance.	18
I can get by and rarely ask for assistance.	28
I am able to work independently and can usually figure problems out on my own.	36
I am very proficient, so much so that others often seek my advice.	18

The next three survey items asked teachers (a) which mobile devices (choices: cell phone, mp3 player, e-book reader, PDA, laptop computer, tablet computer, or slate) they had operated more than one time; (b) which mobile devices they currently own; and (c) which mobile devices they use to create lesson plans or to create their own daily learning opportunities. Table 8 shows a more detailed representation of teacher ownership rates and usage of mobile devices.

Of even greater importance to this study, however, was the third question in this sequence of questioning, which asked teachers which mobile device(s), if any, they use for creating lesson plans and/or interacting with their students. This information is also included in Table 8. The responses suggest that most teachers have used a laptop or cell phone and many have also used an mp3 player at least one time in the past. Teacher ownership of these devices is relatively low compared to the student ownership of the devices; however, a large number of teachers own cell phones and/or laptop computers. Even more alarming, whereas 67.3% of teachers are using laptop computers for the

creation of classroom learning opportunities for their students, a fewer amount of teachers than students are using cell phones or mp3 players for learning purposes.

Table 8

Mobile Device Usage, Ownership, and Uses by Teachers in Their Classrooms

Mobile Device	Cell Phone or Smartphone (%)	mp3 Player (%)	PDA (%)	e-book Reader (%)	Laptop (%)	Tablet PC (including iPad or XOOM; %)	None (%)
Used by Teachers	92	70	30	32	84	28	6
Owned by Teachers	94	70	14	28	80	16	4
Used by Teachers to Create Learning Opportunities	22.4	28.6	2	2	67.3	14.3	22.4

Current Use of Mobile Learning in Classes at School

Questions 10 through 20 on the teacher survey asked teachers about the current use of mobile technologies in the classes they teach at school. According to the results of Items 10, 11, and 17, which are illustrated in Figure 4, a majority of teachers are not using mobile devices with their students in class to (a) solve real-world problems in the classroom (78%), (b) help students study specific classroom content while at school (68%), and/or (c) spark the creativity of students in class (62%). When considering the data, it should be noted that the subject high school does have a policy that prohibits the use of mobile devices during instructional time.

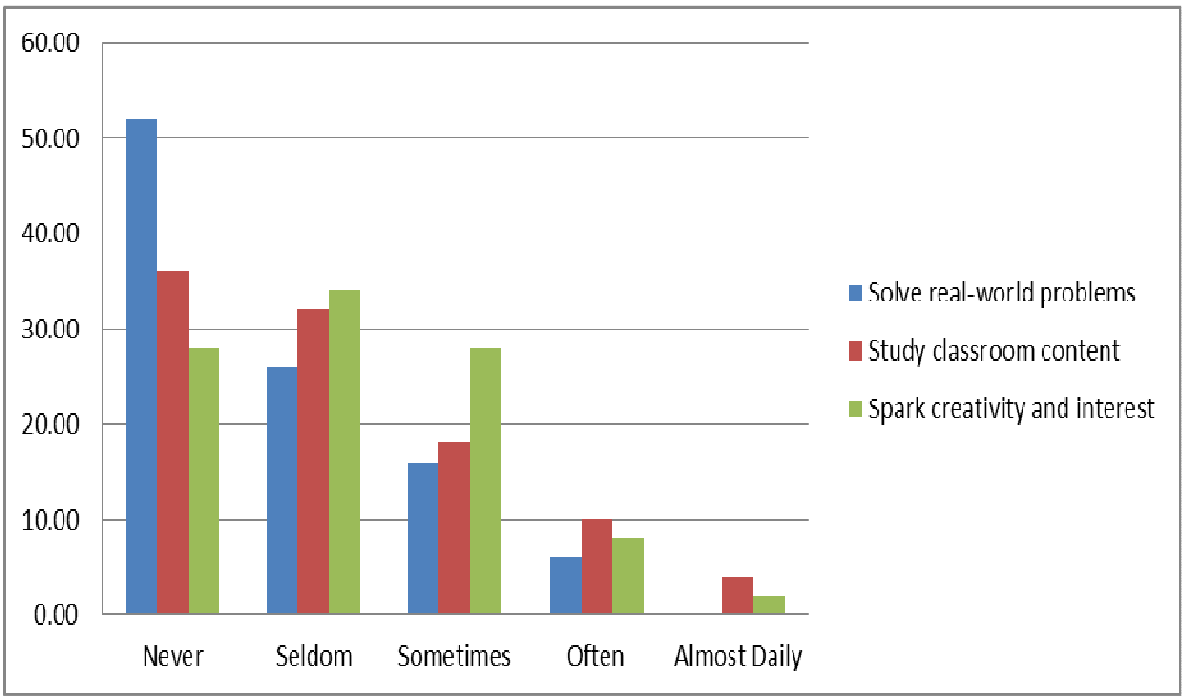

Figure 4. Teacher use of mobile devices with students in school (%)

The teacher responses to those survey items that pertained to the current use of mobile devices by their students outside of the classroom (Items 13, 15, 18, and 19) were also rather negative. Of particular note on these next few survey items, those students who were surveyed use mobile devices much more frequently to enhance their learning experiences than their teachers know. According to the teacher responses, teachers feel that students are in fact using mobile devices outside of the classroom, but not as frequently as students see themselves using the devices to (a) research classroom content (36%), (b) collaborate and communicate with others (84%), (c) learn and spark their own creativity (44%), and/or (d) engage in collaborative problem-solving opportunities (58%). Figure 5 displays teacher perceptions of the ways that their students are using mobile technologies outside the classroom for learning.

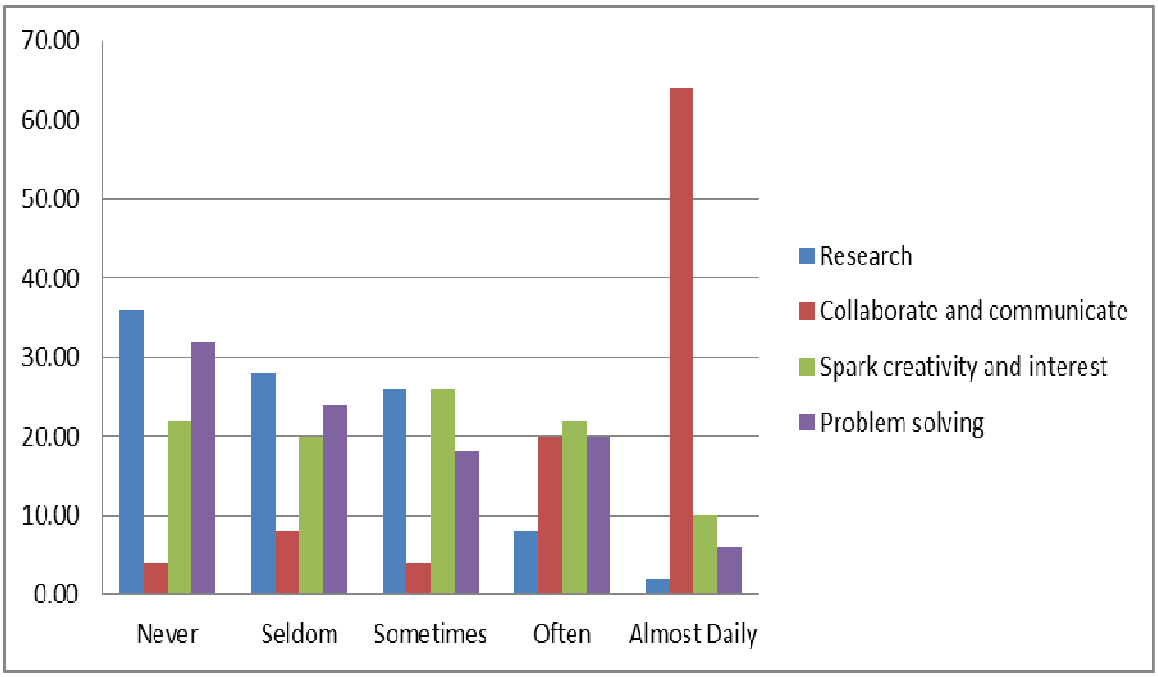

Figure 5. Teacher perceptions regarding their students' use of mobile devices for learning (%)

When teachers answered questions concerning their current role in allowing students to use mobile devices in school, the responses remained quite negative. According to Items 14, 16, and 20, a large number of the teacher respondents feel that for the most part they are (a) prohibiting the use of mobile devices in their classrooms (90%), (b) not promoting or monitoring the ethical use of mobile devices in their classrooms (54%), and (c) not modeling and facilitating the effective use of current and emerging mobile devices, applications, and programs to support teaching and learning in their classrooms (84%). Figure 5 clearly illustrates that teachers are extremely aware of the use of mobile devices by their students for collaboration and communication on a daily basis, but they are unaware of the frequency by which students are using their mobile devices for research, sparking creativity, and/or problem solving.

Future of Mobile Devices for Learning in Schools

Items 21 through 30 on the survey posed questions pertaining to teachers' perceptions of their students' future use of mobile devices for learning in schools. Within this range of questions, Items 21, 22, 24, and 28 related to the manners in which mobile devices may be used by students in schools to support learning. According to the results of the survey, a large percentage of teachers who participated in the survey felt that students would in fact use mobile devices for the following reasons if they were permitted in schools: (a) to solve or investigate problems (70%), (b) to supplement or enrich the content learned in class (76%), (c) to conduct research on classroom topics (82%), and/or (d) to promote or spark creativity (78%).

Teachers also responded to three survey items (27, 29, and 30) regarding the role of the teacher in the process of allowing mobile devices to become effective learning tools in high schools. As a result of mobile devices becoming permissible in schools, teachers were asked to respond to questions to determine whether they felt they would (a) promote and monitor the ethical use of mobile devices in the classroom for students (82%), (b) be more willing to model and facilitate the effective use of mobile device for their students in their classes (84%), and (c) create lessons that involved the use of mobile devices to spark the creativity of students (90%). The favorable responses of the teachers indicate that they would be willing to promote the use of mobile devices if they were allowed in school.

Summary of Teacher Responses

There were 50 teachers from the subject high school who took the online survey based on mobile learning. Of these 50 teachers, 36% were male and 64% were female. Of

the teachers who took the survey, 84% were Caucasian. The 31 to 50 age range was the most commonly selected by teachers on the survey, with 62% of the teachers who responded falling into this categorical range. Of all the teachers who took the survey, 34% stated that they had been teaching for 6 to 10 years. There were 30% who taught English and another 22% who taught history/social science. The technological capabilities of 36% of those teachers who participated in the survey were Category 4 (able to work independently and usually can figure out problems on their own). Of the teachers who took the survey, 92% have operated a cell phone or smartphone, 84% have tried using a laptop, and 70% expressed familiarity with an mp3 player (such as an iPod). Teachers are also using some of these mobile devices to create lessons. Laptops were the most commonly used device among teachers, with 67% of teachers stating they had used a laptop to learn or to produce instructional materials, whereas 22% have used a cell phone or smartphone to do the same and 22% have used none of these devices for either purpose.

Of those teachers surveyed, 78% are not using mobile devices in their classrooms with students on a regular basis and 64% of teachers are unaware that students are occasionally using their mobile devices for research purposes. In school, 40% of teachers are occasionally allowing students to engage in mobile learning activities. As collaborative learning tools, teachers feel that 84% of students are taking advantage of mobile devices, which is fairly consistent with the results on the same question asked of students. According to the student survey results, only 14% of the teachers at the school are encouraging students to use the devices to learn, but 38% of teachers feel that they are in fact encouraging the use of mobile devices with their students.

If allowed in schools, 70% of teachers feel that their students would frequently engage in planned activities that involve the use of mobile devices, whereas 76% of teachers would encourage the use of mobile devices with their students as a supplement to what they were learning in class. Of the teachers, 84% feel that students would use the devices for research purposes if they were allowed in schools, compared to the 92% of students who claim that they would use mobile devices for research purposes. Even though 88% of students suggested they would be comfortable using mobile devices in class, 72% of teachers would still feel comfortable allowing students to use their mobile devices in class. Overall, 78% of the teachers in the survey see the use of mobile devices as a great tool to promote creativity and innovative thought in the classroom, compared to 90% of teachers who feel that students should also be using the mobile devices outside the classroom to promote creativity and innovative thinking. Approximately 63% of teaches are in favor of using mobile devices in school compared to the 20% of teachers who are against the use of mobile devices in schools.

Regarding the potential future uses of mobile technologies in schools, 37% of teachers who were surveyed feel that mobile devices can help teachers create course materials or lesson plan; 33% agree that the most practical use of mobile devices is the ability of the devices to provide instant access to information; 15% of teachers would like more instruction, support, staff development, and/or teacher tutorials and training to assist with a smoother implementation; and 20% of teachers claim that they will never use mobile devices for educational purposes. The most practical future uses of mobile devices, according to the teachers who were surveyed, are digital textbooks (32%),

instant access to information that the devices can provide users (32%), and use of the devices as research tools (17%).

The results of the survey show that teachers are not as effective users of technologies as their students. Furthermore, teachers own fewer mobile devices than students and are also less familiar with the use of mobile devices than their students. Collaboration and communication was the area that most teachers felt that their students used their mobile devices for on an almost daily basis. However, despite students' claims to frequently use mobile devices for other reasons, teachers are very unaware of the frequency that students use mobile devices for reasons beyond social interaction, such as research, problem solving, and sparking creativity. Very few teachers are currently encouraging the use of mobile devices in their classrooms at school, but a high percentage (more than 76%) claim that they would encourage their students to use the devices if they were permissible in school. For the most part, teachers at the subject school were very open to implementing the use of mobile devices in the classroom, as 63% were completely in favor of allowing the devices compared to only 20% of teachers who opposed their use.

RQ 3: Students Versus Teachers–Current and Future Uses of Mobile Devices Inside and Outside of the Classroom

Comparison of Teacher Versus Student Survey Responses

As indicated earlier, the information gathered from the first 30 questions on either survey (teacher or student) measured three areas: (a) demographic information and typical usage patterns (questions 1 through 9); (b) current use of mobile learning in classes at school (questions 10 through 20); and (c) the future of mobile devices for learning in schools (questions 21 through 30). This section will include a comparison of

the information gathered from the student and teacher surveys to address the third research question. The main focus will be on comparing the student survey responses with the teacher survey responses on Items 10 through 30, focusing on those questions from the survey that showed the most similarities between the students' and teachers' responses and those survey items that showed the most discrepancy between how students answered and how teachers answered various survey items. Each Likert-style survey question is comparatively analyzed using the following null hypothesis: The attitudes and perceptions of high school students versus teachers are different regarding the current and/or future use of mobile devices for learning.

Meanwhile, the last 5 survey items were open-ended questions that were designed to measure student attitudes and perceptions toward mobile learning. These items were designed so that students and teachers could detail their responses more thoroughly than through the prior series of multiple-choice and Likert-style items. Each item was broken down into a group of categories or themes, and then the responses were coded and tallied for an accurate measure of frequency. The coded and categorized data were then reviewed by a second coder to confirm the accuracy of the initial analysis. Creswell (1998) suggests a three-stage process for analyzing open-ended data, which includes: reading through the responses, creating summaries, and then sorting the data into categories or themes. The following is a comparative analysis of the survey results separated into two subdivisions: (a) current uses of mobile learning in school and (b) future uses of mobile learning in school.

Current Use of Mobile Learning in Classes at School

Similar responses. The responses to Items 10 through 20 on both the teacher and student surveys that were most similar were those responses to survey Items: 12, 14, and 20. A set of data that represents the responses to these three survey items can be viewed in Table 9. Student Item 12 asked students whether they only use mobile devices in the classroom and not their teachers, whereas teacher Item 12 asked teachers whether they are the only ones who use mobile devices in their classrooms, but not their students. The mean, or average, of the student survey responses was 2.41, with a standard deviation of 1.29 and a variance of 1.66. The standard deviation represents the overall spread of the data on average from all the collected observations taken one at a time. Therefore, a standard deviation of 1.29 indicates that 68% of all responses by students on this question fell between 1.29 units above or below the mean (between 1.12 and 3.7).

The mean of the teacher responses to this question was 2.37, with a standard deviation of 1.35 and a variance 1.82. There was an aggregate standard deviation of 1.31 with 151 degrees of freedom. The aggregate data are a combination of student and teacher averages using all the responses gathered for this question. Because there were 152 total respondents, including teachers and students on this question, the degrees of freedom was calculated by taking the total number of responses on any given survey item and subtracting one from the total (i.e., 152 – 1 = 151). After conducting a two-sample heteroscedastic *t* test comparing the responses given by the teachers versus the students, the results show a *t* value of 0.203. A *t* test is used to show major consistencies or discrepancies in the responses to the same or similar question by two different groups. In this study, the *t* tests were used to determine whether students and teachers had similar or

different feelings about the use of mobile devices in schools for learning. The closer a *t* score is to zero, the more consistent the responses are. The probability of the result, assuming the null hypothesis, is 0.84. The probability of the result indicates that there is 84% likelihood that the *t* value is accurate. In this case, because the *t* value is relatively close to zero, the indication is that the student and teacher responses, although from two separate populations with unequal variances, were almost identical in nature. Therefore, the null hypothesis should be rejected. The rejection of the null hypothesis simply means that the original hypothesis, which states that students and teachers have different perceptions of mobile devices use in schools, should be rejected. In other words, the *t* test shows that the responses to this survey item were very similar and suggest that teachers and students have similar perceptions regarding who is using mobile devices in the classroom.

Item 14 also elicited a similar result. This survey item asked students if they are currently permitted to use mobile devices in their classes. The item asked teachers whether they currently allow the use of mobile devices in their classrooms. The mean of Item 14 on the student survey was 2.37, with a standard deviation of 1.13 and a variance of 1.27. The mean of the same survey item on the teacher survey was 2.30, with a standard deviation of 1.09 and a variance of 1.19. Together, the two groups (students and teachers) had a standard deviation of 1.12 with 153 degrees of freedom. The result of a two-sample *t* test with unequal variances was once again performed for this question, which resulted in a *t* value of 0.372. The probability of the result, assuming the null hypothesis, is 0.71. A *t* value that is somewhat close to zero would indicate that the means of the student and teacher responses were very similar; thus, the null hypothesis

should once again be rejected. Therefore, students and teachers have similar views of the permissibility of mobile devices while in their classes at the subject high school.

Table 9

Similar Student Versus Teacher Responses to Likert-Style Survey Items

	Item 12		Item 14		Item 20	
	Student	Teacher	Student	Teacher	Student	Teacher
Mean	2.41	2.37	2.37	2.30	2.39	2.28
Standard Deviation	1.29	1.35	1.13	1.09	0.94	1.13
Variance	1.66	1.82	1.27	1.19	0.87	1.27
p value (α)	.05		.05		.05	
f value	0.69		0.81		0.12	
t test (two sample)	0.203		0.372		0.643	
Probability (*P*)	0.84		0.71		0.52	

The final Likert-scale question that elicited similar student and teacher responses was Item 20. Item 20 asked students whether their teachers effectively modeled and facilitated the appropriate use of mobile devices in their classes. The question also asked teachers if they engage students in activities in the classroom that would demonstrate the effective and appropriate use of mobile devices in their classrooms. The mean of the student survey item was 2.39, with a standard deviation of 0.94 and a variance of 0.87. Results of the teacher survey indicate that their mean was 2.28, with a standard deviation of 1.13 and a variance of 1.27. After conducting a two-sample *t* test comparing the data from the student responses with the data from the teacher responses, a *t* value of 0.643 was achieved. The probability of the result, assuming the null hypothesis, is 0.52. The two data sets produced a standard deviation of 1.00 with 153 degrees of freedom. Recall that the null hypothesis stated that the attitudes and perceptions of students and teachers would be different. Therefore, the null hypothesis should be rejected, indicating that the responses to this survey item were similar. These results indicate that students and

teachers feel similarly about how often they are engaging in activities in the classroom with the use of mobile devices.

Different responses. The survey items that produced differences when comparing the attitudes and perceptions of students' and teachers' current use of mobile devices for learning within the first set of Likert-scale survey items were Items 13 and 18. Table 10 shows the results of the data analysis in a table format. Item 13 asked students if they frequently used mobile devices to engage in research related to learning, whereas the same question on the teacher survey asked teachers if they felt that their students were in fact using mobile devices frequently for education-related research. The mean student response on this item was 3.19, with a standard deviation of 1.27 and a variance of 1.62. The responses of the teacher survey yielded a mean score of 2.12, with a standard deviation of 1.06 and a variance of 1.13. Based on the discrepancies in the means of the two samples (students and teachers) on the same survey item, a *t* test value of 5.15 was the result. The overall standard deviation of the two samples was 1.21 with 153 degrees of freedom. The high *t* value that resulted on this item suggests that the answers provided by students and teachers on this survey item were dissimilar. Furthermore, the probability that the result occurred by chance is less than .0001, indicating that the null hypothesis may not be rejected. Not rejecting the null hypothesis means that the null hypothesis is being accepted. Based on the responses to this survey item, students and teachers have very different viewpoints regarding how often students are using mobile devices to engage in education-related research.

A similar conclusion to Item 13 was gathered from the responses to Item 18. This item asked students if they use their mobile devices outside of the classroom to learn

and/or spark their own creativity. Teachers were similarly asked if they encourage their students to use their mobile devices outside of school to learn and/or spark their creativity. The mean student response on survey Item 18 was 3.78, with a standard deviation of 1.11 and a variance of 1.22. The teacher responses yielded a mean of 2.78, with a standard deviation of 1.30 and a variance of 1.69. A *t* test was performed to analyze the means of the student and teacher populations resulting in a *t* value of 4.96. The two samples produced a standard deviation of 1.17 with 152 degrees of freedom. Once again, the high *t* value that resulted on this item indicates that the answers provided by students and teachers on this survey item were different. Moreover, the probability that the results of the *t* test occurred by chance is less than .0001, which means that the null hypothesis may not be rejected. This result further confirms a discrepancy between how the students and the teachers perceive the current uses of mobile devices by students outside of the classroom for learning.

Table 10

Different Student Versus Teacher Responses to Likert-Style Survey Items Regarding the Current Use of Mobile Devices for Learning

	Item 13		Item 18	
	Student	Teacher	Student	Teacher
Mean	3.19	2.12	3.78	2.78
Standard Deviation	1.27	1.11	1.11	1.30
Variance	1.62	1.22	1.22	1.69
p value (α)	.05		.05	
f value	.16		.18	
t test (two sample)	5.15		4.96	
Probability (*P*)	<.0001		<.0001	

Open-ended Item 4. Open-ended Item 4 on both the student and teacher surveys asked each group how they would use mobile devices intentionally or unintentionally for learning as technologies continue to advance. Of the 50 teachers to take the survey, 46

teachers responded to this survey item, which represents a 92% response rate for this question. Meanwhile, 93 of the 106 students who took the survey responded to this question, which represents an 88% response rate. The actual question read, "As mobile technologies continue to advance, how are you using or how will you use your own mobile devices (e.g., cell phone, iPod, e-book reader, PDA, tablet PC, laptop) to create intentional (planned) or unintentional (spur of the moment) informal learning opportunities?" Based on the responses to this item, seven themes were created to represent how teachers feel that they will be using mobile devices for their own learning purposes as technologies progressively advance, and seven themes were also created to represent how students feel that they are using or will be using mobile devices in the manners described in the survey question. The themes are illustrated in Figure 6.

According to the chart, students really see themselves using mobile devices for access to information, as collaborative tools, and as homework/study tools. Meanwhile, teachers are aware of their own need for professional training to effectively use the devices with students in the classroom and see the biggest use for the devices in school as aides for planning for lessons. Teachers are in agreement that information access is a valid use for mobile devices, but far fewer teachers feel that information access is as relevant as students suggest. Most students see the current and future use of mobile devices in education as ways to access information, as homework or study tools, and/or as collaborative devices to help them learn. Meanwhile, teachers are more focused on lesson planning, digital textbooks, and the need for further staff development and training to effectively implement the devices into the classroom with students. Figure 6, below, further illustrates these differences in perceptions between teachers and students.

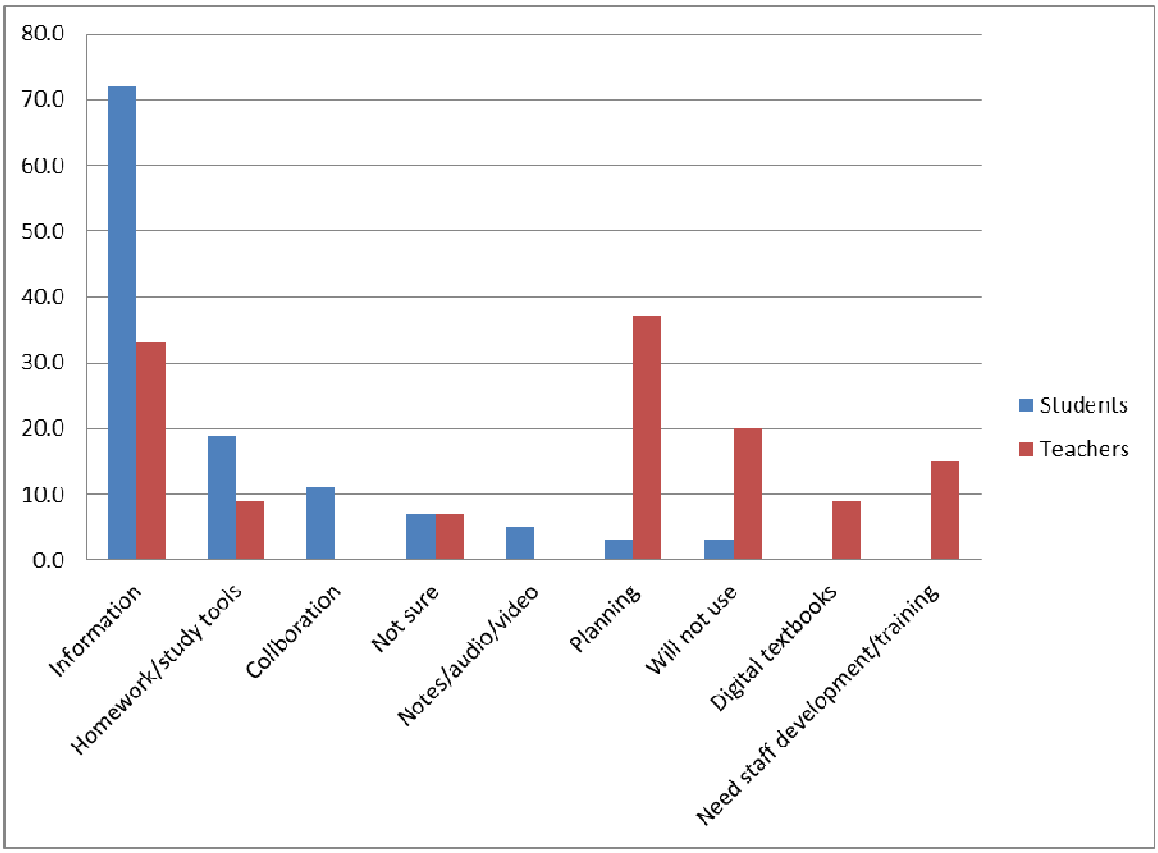

Figure 6. Student versus teacher perceptions regarding intentional or unintentional current or future use of mobile devices for learning in schools (%)

Future of Mobile Devices for Learning in Schools

Similar responses. After conducting the survey and analyzing the results, it can be concluded that none of the results of the questions on the survey that ask students and teachers about the future use of mobile devices in schools (Items 21 through 30) can be deemed similar in nature. Instead, the null hypothesis may be rejected on several of these next 10 survey items, which indicates that students and teachers have quite different attitudes and perceptions regarding the future use of mobile devices in schools according to the responses to the Likert-style survey items.

Different responses. Of the final 10 Likert-style survey items on both the student and teacher surveys, major discrepancies were discovered when comparing the results of the questions. The ensuing paragraphs outline the findings of the 5 survey items that

produced the most diverse responses to these final 10 questions. This set of survey items aimed to measure the differences in attitudes and perceptions of students versus teachers regarding the future uses of mobile devices for learning inside and outside the classroom. The analytical tools used to compare the responses to the student and teacher survey items were mean, standard deviation, and variance, as well as a two-sample *t* test, which produces a *t* value that indicates the distance or difference the mean lies from zero when comparing the data in two sample groups (students and teachers), and finally the probability or likelihood that the difference in the means (*t* value) of both sample groups may have been by chance. The data that were used to draw conclusions on the differences in the attitudes and perceptions of students and teachers regarding the use of mobile devices for learning on these five questions can be found in Table 11 and Table 12.

Survey Item 21 asked students if they would use mobile devices to engage in learning activities to solve real-world problems or issues if the devices were allowed in schools. The same item on the teacher survey asked teachers the frequency by which they would use mobile devices with their students, if permitted in school, to engage in planned learning activities that allow students to solve real-world problems. The mean student response, on a Likert-scale of 1 to 5, was 4.10, with a standard deviation of 0.98 and a variance of 0.95. The mean teacher response was 3.06, with a standard deviation of 1.19 and a variance of 1.40. After running a two-sample (student and teacher) *t* test on this survey item, a *t* value of 5.75 was achieved. The two samples produced a standard deviation of 1.05 with 153 degrees of freedom. The probability that the results of the *t* test occurred by chance is less than .0001. The high *t* value would indicate a large difference in the means of the responses from zero, which would imply that the null

hypothesis may not be rejected. Therefore, this survey item confirms the null hypothesis that students and teachers have different attitudes and perceptions regarding the future use of mobile devices for learning.

The responses to Item 24 also produced results that are consistent with the null hypothesis. This survey item asked students how often they would use mobile devices for research purposes if they were allowed in schools. The question similarly asked teachers how often they felt that their students would be using mobile devices for research purposes. The mean student response to this survey question was 4.05, with a standard deviation of 1.00 and a variance of 1.00. The teacher responses yielded a mean of 3.26, with a standard deviation of 0.94 and a variance of 0.89. The two-sample *t* test resulted in a *t* value of 4.67 and a two-sample standard deviation of 0.982 with 154 degrees of freedom. The probability that the differences that resulted from the two samples occurred by chance was less than .0001. Thus, the null hypothesis may not be rejected, implying that significant discrepancies exist between the responses of students versus teachers regarding the future use of mobile devices for learning in schools.

The next survey item that showed differences between the responses of students and teachers was Item 25, which asked students how comfortable they would be using mobile devices for learning either inside or outside of the classroom. The same item on the teacher survey asked teachers how comfortable they would be allowing students to partake in activities with the use of a mobile device if the use of mobile devices were permitted in school. The mean student response on this item was 4.30, with a standard deviation of 1.00 and a variance of 0.99. The mean teacher response on this same question was 3.34 with a standard deviation of 1.29 and a variance of 1.66. The result of

the two-sample *t* test yielded a *t* value of 5.11, a two-sample standard deviation of 1.10, and included 154 degrees of freedom. The probability of the results, assuming the null hypothesis, is less than .0001, which indicates that the null hypothesis may not be rejected. This result suggests that a significant discrepancy exists between the comfort level of students using and teachers accepting mobile devices as learning tools inside and outside of school.

Table 11

Different Student Versus Teacher Responses to Likert-Style Survey Items Regarding the Potential Future Use of Mobile Devices for Learning

	Item 21		Item 24		Item 25	
	Student	Teacher	Student	Teacher	Student	Teacher
Mean	4.1	3.06	4.05	3.26	4.3	3.24
Standard Deviation	0.98	1.19	1.00	0.94	1.00	1.29
Variance	0.95	1.40	1.00	0.89	0.99	1.66
p value (α)	.05		.05		.05	
f value	0.10		0.67		.03	
t test (two sample)	5.75		4.67		5.11	
Probability (*P*)	<.0001		<.0001		<.0001	

Item 26 also appeared to show some discrepancies between the responses of students versus teachers regarding the use of mobile devices outside of the classroom as collaborative tools, communicative devices, and apparatuses on which to conduct research of personal interest. The student survey item asked the students how often they might use their mobile devices in the manner described, whereas the teacher survey item asked teachers how frequently they feel that they would encourage their students to use such devices outside of the classroom in the manners described. The mean student response was 4.49, with a standard deviation of 0.82 and a variance of 0.67. The mean teacher response was 3.72, with a standard deviation of 1.07 and a variance of 1.14. A two-sample *t* test produced a *t* value of 4.95. The standard deviation of the aggregated

data was 0.907 with 154 degrees of freedom. The probability that the differences in the responses were caused strictly by chance was less than .0001. A high *t* value, coupled with a very low probability of the results being different by chance, indicates that the student and teacher responses on this survey item varied significantly. Therefore, the null hypothesis may not be rejected.

Table 12

Different Student Versus Teacher Responses to Likert-Style Survey Items Regarding the Potential Future Use of Mobile Devices for Learning

	Item 26		Item 28	
	Student	Teacher	Student	Teacher
Mean	4.49	3.72	4.14	3.24
Standard Deviation	0.82	1.07	1.02	1.17
Variance	0.67	1.14	1.04	1.37
p value (α)	.05		.05	
f value	.02		0.69	
t test (two sample)	4.95		4.91	
Probability (*P*)	<.0001		<.0001	

The last survey item that showed differences between student and teacher responses was Item 28. Item 28 asked students if they would enjoy using mobile devices for learning to help promote creativity and innovative thinking. Likewise, the teacher survey item asked teachers whether they felt they would encourage their students to use mobile devices to promote creativity and innovative thought. Student responses to this survey item yielded a mean of 4.14, with a standard deviation of 1.02 and a variance of 1.04. Teacher responses, on the other hand, yielded a mean of 3.24, with a standard deviation of 1.17 and a variance of 1.37. The two-sample *t* test resulted in a *t* value of 4.91. When analyzing the data together, the aggregated standard deviation was 1.07 with 152 degrees of freedom. The probability of the *t* value, assuming the null hypothesis, is less than .0001. The *t* value, therefore, confirms on this survey item that differences do

exist between the perceptions and attitudes of students versus teachers regarding the future uses of mobile devices as learning tools in the educational setting.

Open-ended Question 1. The first open-ended question on both surveys read, "What do you feel are the biggest obstacles and/or challenges that high schools may face in their efforts to implement the use of mobile devices in regular classroom instruction?" There were exactly 100 students who responded to this question out of the 106 students who took the survey, which represents a 94.3% response rate for the question. There were 49 teachers who responded to this question out of the 50 teachers who took the survey, which represents a 98% response rate for the question. The responses by teachers and students were analyzed and categorized into one of seven distinct categories. The seven categories were ultimately formed by manual transcription of the responses by the teacher and student respondents to this survey item numerous times. The responses were then reanalyzed twice after an initial set of 12 categories was created to consolidate the responses into more manageable and meaningful data. Figure 7 shows a comparison of the student and teacher responses to this open-ended question.

Students perceive the biggest obstacle to the implementation of mobile devices into schools as the distractibility that the devices may cause in a classroom environment. Several students suggest that the cost of the devices may be an issue to be considered, as well as the increased opportunities to cheat and the challenges facing teachers to effectively lesson plan. Teachers are in agreement with students when it comes to the obstacles and challenges that students and educators will face, but teachers also voiced their concerns regarding the challenges in monitoring the proper use of mobile devices by students and managing an effective mobile-classroom environment.

As shown in Figure 7, both students and teachers claimed that distractibility and cost are significant obstacles to the integration of mobile technologies into education, but almost twice the percentage of students saw distractibility as a barrier compared to teachers. On the other hand, twice the percentage of teachers feel that cheating will be an obstacle to overcome compared to students. Also, several students cited trust and maturity as barriers, whereas no teachers felt that trust and maturity were significant issues. Meanwhile, teachers claimed that monitoring student use and the resistance by schools and/or districts were noteworthy obstacles, but no students cited these as issues. Teachers were more concerned with issues dealing with the management of a classroom environment and the rules and regulations governing the use of mobile devices, whereas students were more occupied with their personal experiences pertaining to the actual uses of the devices in a classroom environment.

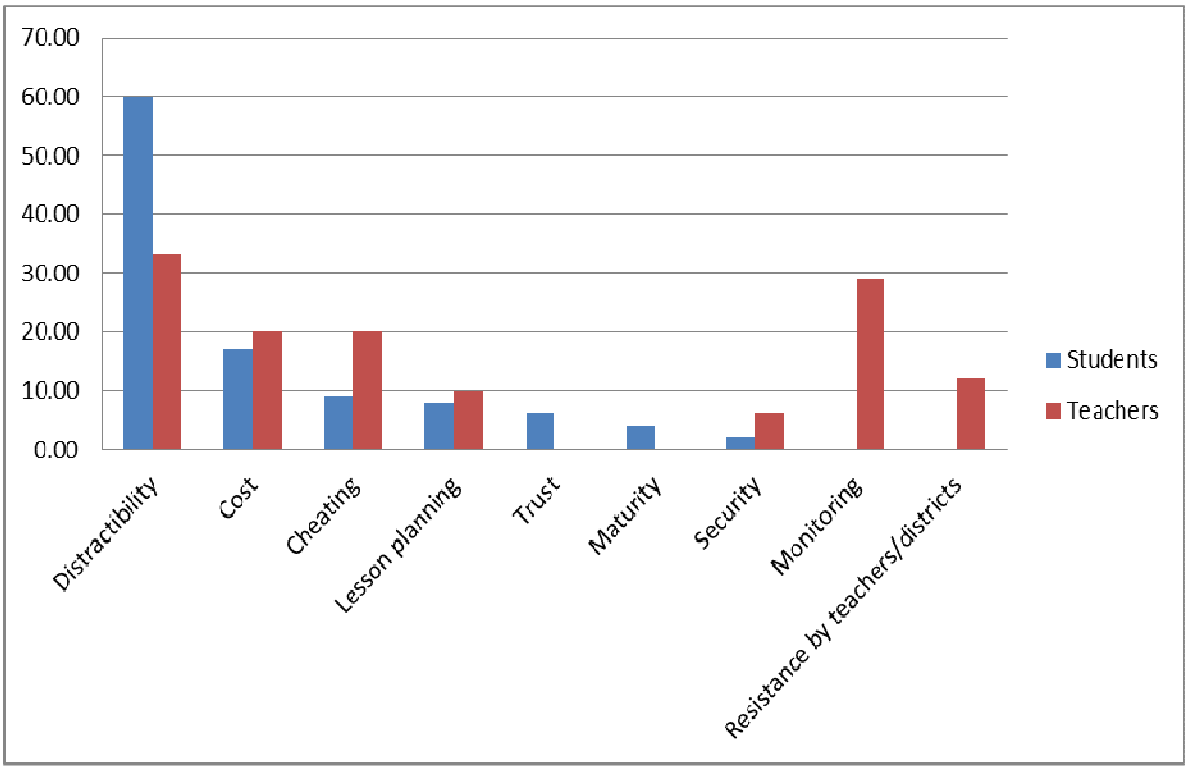

Figure 7. Biggest obstacles and challenges schools face to implement mobile devices (%)

Examples of the actual responses given by students to the prior survey item that could be classified into one or more of the seven categories are explained hereafter with a rationale for the choice of categories in which the response was classified. All quoted materials in this section are based on personal communication or handwritten responses by research participants. One student stated, “Money to buy the mobile devices. The teacher’s knowledge of the device and ability to teach with it to us.” This quote was categorized in cost of technology and ability of teachers to plan lesson. Any item that had the term *money*, *cost*, or anything to do with a financial decision was categorized into cost of the technology. The second sentence was classified in the ability of teachers to plan lessons due to the respondent’s reference to teachers and their knowledge of the mobile devices and/or the ability of teachers to teach in a classroom environment in which mobile devices are prevalent. Next, “A problem schools may face would be the problem of getting every student to have access to these mobile devices. Some students might not be able to afford such devices or be able to care for them outside of school for personal and outside reasons.” Once again, this response was categorized in cost of technology due to the affordability reference. Meanwhile, the reference to access also classifies the response into the accessibility category.

Another quote by a student was,

> Controlling what people do on mobile devices is the hardest obstacle schools face when deciding to allow mobile devices. Although these devices can help out in the classroom, they could also be used to cheat on tests, talk with friends, play games, and possibly diminish the school's learning experience. Some rights can be restricted at schools to provide better control with mobile devices, but these measures would be unpopular with many students.

This response was categorized in cheating because of the student’s reference to the term *cheat* and also categorized as distractibility due to the events that are mentioned that

pertain to distractions in the classroom, such as playing games, talking with friends, or any other off-task behavior that may be exhibited by students who are using mobile devices in school.

> Many teaching professionals view cell phone use close-mindedly [*sic*]. I feel that it would be difficult to convince many teachers that students would use the devices only for learning. The challenge would be providing a way for students to use educational programs while preventing purely social interactions, like texting.

This student's response indicates that teachers may not have the ability to manage an effective mobile classroom, hence the categorization of the response into ability of teachers to plan lessons. Because the response also included details like social interactions and texting, distractibility is a category that naturally fit.

The last sample response included is,

> Some problems are that the mobile/electronic devices could become stolen by lack of protection or jealousy of another person's device, not everyone can afford a mobile device with Internet, and some people may abuse the privilege and text others to distract them from their learning process

This student response can be categorized in three different categories: security, cost of technology, and distractibility. Any mention of the term *security*, *stolen*, or *lost* would place a response into the security category. Meanwhile, the mention of texting forces the response into the distractibility classification, whereas the reference to being able to afford the device places this student response into a third category, affordability.

The following are examples of the actual responses given by teachers that could be classified into one or more of the seven categories with a rationale for the choice of category or categories in which each response was classified. One such was:

> Some of these devices prove to be more of a distraction than a supplementation. I am fine with laptops being used but mobile phones and iPods give idle hands something else to do than doing what they are supposed to do. I do believe we need technology but not in this way.

The response by this teacher included the term *distraction*, which automatically classified that response into the distractibility category:

> Schools are not keeping up with technology. Rather than vilifying the use of this technology we should embrace it. School is the most boring part of a student's day. In large part because we as a group are saying that outside of these walls this technology is changing the world, but inside of these walls we don't allow it. At one point or another, the institution of public education should accept that mobile devices are not toys. They can be used to enhance the public educational experience. Furthermore the restrictions placed on our computers as teachers are ridiculous. I can't get pictures of Vietnam from the Internet because they are flagged. One of the flags was Marxism. Aren't we supposed to be learning about Marxism rather than sheltering ourselves from it?

This teacher suggested that schools are not keeping up with technology even though technology is becoming more commonplace; therefore, this response was categorized in resistance by teachers/districts.

Yet another example of a teacher response to this survey item was:

> How do you monitor the websites they are accessing and do you allow ALL students to use them? I would not feel comfortable allowing my general level students access to cell phones and iPods in class; however laptops may be okay.

The mention of the term *monitoring* helped categorize this response in monitoring student use. "Old people with old ideas that don't work anymore!" The negative tone and subject of this response was the reason for its categorization in the resistance by teachers/districts grouping. The last example quote is: "Having a curriculum that demonstrates and includes the technological devices." The mention of the term *curriculum* helped categorize this response in lesson planning.

Open-ended Question 2. The next open-ended question on both surveys asked, How do you feel about the future of mobile devices in the classroom? This question was designed to gain a broader perspective on the attitudes and perceptions of the high school students and teachers who took the survey regarding the use of mobile devices in the

classroom. Of the 106 students who took the survey, 101 answered the question, which represents a 95.3% response rate on the question. Meanwhile, 49 out of the 50 teachers who took part in the survey answered the question, which represents a 98% response rate on the question. For this question, the data were analyzed and categorized into only three groups: (a) for (in favor of), (b) against (not in favor of), or (c) maybe (not necessarily for or against). Figure 8 illustrates the breakdown of the responses to this survey item.

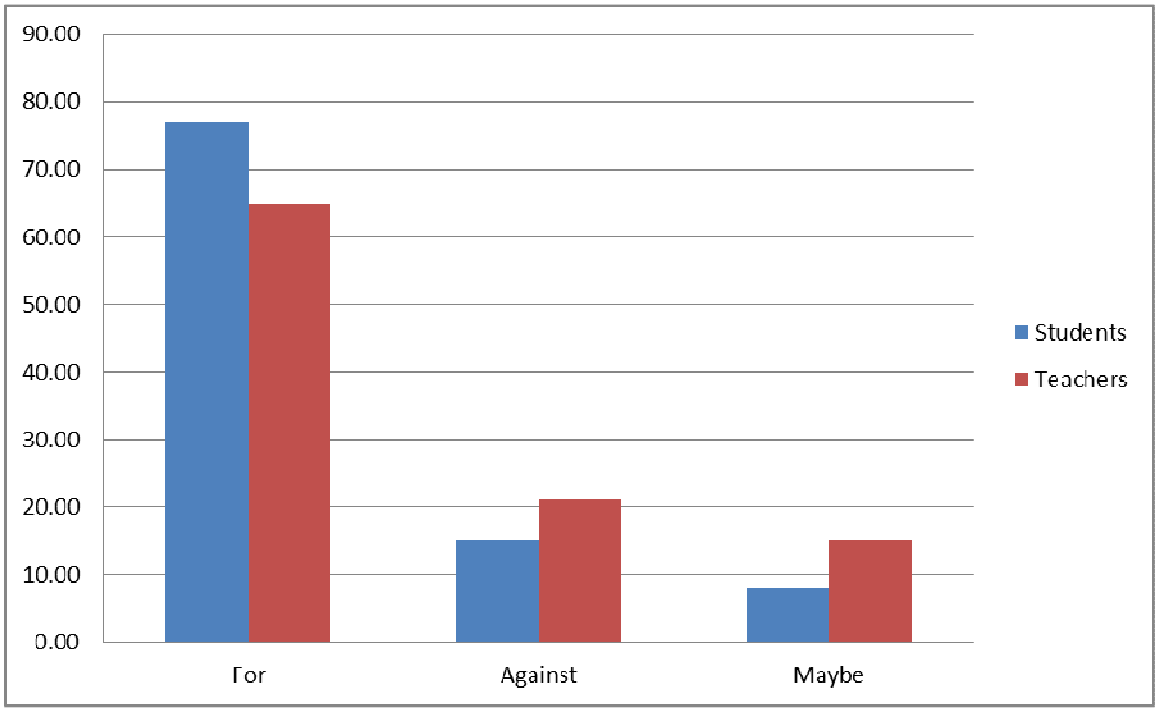

Figure 8. The future of mobile devices in high school classrooms (%)

The responses suggest that teachers and students are in both in favor of allowing the use of mobile devices in schools. Teachers are slightly less accepting of the devices, and more teachers are against the idea of using mobile devices in classrooms than students. Teachers also outscored students in the *maybe* category, which suggests that teachers may still be reluctant or hesitant to implement the devices into their classrooms.

One example of a positive student response was,

> I hope that teachers become more open-minded. In the few classes that I can use a cell phone, I am using it to look up information or help with homework. It really does make a difference when you need to quickly look up information. I feel that mobile devices have many potential educational purposes; however, teachers must be willing to trust their students.

Another student wrote, "It helps kids like me that are dyslexic learn things in different ways." An additional positive response was, "I personally support the usage of mobile devices in a classroom, because many students I know and including myself would be more willing to learn in a fun and interactive way."

Students who responded negatively wrote, "I feel that implementation at the college level is appropriate, though implementation at the high school level will result in a decrease in learning." Another negative response was, "I would rather not see them used. Let's stick to books." Examples of the *maybe* responses include, "I think laptops would be a good idea, that way we would not have to carry around many books, but I think that they should be like the school computers, where most things are blocked. I do not think things such as cell phones or smart phones are a good idea." Another example is,

> I feel that certain mobile devices would be a great improvement to the learning environment (such as e-books), but cell phones and iPods will be more of a distraction from learning. I believe mobile devices could further education greatly, but only if used properly and if certain rules were established and enforced.

An example of a positive teacher response was, "I think mobile devices will have a big part to play in future classrooms, and if monitored properly (i.e., the teacher directs use of the devices) they will be helpful." Another teacher wrote, "I'm positive that these devices can make students from the technological age more interested in learning." An additional positive response was,

> I feel as though there is no option but to accept them. Books are dead; money will be saved by using tablets in place of paper books. We can update information immediately on digital textbooks, not on the paper ones we keep for ten years!

Teachers who responded negatively wrote, "It would most likely open up many other problems and issues that the classroom teacher would be responsible to monitor." Another negative response was, "It's a bad idea. Students will continue to be drawn further off task." Examples of the maybe responses include: "We would need to restrict their use to ONLY certain purposes—perhaps controlled by the office. We would use it and all devices to socialize!" Another example is,

> I don't see why students need phones or iPods in class; they need to be paying attention, not texting or listening to their music. iPods are occasionally useful for music during a presentation if there is a dock. Laptops would be great for students to either take notes or do research without having to go to the library. E-books could possibly help reduce our textbook costs, save kids' backs, and maybe reduce the 'I forgot my book' problem. Smartphones would be good for Internet access when doing research, but everyone I've seen with one is TOTALLY absorbed in looking at it, looking up stuff and not interacting with others.

Those students and teachers who responded *maybe* thought that mobile devices would be a positive contribution to classrooms; however, many students felt that there should be limitations on the types of allowable devices in the classroom and their frequency of use. The teachers who responded *maybe* thought that mobile devices would be a positive contribution to classrooms; however, many of these teachers also agreed with students that there should be limitations on the types of allowable devices in the classroom and their frequency of use. Teachers also suggested the capability of monitoring or restricting what can be accessed from the devices during instructional time as a major need for successful implementation of the devices into schools.

Open-ended Question 3. The next open-ended survey item asked: What are your thoughts on students using mobile devices outside the classroom to support the

instruction that took place in class, rather than having students bring the devices to school? This open-ended question was coded and six common themes emerged: (a) already doing this, (b) good idea, (c) may as well not restrict to just outside school, (d) more likely to use mobile devices in class, than at home, (e) bad idea, and (f) no opinion. This survey item was answered by 100 out of the 106 students who took the survey, which represents a 94% response rate on this question, and this item was answered by 46 out of the 50 teachers who participated in the survey, representing a 92% response rate. Figure 9 details the frequency of responses to this survey item.

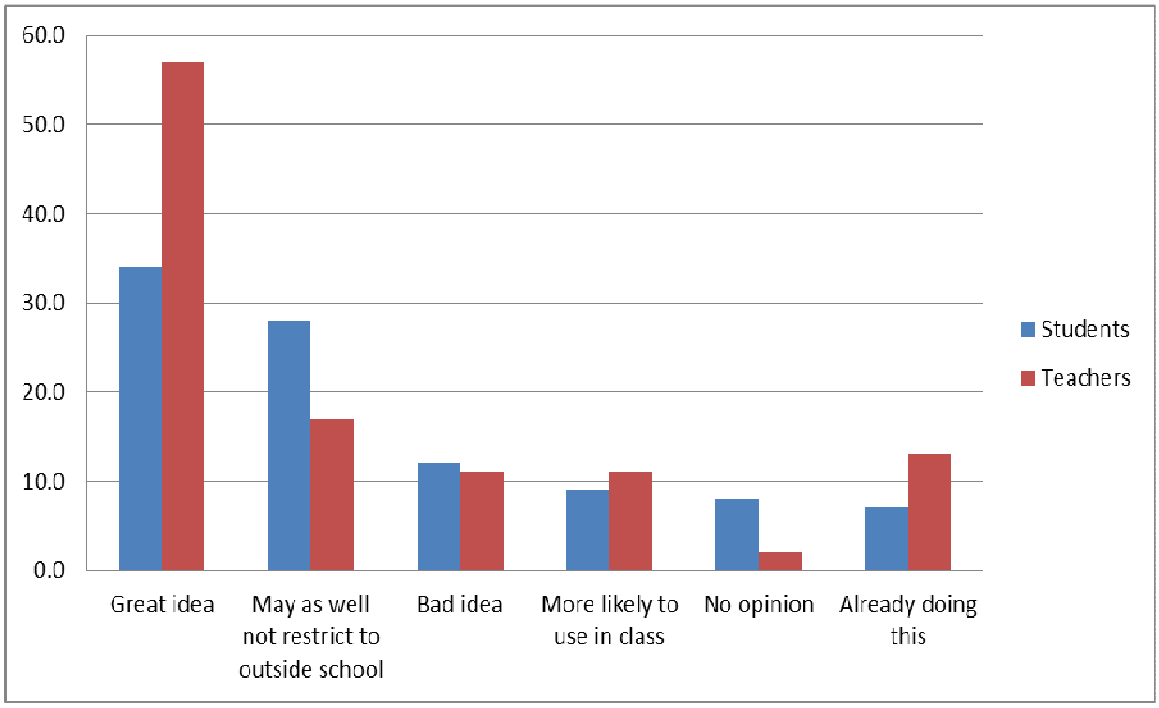

Figure 9. Perceptions that the place for mobile devices is outside of school (%)

The most popular response among students was that using the devices outside the classroom was a great idea. Students cited reasons that included the use of mobile devices was easier outside school because the risk that the devices were stolen at school would be minimized, using devices outside the classroom would cut down on distractibility during

instructional time, and their use outside school would prevent students from text messaging while in class. Others commented that using the devices outside the classroom was like bringing the classroom home. Students also felt strongly that the devices should not just be restricted to use outside the classroom. Although these students were not against using mobile devices outside the classroom, they did feel that their use in the classroom would also benefit the student. Furthermore, other students indicated that they thought that using the mobile devices outside the classroom was a bad idea. These students cited accessibility issues, claimed that using mobile devices outside the classroom was not as effective, and claimed that if the devices were not going to be used in the classroom, why would students want to use the devices outside the classroom?

As illustrated in Figure 9, the most popular response among teachers was also that using the devices outside the classroom was a great idea. Teachers cited reasons that included the use of mobile devices was easier outside school because the risk that the devices were stolen at school would be minimized, using devices outside the classroom would cut down on distractibility during instructional time, and their use outside school would prevent students from text messaging while in class. Others commented that using the devices outside the classroom was like bringing the classroom home. Teachers, however, also agreed similarly with students that the mobile devices should not just be restricted to use outside the classroom. Although these teachers were not against using mobile devices outside the classroom, they did feel that using the devices both at home and in the classroom would be more beneficial to students. Those teachers who suggested that using mobile devices in the classroom was a bad idea cited issues such as accessibility and equity, and claimed that using mobile devices outside the classroom was

not as effective. They also felt that students could cheat more by communicating through text messages to be given answers to independent projects or reports that are worked on at home, and claimed that if the devices were not going to be used in the classroom, then students may not have a desire to fully use the devices for learning purposes outside the classroom.

Open-ended Question 5. The last open-ended item on each survey asked: Describe how you envision high school students using mobile devices to provide the most ideal learning opportunities for themselves either inside or outside the classroom. This question was designed to gain insight into what students and teachers were feeling toward the future use of mobile devices in high school classrooms. The results of this question were categorized into 10 themes that detail the ways in which students feel that mobile devices will be used in educational settings in the future, and an additional 10 themes that illustrate the ways in which teachers feel that mobile devices may be used for learning in the future. There were 92 student responses to this question, representing an 87% response rate for the question, and 41 teacher responses to this question, representing an 82% response rate for the question.

Figure 10 shows the comparative results of the student and teacher responses to this survey item. The most common response for this question by students was a "more fun and inviting learning environment," which included responses such as a more collegial feel to the campus, an increased spark in creativity, faster accessibility, increased levels of maturity, and more students being involved and engaged in their work. Although students felt strongest about the desire to make the learning environment more fun and inviting, no teachers suggested the future use of mobile devices will be to

engage students. Teachers and students were in agreement, however, with both groups citing instant access to information, student accessibility (every student will have one), and the ability to perform research on the mobile device. Teachers were much more perceptive of the use of mobile devices as digital textbook than were the students. Several teachers were also excited about the prospect of students taking tests and quizzes on the devices or using the devices to check for student understanding.

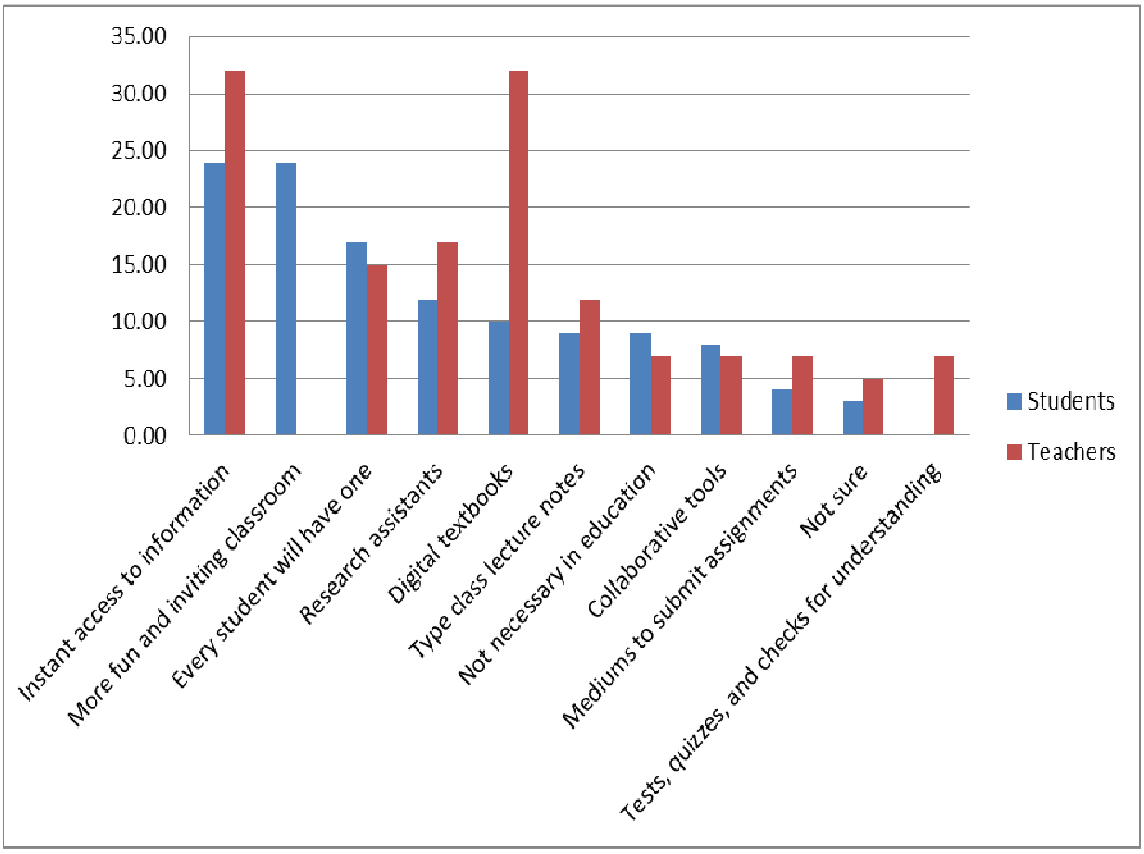

Figure 10. Ways students and teachers envision potential uses of mobile devices for learning (%)

Open-ended comparative summary. Of the five open-ended questions on the student and teacher surveys, four of the questions pertained to the future use of mobile devices in schools for learning. These four questions, open-ended Items 1, 2, 3, and 5, elicited student and teacher responses that were similar and different regarding the potential future use of mobile devices in schools for learning. Item 1, the 31st question on

the survey, asked students and teachers to record what they felt were the biggest obstacles or challenges that education may face in trying to implement mobile devices into schools. The two areas in which students and teachers felt practically the same were costs of the mobile devices (students = 17%; teachers = 20%) and lesson planning (students = 8%; teachers = 10%). There were also three responses to this question that were quite different in frequency. One of these is distractibility, which 60% of students saw as a challenge or obstacle, but comparatively only 33% of teachers felt distractibility was an issue. Next is cheating, or the misuse of the devices during class, which only 9% of students saw as an obstacle and more than twice that percentage of teachers (20%) saw as a challenge. Last, the security of the devices to prevent against vandalism and/or theft was an apparent barrier affecting the integration of mobile devices into schools by only 2% of students, yet more than three times the percentage of teachers (6%) cited the security of the devices as a barrier.

Item 32 on both the student and teacher surveys asked how students and teachers felt about the future potential of mobile devices as learning tools in school. After coding and categorizing the responses, three categories were achieved, and the data were sorted into one of these three themes as described early in this chapter. The responses of students versus teachers on this question were not identical but were quite similar in nature. There were 77% of students who took the survey who were in favor of the future of mobile devices, and 63% of teachers who also felt that using mobile devices in the future was a positive. Meanwhile, 15% of students were against the future of mobile devices as learning tools, and comparatively 20% of teachers were against their use in the future. The largest discrepancy was in the *maybe* category, in which 8% of student

answers were classified compared to nearly twice as many teachers who answered maybe (14%). The resistance of mobile devices by teachers may be more evident than ever according to the number of teachers who felt that they would maybe use mobile devices for learning in the future. These responses indicate that teachers may like the idea but are very hesitant to accept the devices into their classrooms until further support and assurances are provided.

More similarities and differences were evident in the student and teacher responses to open-ended Question 3 (Item 33), which asked students and teachers how they felt about having students use mobile devices for learning outside of the classroom rather than bringing the devices to school. The only response that appeared to be similar for students and teachers was that using them only outside of schools was a bad choice. Of students, 12% felt that only using the devices outside of school was a bad idea, whereas comparatively 11% of teachers felt against the idea. Large discrepancies were apparent when comparing some of the other common responses by students and teachers, including: (a) we are already doing this (students = 7%; teachers = 13%), (b) the devices are more likely to be used if they are allowed in the classroom (students = 6%, teachers = 11%), (c) the use of the devices may as well not be restricted to outside of the classroom (students = 28%; teachers = 17%), and (d) good idea (students = 34%; teachers = 56.5%). Based on these differences, namely the fact that 56.5% of the teachers feel in favor of only allowing students to use mobile devices outside of school compared to 34% of students who are in favor of only using the devices outside of the classroom, teachers still do not appear ready to accept mobile devices as learning tools into their classrooms.

The final question on the survey was Item 35, which asked students and teachers how they felt about students using mobile devices to create the most ideal learning situations for themselves. There were four responses to this question that were of particular interest. Three of the four elicited responses that were comparatively similar between students and teachers were (a) every student will eventually have his or her own mobile device (students = 17%; teachers = 15%); (b) mobile devices are not necessary in the classroom (students = 9%; teachers = 7%), and (c) students will use the devices mainly as collaborative tools (students = 8%; teachers = 7%). One response that provoked very different results between students and teachers was the digitizing of textbooks. Only 10% of students saw digital textbooks as a pertinent way to use their mobile devices to provide the most ideal learning conditions, whereas more than three times that percentage of teachers (32%) felt that students would use the digital textbooks on their mobile devices most often to create ideal learning opportunities.

Students and teachers have different perceptions when it comes to the biggest obstacles and challenges that schools face in the implementation of mobile devices into the classroom. Students and teachers agree that the cost of the devices and the ability of teachers to plan lessons are significant issues, but students and teachers differ in their perceptions that the distractibility of the devices and cheating are significant barriers. Students tended to more commonly cite obstacles that related to classroom behaviors, whereas teachers cited reasons that were related to school rules and regulation and the effective management of a technological classroom. Teachers appear hesitant to implement mobile learning into their classrooms because most felt that it was a good idea

that students use their mobile devices for learning outside of the classroom rather than bringing the devices to school.

Focus Group Data

There were two separate focus groups that were conducted as part of the research. The objective of the focus groups as to gain further insight into the attitudes and perceptions of students and teachers when it comes to using mobile devices as future tools for learning in schools. Furthermore, the primary purpose for conducting focus groups was to gain a broader understanding of the responses of the survey participants on the open-ended survey items. According to Gall et al. (2003), the facilitator of a focus group can gain more in-depth information regarding the attitudes, perceptions, or beliefs of a group of people than through interviews. Furthermore, Bryman and Bell (2007) suggest that the use of focus groups has proven to be very beneficial in helping researchers define problems in new and innovative ways. Thus, these focus groups—one teacher-only focus group that consisted of seven teachers, and one student-only focus group that consisted of six members—were set up independently in an attempt to elicit more in-depth responses than previously recorded on the open-ended survey items.

Perceptions of Biggest Obstacles or Challenges

Both groups were extremely receptive to the questions asked of them, as the groups provided useful information that can be compared and contrasted beyond the open-ended survey responses. The focus groups were recorded and then transcribed. From the transcription, information was coded and categorized by theme. The themes were narrowed to make the data more concise and telling. One area of significance that the focus groups sought to uncover was how students and teachers perceived the

obstacles or challenges that education faces in adopting or integrating mobile devices into its normal everyday functions. The students collectively cited the following challenges that they feel are restraining mobile technologies in schools: (a) distractibility; (b) veteran teachers who cannot operate or care to learn how to use the devices; (c) control over the classroom learning environment or the ability of teachers to monitor what students are doing on their devices during instructional times; (d) too much control of what students can and cannot access from their devices; and (e) if the mobile devices are eventually school-issued, there could be restrictions on what is blocked. If the devices were the students' personal mobile devices, then restrictions on these devices would be much more difficult to manage.

The teacher responses were quite different from the student responses regarding the obstacles or challenges that would need to be circumvented before a wide-scale adoption or integration of mobile devices into schools can take place. Among these challenges cited by teachers were: (a) teachers who are not willing to accept or embrace the technologies as learning tools, (b) the cost of the devices, (c) the cost of training teachers to use the devices effectively in their classrooms, (d) lack of electric outlets or charging stations to accommodate mobile devices, and (e) the integration of these devices into a high school may need to be gradual so as not to be overly expensive and so that students and teachers do not experience culture shock from the sudden implementation of mobile devices into their classes. The most surprising omissions from the teachers were distractibility, cheating, and monitoring student use of the devices. Although the student focus group mentioned some of these areas as concerns, teachers did not mention these during the focus group, even though several teachers suggested some of these reasons on

their open-ended survey responses. Figure 11 depicts the primary themes extracted from the focus group transcripts for each group, students and teachers.

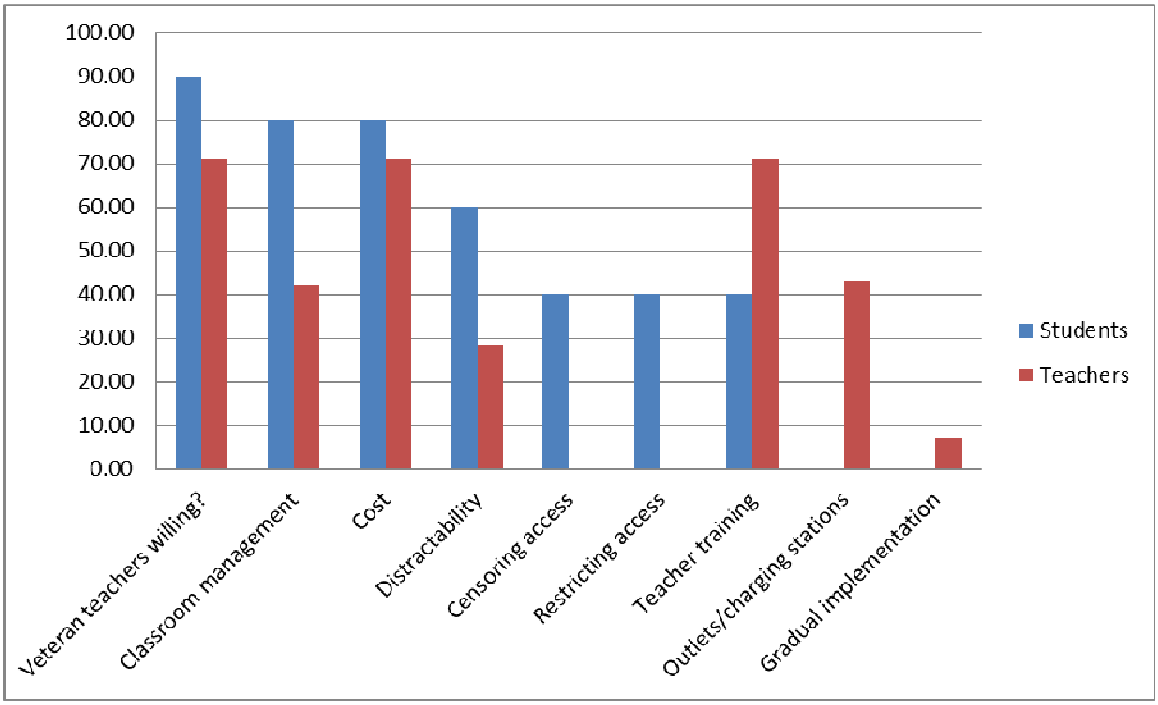

Figure 11. Challenges of implementing mobile device programs in schools (%)

Based on the information compiled in Figure 11, students and teachers are in partial agreement that the main challenges in implementing m-learning in schools are: (a) convincing veteran teachers of the positive effects of mobile learning on student achievement and motivation, (b) classroom management and issues related to the use of mobile devices in school, (c) the high monetary cost associated with the implementation of an m-learning program, and (d) the ability to more effectively train teachers how to use mobile devices with students in the classroom. The censoring of information or the restriction of using the devices at various times in the classroom are concerns raised by students only, whereas teachers were the only ones to mention outlets and charging stations as issues, as well the issue of gradually implementing an m-learning program into a school to limit the risk of culture shock.

Roles of Mobile Devices in Schools

Although the use of mobile devices by teenagers has increased significantly during the past decade (Engel & Green, 2011), their use in schools has consistently been impeded due to a number of factors, such as cost, equity, distractibility, and the security of the devices (Traxler, 2007). As a result of conducting the focus groups, the attitudes and perceptions of students and teachers were gathered concerning their thoughts on the future of mobile devices in schools. Students were very much in favor of the integration of mobile devices into schools; however, there were some students who expressed some concerns. To maintain the confidentiality of students and teachers who partook in the focus groups, students will be referred to by the letter *S* followed by a number (e.g., S1, S2, etc.), whereas individual teachers who participated will be represented by the letter *T* followed by a number (e.g., T1, T2, etc.). S5 commented that with all the advances in technology, the changes will be necessary. S3's impression of mobile devices in the classroom is that their use in class would make teaching easier, as the devices can be used to clarify things in class. S1 suggested that students could particularly benefit from the use of mobile devices when they are unable to make it to school. S4 thinks that the mobile devices are excellent ways to have instant access to information and to perform further research. S2 felt that he would be more supportive of the use of mobile devices inside the classroom because he feels that using a computer to type an essay or create a PowerPoint is more efficient than trying to do the same on his smartphone.

The teachers who attended the focus group were also very supportive of the use of mobile devices in the classroom in the future, although they too had some reservations. T2, a special education instructor, suggested that mobile technologies reaching the

classroom are inevitable. She continues to explain that her students want to and are going to use the devices for learning, so there is no reason to fight it. T1, a world history teacher, feels that in 5 to10 years all textbooks will be available online on a single device. He also feels that every PowerPoint presentation, film clip, or picture that is part of his lesson can be instantaneously uploaded to a device (such as a slate) and accessed by all students. T6, a math teacher, feels that the kinks in the system (not of the mobile devices themselves) and the process of implementation need to be worked on first. She addressed concerns about students passing notes when she was in school, but nowadays students have found new ways to do the same things they have always done. T3, an English teacher, claimed that having a single mobile device that students could check out from the library would be ideal. If the textbook and all the novels were on a single device, students would have fewer excuses for not bringing their material to class. T4, also a math teacher, felt that the use of school-issued wireless devices that can be used by all students will be particularly beneficial to those students who do not have access to the Internet from their homes.

Comparative Future Perceptions of Mobile Devices for Learning

Students report using mobile devices outside the classroom to communicate with others, to access information, and to create their own unique learning opportunities. Therefore, students seem aware of the uses of these technologies and are willing to accept them as useful classroom learning tools. On the other hand, high school teachers who were surveyed and who participated in this study's focus group are not all owners of the most state of the art technology, nor do a large number of teachers know how to effectively operate some of these devices. In each focus group, students and teachers

were asked how they currently use their own mobile devices for learning purposes and how they foresee themselves using mobile devices for learning in the near future.

Every student who participated in the focus group claimed to have used a mobile device of some kind to access information or research a topic while on the go. Other students indicated that they use their mobile devices, mainly smartphones, to collaborate with others and to play games. S3 uses his mobile device to study vocabulary. He will use applications on his smartphone that are designed to serve as study tools. This student feels that the instant access to information that a mobile device provides helps stimulate his curiosity and sparks his motivation to learn. S5 suggested that students will be more excited about using technology, rather than reading a passage from a book, because reading from the device itself can help incite the motivation to learn.

Finally, the teachers who partook in the focus group were not already engaging with mobile devices as frequently as their student counterparts. Two teachers, T1 and T7, claimed to have used their own mobile devices to access the Internet, send and receive email, do crossword puzzles, access online textbooks, and read novels. While reading *Moby Dick* on his iPad, T1 had an epiphany: "paper books are dead, everything is becoming digital." T5, on the other hand, has not yet converted to an e-reader. He still enjoys the tangibility of a book, citing the aesthetic nature and appeal that he feels e-books do not possess. T2 is not yet using a mobile device for learning purposes. She does, however, love the future idea of the books that are taking up space on her bookshelves to be housed on and accessed from a single electronic, mobile device. T6 loves the idea of all of a student's books to be stored on one device, rather than a student lugging a heavy backpack around school. Last, T5 does not use any mobile technologies

in her classroom, but would be very in favor of using the devices that would allow students to access information or perform searches relevant to classroom instruction. She adds that timeliness of the information is probably the greatest learning feature of a mobile device. Struggling students will be more motivated to learn, and students who need a quick answer to a question do not have to wait until the teacher arrives to ask.

Summary

In this chapter, the responses to the first 30 multiple-choice and Likert-style items on both surveys, student and teacher, were analyzed by question. The open-ended survey responses, which concluded the survey, were also analyzed. Finally, the pertinent information that resulted from the focus groups was analyzed to look for further evidence of similarities and differences in the perceptions and attitudes of students versus teachers from one Southern California high school regarding the current and future uses of mobile devices for learning. The responses were organized by research question. The section with the first research question contains an overall look at the student responses to the survey items. The section on Research Question 2 includes the aggregated responses to the teacher survey items. And the third section of the chapter on Research Question 3 analyzes the similarities and differences from the student and the teacher responses to the survey. Furthermore, the focus group information was analyzed in this third section of the chapter to show additional similarities and differences in the perceptions of students and teachers when it comes to using mobile devices as educational tools.

After analyzing the results of all the survey items, a cross-tabulation was performed on every survey item on the student and teacher surveys, independent of one another, to determine whether any significant findings could be revealed. The student and

teacher cross-tabulations were performed through Survey Monkey's Cross-Tab feature. The cross-tabs used on the student survey were (a) gender, (b) grade level, (c) favorite subject, and (d) comfort level with technology. For the cross-tabular analysis of the teacher survey, the cross-tabs employed were (a) gender, (b) number of years in education, (c) primary subject taught, and (d) comfort level with technology. The analysis of the data on both the student and teacher cross-tabulations showed no significant findings beyond the information extrapolated from the original survey results. Despite no significant findings from the cross-tabulation analysis, the researcher felt that including demographic data on the student and teacher participants was important for understanding the overall sample used for the research.

The comparative analysis between the student and teacher survey responses provided few similarities and several differences. The survey questions that students and teachers responded similarly to dealt with (a) students being the only ones allowed to use mobile devices in the classroom versus teachers being the only ones able to use mobile devices in their own classrooms; (b) which teachers, if any, permitted mobile devices in their classrooms; and (c) which teachers, according to students and teachers, effectively modeled and facilitated the appropriate use of mobile devices in their classrooms. The responses to these questions indicate that teachers and students have nearly the same perceptions regarding the restrictions put on mobile devices at school and the frequency that mobile devices are used while in the classroom.

On the other hand, there are differing attitudes and perceptions among students and teachers when it comes to the feelings these two groups have regarding both the frequency that students are using mobile devices as learning tools outside of the

classroom and the prospective uses of mobile devices, should they be permitted in schools in the future. According to the survey responses, teachers are unaware of how frequently students are engaging with their mobile devices as learning tools either to supplement the curriculum or as tools to engage in learning activities informally beyond the classroom walls. Moreover, many of the responses to these questions that produced significant two-sample *t* test results indicate that teachers are not as willing to encourage the use of mobile devices as learning tools as students would like. The responses to the survey items also suggest that teachers are not too comfortable with mobile technologies, whereas their student counterparts are very ready. Evidence of teachers' comfortableness with mobile devices in school is further validated by teacher responses on the open-ended survey items related to improved staff development and training that will be necessary before the use of mobile devices in schools can become a reality.

Chapter 5: Conclusions, Recommendations, and Closing Thoughts

Introduction

Although the use of mobile Internet devices continues to rise, schools have remained resistant to the adoption of the devices. Schools claim that the devices cost too much and are distracting to the learning environment, or suggest that the safety and privacy issues that come with the devices are simply not worth their benefit. Nonetheless, studies have shown that students become more motivated when technology and social media are used to assist learning (Kozma, 2005).

Teachers and students at a high school underwent an online survey and follow up focus group to determine the reason for such a wide disparity in the viewpoints of students and teachers. The study yielded differences in the perceptions of students and teachers regarding the potential implementation of the devices into high schools as current or future learning tools.

The findings of the research indicate that students and teachers at the subject high school are ready for mobile learning. Students, however, feel that their teachers need further training and education to effectively use mobile devices in their classrooms education. Meanwhile, although teachers are aware that students use mobile devices to socialize, they were unaware of the frequency by which students use the devices for learning purposes. Finally, students and teachers both agree that the use of mobile devices in schools may be a difficult transition, but will ultimately help increase student motivation, improve overall achievement levels, and create a more positive learning environment.

Conclusions

Analysis of the findings led to three major conclusions: (a) students have nearly ubiquitous access to mobile devices outside of the classroom, yet teachers still remain reluctant to accept the devices as learning tools because teachers feel the need for additional support and training to demonstrate appropriate knowledge and expertise to convincingly use the devices with students; (b) teachers are not aware of the everyday dependency of students on these devices for communication, collaboration, and for educational purposes, so teachers have not made the necessary efforts to integrate the devices into their curricula; and (c) teachers and students agree about the potential for mobile devices to spark the creativity of learners, create a more positive classroom learning environment, and increase student motivation. However, students will need to understand proper mobile device etiquette in school, whereas teachers need additional training to effectively manage a mobile learning environment. The following section will justify the conclusions based on the research questions and discuss the relevance of the conclusions drawn from the research.

Conclusion 1

Ubiquity. A major finding associated with the research questions is that teachers do not possess the proper knowledge of the uses of mobile technologies to successfully integrate the use of mobile devices into their curricula. Thus, the primary conclusions that can be drawn as a result of the research are that a large majority of students now own and frequently operate mobile devices for educational reasons, yet a majority of teachers are very novice when it comes to the effective uses of mobile devices in schools. Although some teachers are making the effort to incorporate the use of mobile devices into their

regular classroom practices, other teachers still require a great deal of training to efficiently implement an effective m-learning strategy into their classroom. The research revealed that most students are thus not too encouraged with the ability of their teachers to accept and understand the uses of mobile technologies due to teachers' lack of knowledge of the effective uses of the mobile technologies for learning purposes.

The main evidence that would suggest that students are more capable users of mobile devices came from the information gathered from the survey and focus groups, as well as from the literature. From the results of the research, a much greater percentage of high school students are using their mobile devices to create learning opportunities or for school-related purposes than are the teachers who participated in the research. Whereas 85% of students have used laptops and 65% have used a cell phone or smartphone for learning, only 67% of teachers have used laptops and only 22% of teachers have used cell phones or smartphones in an educational capacity. Only 5% of students in the research are not using any type of mobile devices to assist their learning, compared to the 22% of teachers who are not taking advantage of the learning capabilities that mobile devices can provide.

The perceptions of students versus their teachers regarding the use of mobile devices in the future were also consistent with the prior evidence that suggests that students are much more adept users of mobile technologies than their teachers. Survey data indicate that more than 94% of students would like to engage in learning activities with the assistance of a mobile device, whereas only 70% of teachers are willing to use mobile technologies with their students in classroom learning activities. Overall, 92% of the students who participated in the research are in favor of or feel that the use of mobile

devices in education might be a positive feature in schools. Unpredictably, 79% of teachers expressed that they would either be in favor of or might like to see the use of mobile devices in their classrooms.

However, for the integration of mobile technologies into schools to be effective, students are under the impression that teachers need to become better informed of the technologies and should be able to derive ways to incorporate the devices into everyday classroom instruction in the future with some formal training and professional development. According to Don Tapscott (2009) and his extensive investigation of technology usage patterns of kids and their ability to use technology, today's high school students can be classified as *Net Geners*, or ones who have grown up with technology as part of their everyday lives. There are eight characteristics that Tapscott (2009) links to the net generation group, a group that he feels is growing up digitally. These eight characteristics of new-aged students include: (a) a desire for freedom of choice; (b) the ability to customize things and make them their own; (c) enjoyment of communication and conversation, rather than lecturing; (d) ability to easily scrutinize anybody or any organization; (e) a demand for integrity; (f) the need to have fun, especially at work or at school; (g) a fast-paced life is completely normal; and (h) innovation is a way of life (Luidia, 2010).

Tapscott's observations of Net Geners are further evidence that today's students are simply natural users of technology. Thus, students are more adept users of mobile devices than the majority of their teachers. For this reason, teachers are lagging behind when it comes to technology use. As a result, additional support and training will be required before teachers can convincingly implement mobile technology in schools.

Luidia (2010) suggests that the solution may be to have students use their own mobile devices and use any funding on "developing the infrastructure to support emerging technologies and training teachers" (p. 8).

Conclusion 2

Lack of teacher awareness. A second major finding associated with this research question deals with the frequency that high school students actually use mobile devices for learning purposes, compared to the perception that teachers have of the actual frequency that students are partaking in mobile learning. Thus, the primary conclusion that can be drawn as a result of the research is that teachers are not putting forth the necessary effort to integrate the use of mobile devices as learning tools in the classroom due to their overall lack of knowledge regarding the frequency that students use their mobile devices to learn.

Although teachers are aware that their students are reliant on mobile devices in their everyday interactions with others, teachers are also quite uninformed about how often students are engaging with their mobile devices for learning purposes. According to information gathered on the survey and through the focus groups, teachers appear to be quite uninformed about the frequency that students partake in learning activities with their mobile devices. For instance, 69% of students are using their mobile devices to perform school-related research, yet only 32% of teachers feel that students are using their devices for research purposes. Additionally, whereas almost 75% of students are using mobile devices for collaborative problem-solving, only 44% of teachers think that students are using their devices for this reason.

Rogers (2003) suggests that technology use is often shaped by social factors, which may help explain the discrepancy in the perceptions of students and teachers regarding the frequency of using mobile devices for learning. Furthermore, teachers are nowadays very driven and self-pressured to complete rigorous curricula so that their students perform well on standardized tests. According to Purcell (2005), one of the greatest obstacles to integrate mobile technologies into schools is a perceived lack of space in an already crowded curriculum. However, Swan, van 't Hooft, Kratcoski, and Unger (2005) suggest that teachers' lack of knowledge of students' usage patterns of technology may be attributed to the fact that many students "use these technologies as integral parts of their lives outside of schools" (p. 99). Because students are using mobile devices outside the classroom and most teachers continue to ban the use of the devices in their own classrooms, teachers continue to discount the frequency that students use the devices for learning and also struggle to find ways to integrate technology into their own curricula.

Therefore, the attitudes of teachers regarding the permissible uses of mobile devices in the classroom are shaped largely by both social factors and pressures placed on teachers to cover an already plentiful amount of content with their students without the added pressures of integrating technology into the curriculum. Social factors are keeping teachers out of the loop when it comes to their knowledge of their students' uses of mobile devices outside of the classroom for learning. Moreover, the majority of teachers, due to their overall lack of understanding of the powerful capabilities of mobile devices for learning, discount the ability of these mobile devices to make teaching and learning more engaging. Teachers in this study were unaware of how often students engage with

technology outside the classroom, and teachers appeared reluctant to allow mobile devices in their classes due to social factors which may be causing the perceived discrepancy of students' frequency of technology use outside of school.

Conclusion 3

Same future view. Students and teachers have strikingly similar views of the current and future uses of mobile devices as learning tools. Students and teachers are both under the impression that the effective use of mobile devices in the classroom as learning tools will help create a more positive classroom learning environment, help increase student motivation, and will spur student creativity and innovative thinking.

The vast majority of students are using their mobile devices quite often to access information, play educational games, research school-related topics, collaborate and communicate, and interact with applications that allow them to study classroom content. Meanwhile, the extent of the teachers' uses of mobile devices is limited to creating lesson plans or accessing audio or video files to share with their students. These tasks, however, are only being undertaken by a select number of teachers.

Evidence from the research suggests that teachers tend to agree with students in a few distinct areas. Both teachers and students feel that the use of mobile devices is a great way to spark the creativity of learners, create a more positive classroom learning environment, and increase student motivation. Additionally, both groups felt that teachers will need more training on the uses of the devices as educational tools because the average student is much more knowledgeable than his teachers about how to use most of the technologies. Teachers credited the ability to more efficiently reach a wider variety of learners as a reason to allow the use of mobile devices in schools; however, they

cautioned that students would need to be taught the appropriate uses and proper etiquette of the devices for the implementation to be a success.

Consistencies also exist between the findings of this research question and the literature. Continuing studies conducted by Mimi Ito, beginning in 2005, suggest that teens who partook in after-school programs moved along a continuum from students who socialize with friends, to students who engage in learning with games and music, to students who learn current digital media skills to spark their creativity to create greater learning opportunities (i.e., geeking out; MacArthur Foundation, n.d.c). Klopfer and Yoon (2005) suggest that the shift from an industrial to a knowledge-based workplace has forced students to become more able to collaborate, work with incomplete information, adapt to changing conditions, manage complexity, and create and share knowledge. Yet the gap between teachers and students regarding the use of mobile technologies as learning tools continues to widen, due largely in part to insufficient professional development opportunities and lack of preparation afforded new teachers through teacher education programs (Purcell, 2005).

The lack of professional development opportunities for teachers has created a great divide among teachers' understanding of the uses of mobile devices for learning purposes, as well as a clouded understanding of the usage patterns of the devices by their students. Once teachers begin to understand the specific uses of the devices and how often students engage in meaningful learning activities with their mobile devices, the potential for integrating the devices into their classrooms will improve significantly (Kukulska-Hulme & Traxler, 2005). However, teachers will still need to understand and be able to effectively manage an m-learning classroom. This may mean giving up some

control of the classroom, thus creating a more student-centered, rather than teacher-centered, classroom, among other potential issues that may arise.

The findings of the research indicate that students and teachers are also willing to set aside issues such as privacy, security, and disruptiveness (Motiwalla, 2005) in an attempt to integrate an m-learning plan into the high school curriculum that reaches all learners and learning styles, increases motivation among apathetic students, and promotes instant access to limitless information. Students do tend to discount the abilities of their teachers, but other issues involving the implementation of technology into the classroom can be attributed to teachers' lack of understanding of the management of a technological environment coupled with the students' inability to appropriately and respectfully use mobile devices in the classroom (Motiwalla, 2005). To achieve this goal, Rodrigo (2011) feels that educators need to influence students to think of mobile devices as more than just *consumption* devices, but instead get students to use these powerful devices as *production* devices.

Students need more direction, support, and defined rules to appropriately take advantage of using mobile devices as learning tools in an educational setting. Likewise, teachers are in need of education, support, and training regarding the effective implementation of mobile devices into the curriculum and how to manage this technological classroom environment. Although both groups agree how powerful, ubiquitous, and game-changing the use of mobile devices can and have become in the world of education, both teachers and students must still come to understand how to appropriately use the devices as effective learning tools for the implementation of the devices into high schools to be worthwhile.

Suggestions for Future Research

The purpose of this study was to provide high schools, school districts, offices of education, and game and application designers with a unique perspective on the attitudes and perceptions of high school students and teachers to better understand the factors that may be preventing the diffusion of mobile devices into high school classrooms. The data collected in this study provide evidence that teachers may partially be an impediment to the integration of mobile technologies into schools due to their overall lack of experience with technology, coupled with the fact that technology has now become a way of life for the 21st-century student. Furthermore, the data suggest that future research with additional high schools may still be necessary to better gauge both the interest levels of students and the steps that will be necessary before teachers unequivocally accept mobile learning in their classrooms.

After compiling and analyzing the results of the current study, there are some additional studies that can be undertaken in the field of mobile learning that may prove to be beneficial to the future integration and widespread adoption of mobile learning in high schools. First, a study that investigates the primary features of each mobile device that may be suitable for learning, such as comparing (a) screen sizes, processor speeds, keyboard sizes and types; (b) investigating the available applications on the devices and their effectiveness for learning; and (c) the ability of teachers to limit, monitor, or control the use of specific types of devices in their classrooms. Such research could help the developers of these devices cater the devices to meet the needs of 21st-century learners. For instance, a study on the effectiveness of iPads on the retention rates of vocabulary

and definitions for second language learners or the use of cellular phones or iPods to access maps and virtual worlds in a high school history class may also be an option.

Another study that may need to be undertaken is a comparative empirical research study in which different mobile devices are used in two high school classrooms of the same subject. For instance, a cell phone or smartphone can be used by students in one class, and a slate could be used in the other class. The two classes could be compared for similarities, differences, and, most important, overall achievement levels. The results of this research can then be compared to a traditional course to uncover whether the students in the classrooms using either mobile device outperformed students engaging in traditional lessons without the use of mobile devices.

Exploration of student use of mobile devices informally for learning versus the use of the devices in schools may also be of interest for future research. As this study indicated, students are using their mobile devices for learning purposes much more frequently than their teachers sense they are using the devices, especially in informal learning situations. A study that looks more closely at the specific informal uses of these mobile devices for learning may pave the way for a smoother transition of the devices from being banned in schools to being slowly integrated into the everyday school curriculum. Within this study, middle school and possibly even elementary-aged students could be included to determine the habitual uses of mobile devices by younger students as the use of mobile devices continues to broaden in the age of the 21st-century learner.

Additionally, a comparative study could be conducted with a school that allows the use of mobile devices in their classrooms (e.g., a high tech high school or academy) versus a school in which students are not permitted to use mobile devices. The attitude of

the teacher could be investigated in both schools. Furthermore, the perceptions of teachers regarding the current and future use of mobile devices as learning tools can be compared at both school types to determine the effect that the permissibility of the devices in one school versus the proscription of the devices at the other school has on teachers' overall job satisfaction and comfort.

Summary

Despite rapid growth and use of mobile Internet devices, schools have remained resistant to the adoption of the devices. Schools have reasons such as the cost of the devices, the distractibility of the devices to the learning environment, or safety and privacy issues that come with the devices. Nevertheless, studies have shown that students become more motivated when technology and social media are allowed for their learning (Kozma, 2005).

To better understand the usage gap, teachers and students at a high school underwent an online survey and follow up focus group. The study yielded differences in the perceptions of students and teachers regarding the potential implementation of the devices into high schools as current or future learning tools.

The findings of the research indicate that students and teachers at the subject high school are ready to adopt mobile learning. Students feel that teachers need further training and education regarding the uses of mobile devices for education. Teachers, although aware that students use mobile devices to socialize, were unaware of the frequency by which students use the devices for learning opportunities. Finally, students and teachers both agree that the use of mobile devices in schools, albeit a difficult

transition, will help increase student motivation, improve overall achievement levels, and create a more positive school culture.

The conclusions are: (a) students have nearly ubiquitous access to mobile devices outside of the classroom, yet teachers still remain reluctant to accept the devices as learning tools because teachers feel the need for additional support and training to demonstrate appropriate knowledge and expertise to convincingly use the devices with students; (b) teachers are not aware of the everyday dependency of students on these devices for communication, collaboration, and educational purposes; therefore teachers have not made the necessary efforts to integrate the devices into their curricula; and (c) teachers and students agree about the potential for mobile devices to spark the creativity of learners, create a more positive classroom learning environment, and increase student motivation; yet students will need to understand proper mobile device etiquette in school, and teachers will need additional training to effectively manage a mobile learning environment.

Recommendations for further research include a comparative empirical research study to determine which of two devices is better for learning purposes, a comparative study investigating the uses of mobile devices at schools where the devices are allowed in the classrooms versus schools in which the devices are prohibited, and a study that investigates the uses of mobile devices by students for learning in schools versus the uses of the devices in informal settings.

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APPENDIX A

Email to Inform Teachers About the Research and the Online Survey

To: Teachers

From: Jason Messinger

Subject: Research on Mobile Learning

Hello teachers,

As some of you may already be aware, I have been working on achieving a doctorate from Pepperdine University in Educational Technology. My ultimate hope is to utilize the degree to obtain a position in secondary administration, a district-level position, or even a future position in higher education. For my dissertation, I have chosen to study the perceptions and attitudes of high school students versus teachers regarding the use of mobile devices to support or encourage learning inside and/or outside the traditional classroom using ~~XXX~~ High School as the subject school.

The main data collection instruments for my research will be an online survey and a subsequent focus group for teachers. The survey can be accessed by clicking on the link below. My hope is that all teachers will have completed the online survey on or before Friday August 19, 2011. Should you decide to participate you will want to give yourself at about 15 minutes to complete the survey. Although your participation in the research is purely voluntary, please keep in mind that the more teachers who complete the survey, the more accurate the research data will be. Also, please understand that although the research may not be of immediate benefit to us (teachers) or our students, the implications of such research are rather far-reaching. As such, I will be happy to share the results of the surveys and the subsequent focus groups, for which I will be sending another email to recruit the involvement of willing teachers and students, with any person who wishes to see the data.

https://www.surveymonkey.com/s/teachers~~xxx~~

I thank you in advance for your assistance in helping me complete this monumental task of compiling and organizing data into a meaningful document that may inevitably forecast the future of high school education as we progress further into the 21st century. If you have any questions or have any trouble accessing the survey, please contact me.

Respectfully,

Jason Messinger

APPENDIX B

Follow-Up Email for Teachers Who Have Not Completed the Survey

To: Teachers

From: Jason Messinger

Subject: Have you completed your survey?

Hello teachers,

Due to the fact that when you completed your survey, there was no identifying information asked of you, I am unaware of who has or has not yet completed the survey. At this point, 25 out of a total of 98 teachers have completed and submitted their surveys. If you are one of these 25 teachers, thank you very much for taking the time to contribute to my research. If you still have not had the opportunity to access the survey, there is still time. The survey will officially close on Friday, which means there is still one week to get your surveys completed.

By following the link below, you will be taken to the online survey for which you should set aside approximately 15 minutes to input all your responses. If for some reason you are having difficulty accessing the survey or need assistance of any kind, please contact me and I will be happy to help.

Survey Link: https://www.surveymonkey.com/teachers~~xxx~~

Thank you again to all of those teachers who have already responded. And thank you to those teachers who will be responding before Friday's deadline. I will be sending an additional email to recruit the participation of teachers for a focus group, which will be held after school in the next couple of weeks.

Respectfully,

Jason Messinger

APPENDIX C

Email Informing Teachers About the Focus Group

To: Teachers

From: Jason Messinger

Subject: Teacher Focus Group

Hello teachers,

I appreciate all of the responses to my survey that you were able to provide. I realize that we are all busy and finding an extra 15 minutes to complete a survey at this time of year can often be a challenging task. However, to further my research and achieve a better understanding of some of the open-ended responses that were provided by teachers (and students) on the initial survey, I will also be conducting structured focus groups.

The focus group will meet for roughly 45-60 minutes in my classroom, Room 8-14. I am looking for up to 10 eager teachers to be involved in the session. I will also be conducting a student focus group separately from the teacher groups for which I will be recruiting students, as well. I will provide light snacks and refreshments at the focus group for your enjoyment and as an incentive to participate. Because participation in the group is limited to 10 teachers, should I get responses from more than 10 teachers, I will randomly select 10 teachers from the response pool.

The focus group will be held on Friday, August 19th at 3:00 pm in Room 8-14. I was pleased with the response to the survey and am hopeful that the focus group garners an equally positive response. Please reply to this message to indicate your intent to participate in Wednesday's teacher focus group as soon as possible.

Once the maximum number of allowable participants has been reached, an additional email will be sent out indicating whether or not you have been selected to participate. Thank you in advance for your future participation.

Respectfully,

Jason Messinger

APPENDIX D

Email Informing Parents About the Research and the Online Survey

Dear Parent:

My name is Jason Messinger. I am a doctoral student in Educational Technology at Pepperdine University, Graduate School of Education and Psychology as well as math teacher at ~~XXX~~ High School. I am currently in the process of recruiting individuals for a study entitled, "m-learning: an exploration of the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning." The professor supervising my work is Dr. Paul Sparks. My study is designed to investigate student and teacher experiences with various forms of mobile technologies, such as the iPod, smartphones, laptop computers, e-book readers, tablet PCs, and iPads or other slates. Therefore, I am inviting students who attend the high school to be involved in my study. Please understand that participation in my study is strictly voluntary. The following is a description of what participation in my study will entail, the terms for participating in the study, and a discussion of the rights of any study participant. Please read this information carefully before deciding whether or not you wish to allow your child to participate.

If you should allow your child to participate in the study, he/she will be asked to respond to a survey and consider volunteering for a focus group session to be held at a later date. It should take approximately 15 minutes to complete the survey. The survey should be completed alone in a single setting online. The survey data will be completely anonymous. If your child is also interested in participating in a focus group, an announcement will be made via email and/or at school after which they should contact me to indicate their intent to participate. Out of all the volunteers for the focus group, up to 10 total students will be randomly selected to participate in a focus group. The focus group will be audio recorded and transcribed for an accurate record of the event. In the transcription, students will not be identified by name, instead they will be identified as Student 1, 2, 3, etc.

Participation in this study carries the same amount of risk that individuals will encounter during a typical classroom activity. If you have any questions please contact the researcher or IRB Manager Jean Kang at 310-568-2305.

The participant will not directly benefit from participation in the study. If your child should decide to participate and finds that he/she is not interested in completing the survey in its entirety, he/she has the right to discontinue at any point without being questioned about his/her decision. Your child also does not have to answer any of the questions on the survey that he/she prefers not to answer--just leave such items blank.

If the findings of the study are presented to professional audiences or published, no information that identifies your child personally will be released.

If you have any questions regarding the information provided above, please do not hesitate to contact me at the address and/or email provided below. If you have further questions or do not feel I have adequately addressed your concerns, please contact Dr. Paul Sparks at prsparks@pepperdine.edu. If you have questions about your child's rights as a research participant, contact Jean Kang, IRB Manager, Pepperdine University, at jean.kang@pepperdine.edu.

By forwarding this email to your child's email address or sharing this email with your child in any way you are acknowledging that you have read and understand what the participation of your child in my study entails, and are consenting for your child to participate in the study.

Link to survey: https://www.surveymonkey.com/s/students-~~xxx~~

Thank you for taking the time to read this information. I hope you allow your child to participate in my survey.

Respectfully,

Jason Messinger, Doctoral Candidate
Pepperdine University
6100 Center Drive
Los Angeles, CA 90045
jsmessin@pepperdine.edu

APPENDIX E

Assent Form for Survey

Please read this information carefully before deciding whether or not you wish to participate.

If you should decide to participate in the study, finish reading this disclaimer and then check "submit" below to acknowledge your acceptance of the terms of this agreement. If you wish to consider volunteering for a focus group session, I will be recruiting individuals (students and teachers) to participate in separate focus groups within the next couple of weeks. Please see me or email me if you are interested. This survey should take approximately 15 minutes to complete. Please complete the survey alone in a single setting.

Participation in this study carries the same amount of risk that individuals will encounter during a typical classroom activity. Participants will not directly benefit from participation in the study. If you should decide to participate and find you are not interested in completing the survey in its entirety, you have the right to discontinue at any point without being questioned about your decision. You also do not have to answer any of the questions on the survey that you prefer not to answer--just leave these items blank.

If the findings of the study are presented to professional audiences or published, no information that identifies you personally will be released.

By completing this survey, you are acknowledging that you have read and understand what your participation in this study entails, and are consenting to participate in the study. Thank you for taking the time to read this information. I hope you decide to complete the survey.

Kindly,

Mr. Messinger

APPENDIX F

Parental Consent Form for Student Focus Group

m-Learning: an exploration of the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning

Dear Parent:

My name is Jason Messinger. I am a doctoral student in Educational Technology at Pepperdine University, Graduate School of Education and Psychology as well as math teacher at ~~XXX~~ High School. I am currently in the process of recruiting individuals for a study entitled, "m-learning: an exploration of the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning." The professor supervising my work is Dr. Paul Sparks. My study is designed to investigate student and teacher experiences with various forms of mobile technologies, such as the iPod, smartphones, laptop computers, e-book readers, tablet PCs, and iPads or other slates. Therefore, I am inviting students who attend ~~XXX~~ High School to be involved in my study. Please understand that participation in my study is strictly voluntary. The following is a description of what participation in my study will entail, the terms for participating in the study, and a discussion of the rights of any study participant. Please read this information carefully before deciding whether or not you wish to allow your child to participate.

More than likely your child has already participated in the survey. I am now considering students who wish to volunteer for a focus group session to be held next week. If your child is interested in participating in a focus group, please contact me at the email address below or have you child come see me at school to indicate their intent to participate. Out of all the volunteers for the focus group, up to 10 total students will be randomly selected to participate in a focus group. Light snacks and refreshments will be served as an incentive for students to participate. The focus group, which will last about 45-60 minutes, will be audio recorded and transcribed for an accurate record of the event. In the transcription, students will not be identified by name; instead they will be identified as Student 1, 2, 3, etc.

Participation in this study carries the same amount of risk that individuals will encounter during a typical classroom activity. If you have any questions please contact the researcher or IRB Manager Jean Kang at 310-568-2305.

If the findings of the study are presented to professional audiences or published, no information that identifies your child personally will be released.

If you have any questions regarding the information provided above, please do not hesitate to contact me at the address and/or email provided below. If you have further questions or do not feel I have adequately addressed your concerns, please contact Dr. Paul Sparks at prsparks@pepperdine.edu. If you have questions about your child's rights

as a research participant, contact Jean Kang, IRB Manager, Pepperdine University, at jean.kang@pepperdine.edu.

By signing this form, you are acknowledging that you have read and understand what the participation of your child in my study entails, and are consenting for your child to participate in a focus group. Once you sign this form, please send it to school with your student. Your student can bring this form to my classroom (Room 8-14) and will then be eligible to participate in a student focus group.

Thank you for taking the time to read this information. I hope you allow your child to participate in my study.

Respectfully,

Jason Messinger, Doctoral Candidate
Pepperdine University
6100 Center Drive
Los Angeles, CA 90045
jsmessin@pepperdine.edu

By signing below, you are giving consent for your child/student to participate in a student focus group as part of my study.

_____ _____

Parent's Signature Date

APPENDIX G

m-learning Teacher Survey

The following survey contains information pertaining to mobile learning (also known as m-learning). For purposes of this study the definition of m-learning is: a process of education involving a learner positioned in any random location with the assistance of a handheld, portable device that can connect wirelessly to the Internet in an effort to support or extend classroom learning or create new, intentional or unintentional informal learning opportunities. The portable devices that will be constituted as acceptable mobile learning devices for this survey are limited to the following list: (a) cell phones or smartphones; (b) mp3 players (including Apple's iPod); (c) personal digital assistants (PDAs); (d) e-book readers; (e) laptop computers; (f) tablet PCs; and (g) slates (including Apple's iPad and Motorola's XOOM).

Demographic Questions

1. How many years of experience do you have in education?
   a. 0 to 5
   b. 6 to 10
   c. 11 to 15
   d. 16 to 20
   e. 21 to 25
   f. 25+

2. Which category best describes your primary subject/specialty? (mark only one)
   a. English
   b. History/social science
   c. Mathematics
   d. Science/health
   e. Computers/vocational education
   f. Fine/performing arts
   g. Physical education
   h. Other

3. Which category best represents your age range (in years)?
   a. 20 to 30
   b. 31 to 40
   c. 41 to 50
   d. 51 to 60
   e. 61 to 70
   f. 70+

4. Which best describes your nationality?
   a. African American
   b. Asian
   c. Caucasian/White

d. Filipino/Pacific Islander
e. Hispanic/Latino
f. Other
g. Decline to state

5. What is your gender?
   a. Male
   b. Female

6. Please rate your overall comfort level with technology.
   a. If you give me instructions, I am still unable to figure it out.
   b. I am okay, but often ask for assistance.
   c. I can get by and rarely ask for assistance.
   d. I am able to work independently and can usually figure problems out on my own.
   e. I am very proficient, so much so that others often seek my advice.

7. I have used (more than once) the following mobile technologies (mark all that apply).
   a. Cell phone or Smartphone
   b. mp3 player (including an iPod)
   c. PDA
   d. e-book reader
   e. Laptop computer
   f. Tablet PC (including an iPad or XOOM)
   g. None of the above

8. I own the following mobile technologies (mark all that apply).
   a. Cell phone or Smartphone
   b. mp3 player (including an iPod)
   c. PDA
   d. e-book reader
   e. Laptop computer
   f. Tablet PC (including an iPad or XOOM)
   g. None of the above

9. I use the following to assist me with the creation of lesson plans or my everyday interactions with my students (mark all that apply).
   a. Cell phone or Smartphone
   b. mp3 player (including an iPod)
   c. PDA
   d. e-book reader
   e. Laptop computer
   f. Tablet PC (including an iPad or XOOM)
   g. None of the above

Current use of technology by students

For Questions 10 through 20 use the following scale: (a) never, (b) seldom (1 to 2 times per semester), (c) sometimes (1 to 2 times per month), (d) often (at least once a week), or (e) almost daily.

10. Students in my classes engage in planned activities that involve the use of mobile devices to solve real-world problems or issues.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

11. I encourage the use of mobile technologies with my students to supplement the curriculum and reinforce specific classroom instruction.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

12. In my classroom, mobile technologies are used only by me (the teacher) and **not** by my students.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

13. My students use mobile devices for research purposes that require them to investigate issues/problems, take a position, make decisions, and/or seek a solution.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

14. In my classroom, students are permitted to use their mobile devices.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

15. To the best of my knowledge, my students use mobile devices outside the classroom to (a) collaborate with others, (b) communicate with others, and/or (c) research problems of personal interest that address specific content areas.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

16. I promote, monitor, and model the ethical use of mobile technologies in my classroom.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

17. I encourage students to use mobile devices while they are in my classroom to promote student creativity and innovative thinking.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

18. I encourage students to use their mobile devices outside my classroom to support classroom instruction or to create further learning opportunities.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

19. My students use many forms of mobile technologies (e.g., iPods, iPads, e-book readers) to engage in collaborative problem-solving opportunities either inside or outside my classroom.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

20. I model and facilitate the effective use of current and emerging mobile devices, applications, and programs to support teaching and learning in my classroom.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

Future use of technology by students

For Questions 21 through 30, use the same scale (a through e) that was used to answer the previous questions.

21. If mobile devices were permitted in school, students in my classes would engage in planned activities that involve the use of these devices to solve real-world problems or issues.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

22. If mobile devices were permitted in school, I would encourage their use with my students to supplement the curriculum and reinforce specific classroom instruction.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

23. If mobile devices were permitted in school, they would only be used by me (the teacher) and **not** by my students.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

24. If mobile devices were permitted in school, my students might use them for research that requires the investigation of issues/problems, taking a position, making decisions, and/or seeking a solution.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

25. I would be comfortable allowing students to use mobile devices in my classroom if the devices were permitted in school.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

26. If mobile devices were allowed in schools, I would encourage my students to use mobile devices outside the classroom to: (a) collaborate with others; (b) communicate with others; and/or (c) research problems of personal interest that address specific content areas.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

27. I would be more apt to promote, monitor, and model the ethical use of mobile technologies in my classroom if mobile devices were permitted in school.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

28. If mobile devices were permitted in school, I would encourage students to use the devices in my classroom to promote creativity and innovative thinking.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

29. If mobile devices were permitted in school, I would encourage students to use the devices outside the classroom to promote creativity and innovative thinking.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

30. I would be more apt to model and facilitate the effective use of current and emerging mobile devices, applications, and programs to support teaching and learning in my classroom if mobile devices were permitted in school.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

Open Ended Questions

31. What do you feel are the biggest challenges facing the implementation of mobile devices in schools? _____
    _____
    _____
    _____

32. How do you feel about the future of mobile devices in the classroom? _____
_____
    _____
    _____
    _____

33. What are your thoughts on using mobile devices outside the classroom to support in class instruction, rather than having students bring the devices to school? _____
_____
    _____
    _____
    _____

34. As mobile technologies continue to advance, how are you using or how will you use your own mobile devices (e.g., cell phone, iPod, e-book reader, PDA, tablet PC, laptop) to create intentional (planned) or unintentional (spur of the moment) informal learning opportunities?
    _____
_____
    _____
    _____

35. Describe how you envision high school students using mobile devices to provide the most ideal learning situations for themselves either inside or outside the classroom. _____
_____
    _____
    _____

APPENDIX H

m-learning Student Survey

The following survey contains information pertaining to mobile learning (also known as m-learning). For purposes of this study the definition of m-learning is: a process of education involving a learner positioned in any random location with the assistance of a handheld, portable device that can connect wirelessly to the Internet in an effort to support or extend classroom learning or create new, intentional or unintentional informal learning opportunities. The portable devices that will be constituted as acceptable mobile learning devices for this survey are limited to the following list: (a) cell phones or smartphones; (b) mp3 players (including Apple's iPod); (c) personal digital assistants (PDAs); (d) e-book readers; (e) laptop computers; (f) tablet PCs; and (g) slates (including Apple's iPad and Motorola's XOOM).

Demographic Questions

1. I primarily get the following grades on my report cards.
   a. Mostly A's (4.0 or above GPA)
   b. Some A's and some B's (3.5-3.9 GPA)
   c. Some B's and some C's (2.5-3.4 GPA)
   d. Some C's and some D's (1.5-2.4 GPA)
   e. Worse than that (1.4 or lower GPA)
   f. Do not really know

2. Which is your favorite subject? (mark only one)
   a. English
   b. History/social science
   c. Mathematics
   d. Science/health
   e. Computers/vocational education
   f. Fine/performing arts
   g. Physical education
   h. Other

3. Which represents your current grade level?
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior

4. Which best describes your nationality?
   a. African American
   b. Asian
   c. Caucasian/White
   d. Filipino/Pacific Islander
   e. Hispanic/Latino

f. Other
g. Decline to state

5. What is your gender?
   a. Male
   b. Female

6. Please rate your overall comfort level with technology.
   a. If you give me instructions, I am still unable to figure it out.
   b. I am okay, but often ask for assistance.
   c. I can get by and rarely ask for assistance.
   d. I am able to work independently and can usually figure problems out on my own.
   e. I am very proficient, so much so that others often seek my advice.

7. I have used (more than once) the following mobile technologies (mark all that apply).
   a. Cell phone or Smartphone
   b. mp3 player (including an iPod)
   c. PDA
   d. e-book reader
   e. Laptop computer
   f. Tablet PC (including an iPad or XOOM)
   g. None of the above

8. I own the following mobile technologies (mark all that apply).
   a. Cell phone or Smartphone
   b. mp3 player (including an iPod)
   c. PDA
   d. e-book reader
   e. Laptop computer
   f. Tablet PC (including an iPad or XOOM)
   g. None of the above

9. I use the following to assist me with the creation of lesson plans or my everyday interactions with my students (mark all that apply).
   a. Cell phone or Smartphone
   b. mp3 player (including an iPod)
   c. PDA
   d. e-book reader
   e. Laptop computer
   f. Tablet PC (including an iPad or XOOM)
   g. None of the above

Current use of technology by students

For Questions 10 through 20 use the following scale: (a) never, (b) seldom (1 to 2 times per semester), (c) sometimes (1 to 2 times per month), (d) often (at least once a week), or (e) almost daily.

10. In some of my classes, I engage in learning activities that involve the use of mobile devices to solve real-world problems or issues.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

11. I use mobile technologies in the classroom and/or to study classroom content.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

12. In some of my classes mobile technologies are used only by me (the student) and not by my teachers.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

13. I frequently use mobile devices for research purposes that require investigating problems, taking a position, making decisions, and/or seeking a solution.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

14. In my classes, students are permitted to use their mobile devices.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

15. I am likely to use mobile devices when I am outside the classroom to (a) collaborate with others, (b) communicate with others, and/or (c) research problems of personal interest that address specific content areas.
    a. Never

b. Seldom
c. Sometimes
d. Often
e. Almost daily

16. My teachers promote, monitor, and model the ethical use of mobile technologies in their classrooms.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

17. My teachers encourage me to use mobile devices while in the classroom to learn and to spark my creativity.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

18. I use mobile devices outside the classroom to learn and to spark my own creativity.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

19. I use many forms of mobile technologies (e.g., iPods, iPads, e-book readers) to engage in collaborative problem-solving opportunities either inside or outside the classroom.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

20. My teachers model and facilitate the effective use of current and emerging mobile devices, applications, and programs to support teaching and learning in their classrooms.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

Future use of technology by students

For Questions 21 through 30, use the same scale (a through e) that was used to answer the previous questions.

21. If mobile devices were permitted in school, I would use them to engage in learning activities to solve real-world problems or issues.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

22. I would use mobile technologies to supplement what I learned in class and to reinforce specific classroom content.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

23. If mobile devices were permitted in school, I would use them in the classroom, but I do not feel that my teachers would.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

24. If mobile devices were permitted in school, I might use such devices for research purposes that require investigating a problem, taking a position, making a decision, and/or seeking out a solution.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

25. I would be comfortable learning with the use of mobile technologies either inside or outside the classroom.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

26. If mobile devices were allowed in schools, I would use the devices outside the classroom to (a) collaborate with others, (b) communicate with others, and/or (c) research problems of personal interest that address specific content areas.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

27. If they were allowed in school, my teachers would be more prone to promote, monitor, and model the ethical use of mobile technologies in their classrooms.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

28. If mobile devices were allowed in school, I would enjoy using the devices in my classes because their use promotes creativity and new ways of thinking.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

29. If my teachers created lessons that encouraged the use of mobile devices, I would enjoy using these devices outside of the classroom to promote creativity and innovative thinking.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

30. I feel that my teachers would be more willing to model and facilitate the effective use of current and emerging mobile devices, applications, and programs in their classrooms if mobile devices were allowed in school.
    a. Never
    b. Seldom
    c. Sometimes
    d. Often
    e. Almost daily

Open Ended Questions

31. What do you feel are the biggest obstacles and/or challenges that high schools may face in their efforts to implement the use of mobile devices in regular classroom instruction? _____
_____
_____
_____
_____

32. How do you feel about the future of mobile devices in the classroom? _____
_____
_____
_____

33. What are your thoughts on using mobile devices outside the classroom to support the instruction that took place in class, rather than having students bring the devices to school? _____
_____
_____
_____

34. As mobile technologies continue to advance, how are you using or how will you use your own mobile devices (e.g., cell phone, iPod, e-book reader, PDA, tablet PC, laptop) to create intentional (planned) or unintentional (spur of the moment) informal learning opportunities? _____
_____
_____
_____

35. Describe how you envision high school students using mobile devices to provide the most ideal learning opportunities for themselves either inside or outside the classroom. _____
_____
_____
_____

APPENDIX I

Focus Group Questions

1) How do you feel about the future of mobile devices in the classroom?

2) What are your thoughts on students using mobile devices outside the classroom to support the instruction that took place in class, rather than having students bring the devices to school?

3) Do you use any mobile devices (e.g., cell phone, iPod, e-book reader, PDA, tablet PC, laptop) for learning? If so, how are you using your own mobile devices to create these planned or spur of the moment learning opportunities?

4) How might you see yourself using mobile devices (e.g., cell phone, iPod, e-book reader, PDA, tablet PC, laptop) to create planned or spur of the moment learning opportunities in the future?

5) Describe how you envision high school students will use mobile technologies to expand the content taught in their classes.

6) How do you feel that high school students will create unique scenarios either inside or outside the classroom to help support their learning?

7) What are the biggest obstacles and/or challenges that high schools will face in trying to implement the use of mobile devices into regular classroom instruction?

8) Additional thoughts, perceptions, and attitudes toward m-learning in high schools.

Further questions:

9) Possible question(s) driven by responses to teacher/student surveys

APPENDIX J

Email That Informs Students About the Focus Group

To: Students

From: Jason Messinger

Subject: Focus Group for Students

Hello students,

Are you interested in mobile learning? Would you like to participate in meaningful research that may shape the future of education? Would you like the opportunity to provide your opinions about the current state of mobile learning in high schools? Please see Mr. Messinger in Room 8-14 if you are interested and you are available next Thursday (insert date) after school (3:00) for about 45-60 minutes to talk about mobile learning. Light snacks and refreshments will be provided. There is a limit of 10 students for the focus group. If more than 10 students agree to participate in the focus group, then Mr. Messinger will randomly select 10 students from the total amount of students who respond. If you are selected, you will receive an email confirming the location that you will need to report to for the focus group.

The focus group will be a teacher-led group in which you speak in a round table discussion about mobile technologies, mobile devices, and how you are or may be able to use mobile devices for learning purposes. Any participant will be required to bring a signed parental consent form to the focus group in order to participate. The parental consent forms will be emailed to every student who is selected for a focus group.

Thank you in advance for your help with my research.

Respectfully,

Mr. Messinger

APPENDIX K

Email That Confirms Participation in a Focus Group

To: Students Selected for Focus Group

From: Jason Messinger

Subject: You have been selected to participate in a student focus group

Hello [insert student name here],

Congratulations! You have been selected as one of 10 participants for an upcoming focus group on mobile learning. The focus group will be held in the ~~XXX~~ High School library on Wednesday August 24, 2011 at 3:00 pm. Light snacks and refreshments will be provided. The session will be audio recorded for an accurate transcription of the events that took place. Even though I will know all of the participants in the focus group, your identities will remain confidential in the writing of my dissertation.

Thank you again for your interest in further contributing to my research on mobile learning. I look forward to seeing you next Wednesday. If for some reason you have changed your mind or have a conflict with the time and date on which the focus group session will be conducted, please email me as soon as possible so that I may fill your slot with the next alternate on the list. If you feel as though you do not want to participate in the focus group after prior to or after arriving, you may ask to leave without being questioned about your decision to do so.

The focus group will be a teacher-led group in which you speak in a round table discussion about mobile technologies, mobile devices, and how you are or may be able to use mobile devices for learning purposes. **Please be sure to bring a signed consent form to the focus group to be eligible to participate**. The consent form is attached to this email for your convenience.

Thank you in advance for your help with my research.

Respectfully,

Mr. Messinger

APPENDIX L

Consent Form for Teacher Participation in Focus Group

m-learning: an exploration of the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning

Hello teachers,

As a doctoral student in Educational Technology at Pepperdine University, Graduate School of Education and Psychology as well as math teacher at ~~XXX~~ High School. I am currently in the process of recruiting individuals for a study entitled, "m-learning: an exploration of the attitudes and perceptions of high school students versus teachers regarding the current and future use of mobile devices for learning." The professor supervising my work is Dr. Paul Sparks. My study is designed to investigate student and teacher experiences with various forms of mobile technologies, such as the iPod, smartphones, laptop computers, e-book readers, tablet PCs, and iPads or other slates. Therefore, I am inviting teachers who attend ~~XXX~~ High School to be involved in my study. Please understand that participation in my study is strictly voluntary. The following is a description of what participation in my study will entail, the terms for participating in the study, and a discussion of the rights of any study participant. Please read this information carefully before deciding whether or not you wish to participate.

More than likely you have already participated in the survey. I am now considering participants who wish to volunteer for a focus group session to be held next week. If you are interested in participating in a focus group, please reply to the email address below or come see me at school to indicate your intent to participate. Out of all the volunteers for the focus group, up to 10 total teachers will be randomly selected to participate in a focus group. Light snacks and refreshments will be served as an incentive for teachers to participate. The focus group, which will last about 45-60 minutes, will be audio recorded and transcribed for an accurate record of the event. In the transcription, you will not be identified by name; instead you will be identified as Teacher 1, 2, 3, etc.

Participation in this study carries the same amount of risk that individuals will encounter during a typical classroom activity. If you have any questions please contact the researcher or IRB Manager Jean Kang at 310-568-2305.

If the findings of the study are presented to professional audiences or published, no information that identifies you personally will be released.

If you have any questions regarding the information provided above, please do not hesitate to contact me at the address and/or email provided below. If you have further questions or do not feel I have adequately addressed your concerns, please contact Dr. Paul Sparks at prsparks@pepperdine.edu. If you have questions about your rights as a research participant, contact Jean Kang, IRB Manager, Pepperdine University, at jean.kang@pepperdine.edu.

By signing this form, you are acknowledging that you have read and understand what participation in a focus group entails. Once you sign this form, please bring it with you to the focus group so that you are eligible to participate.

Thank you for taking the time to read this information. I hope you decide to further contribute to my research.

Respectfully,

Jason Messinger, Doctoral Candidate
Pepperdine University
6100 Center Drive
Los Angeles, CA 90045
jsmessin@pepperdine.edu

By signing below, you are consenting to participate in the teacher focus group as part of my study.

_____ _____

Teacher's Signature Date

APPENDIX M

Tables and Figures

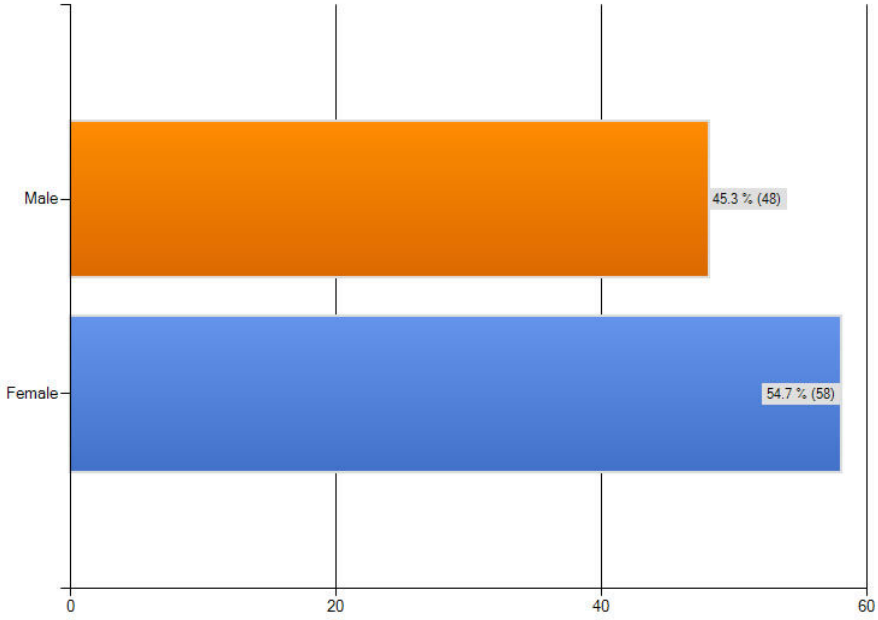

Figure M1. Student gender (%)

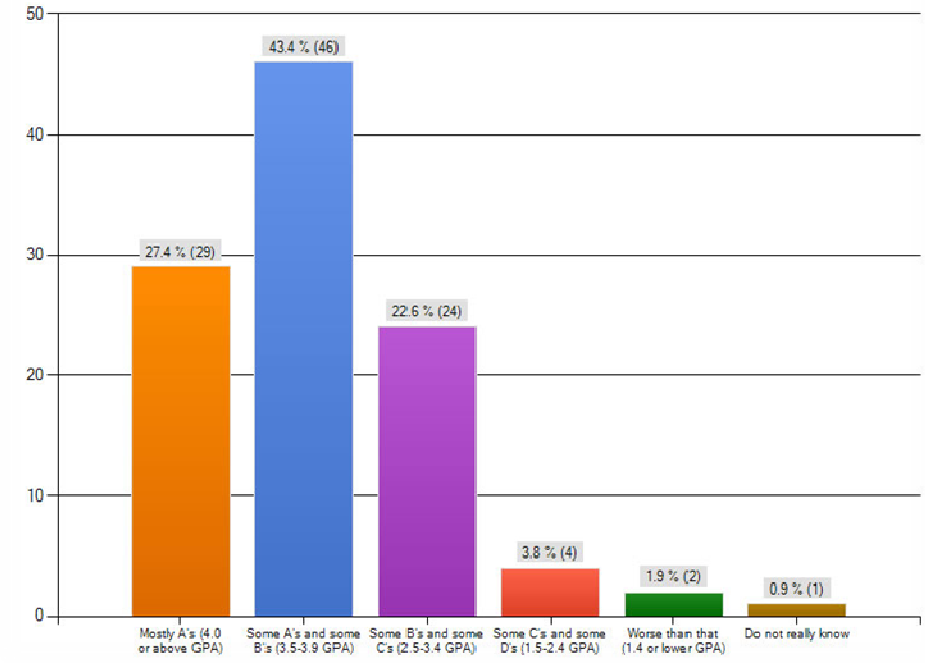

Figure M2: Student grade point average (GPA; %)

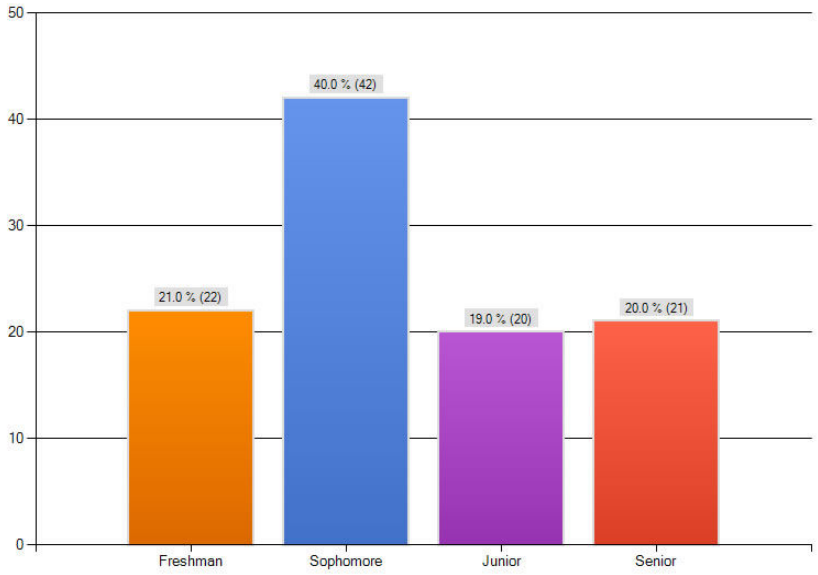

Figure M3. Student grade level (%)

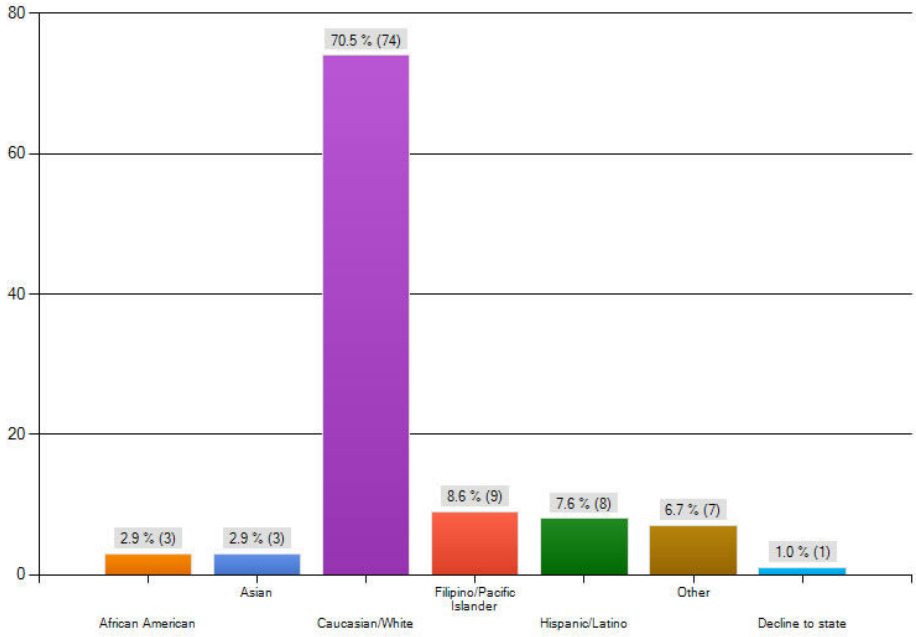

Figure M4. Student nationalities (%)

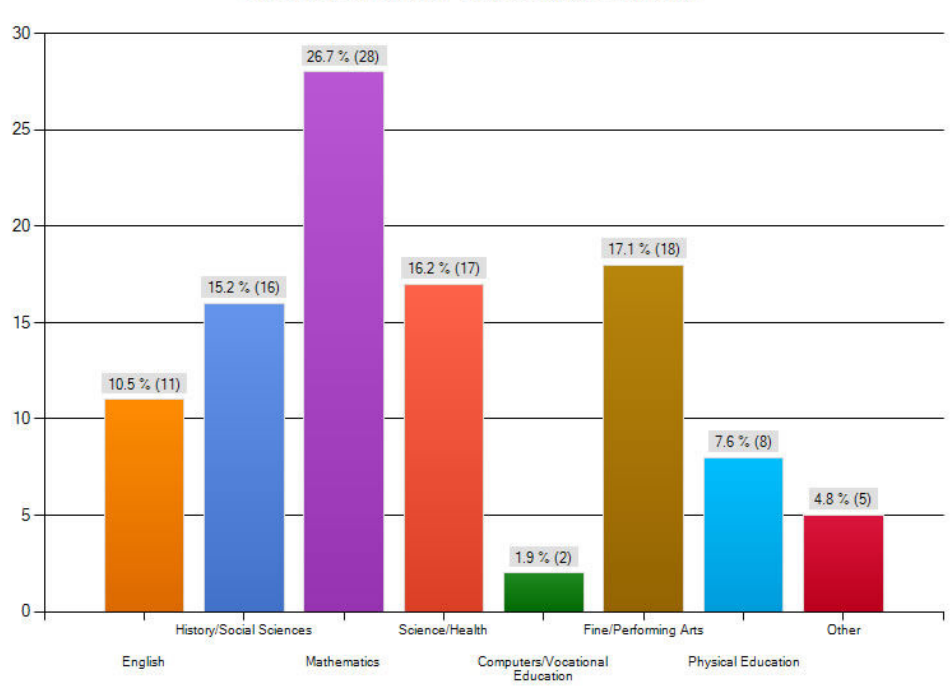

Figure M5. Student favorite subject (%)

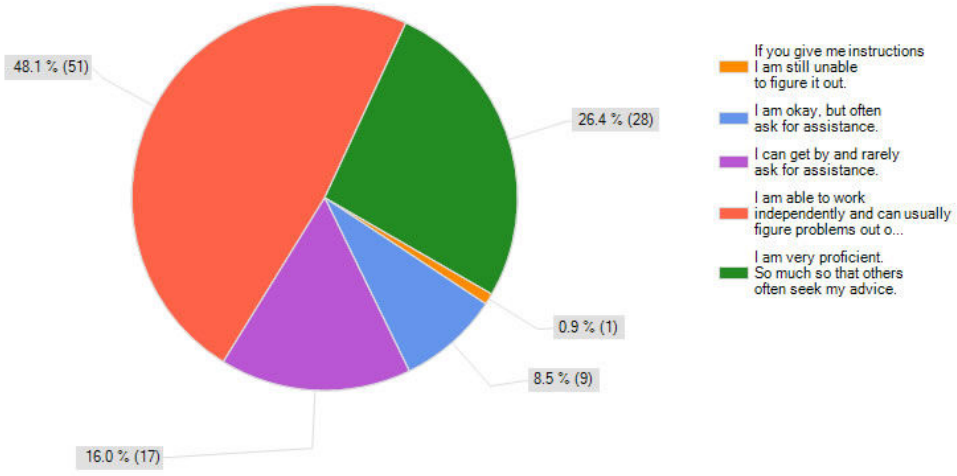

Figure M6. Student comfort with technology (%)

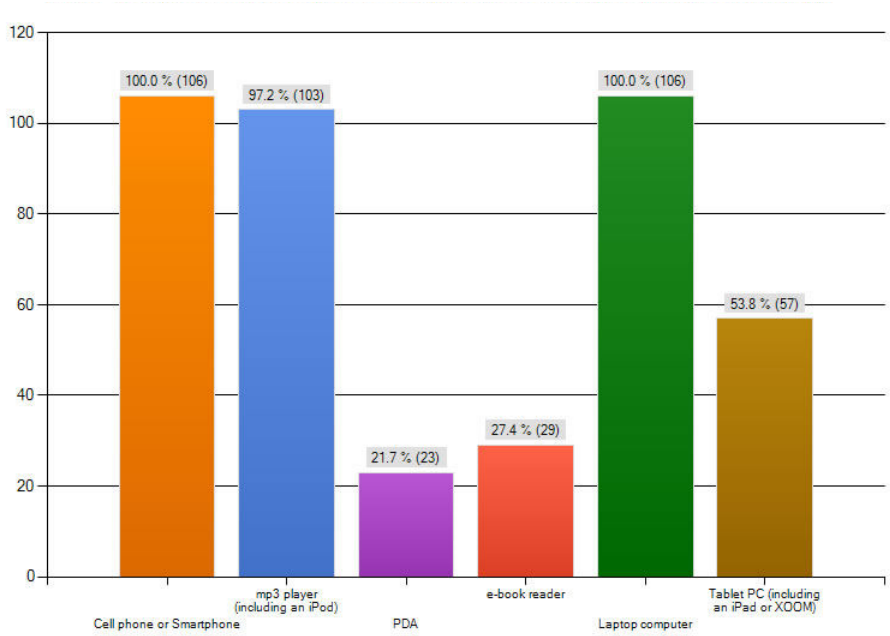

Figure M7. Student mobile devices used (%)

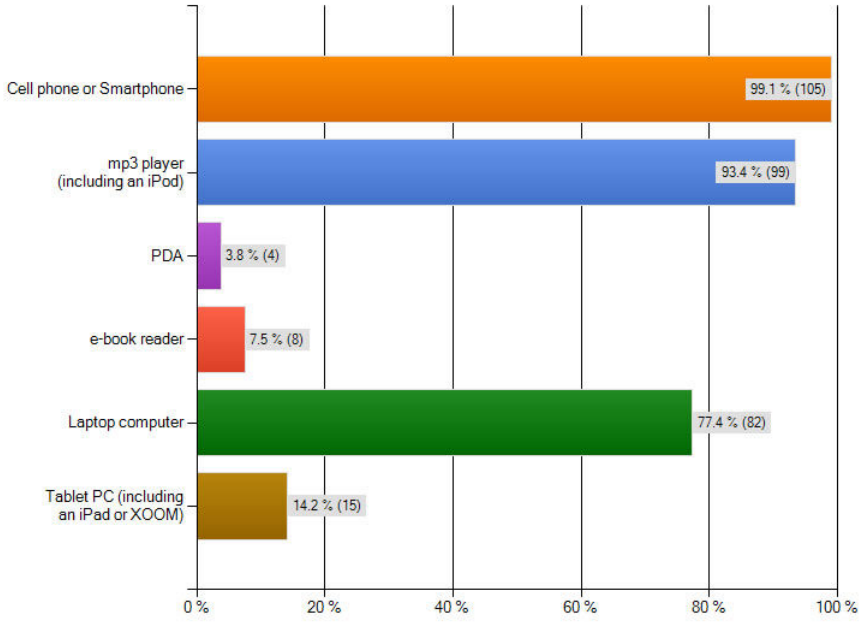

Figure M8. Student mobile devices owned (%)

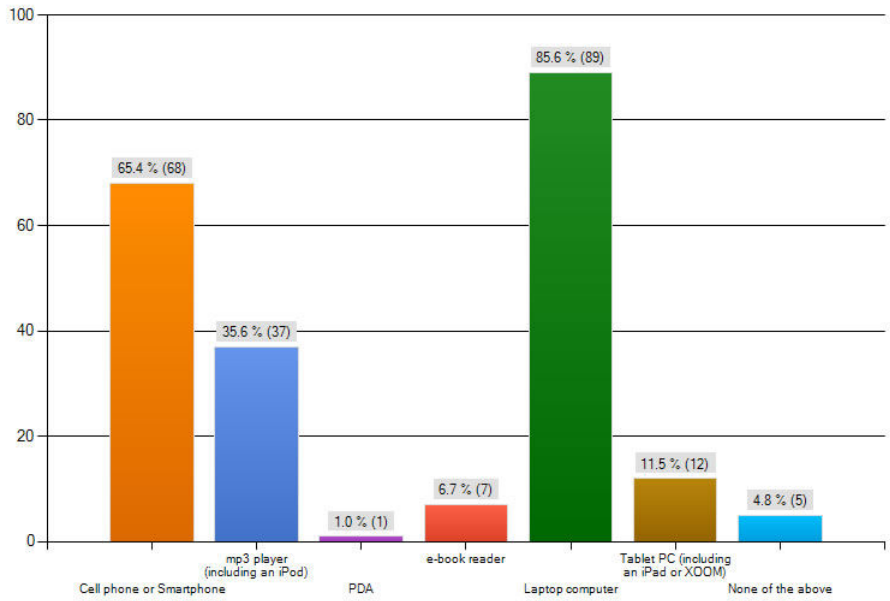

Figure M9. Student mobile devices used for learning purposes (%)

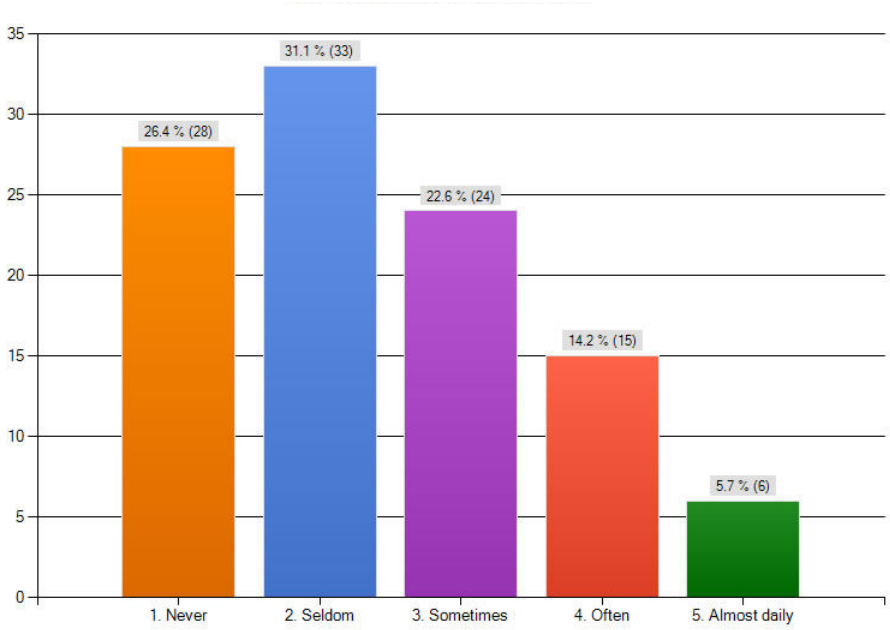

Figure M10. Student responses to Item 10 (%)

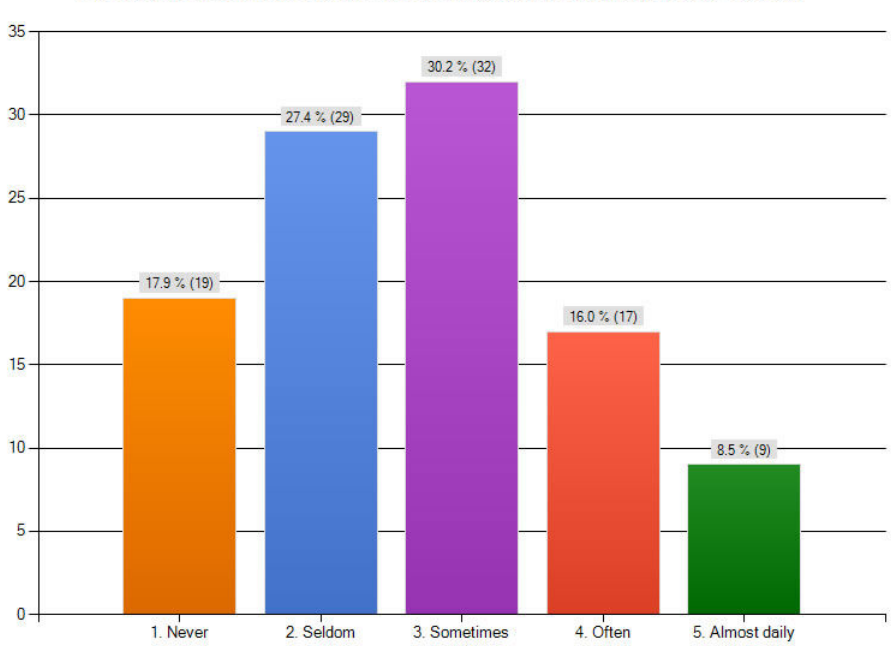

Figure M11. Student responses to Item 11 (%)

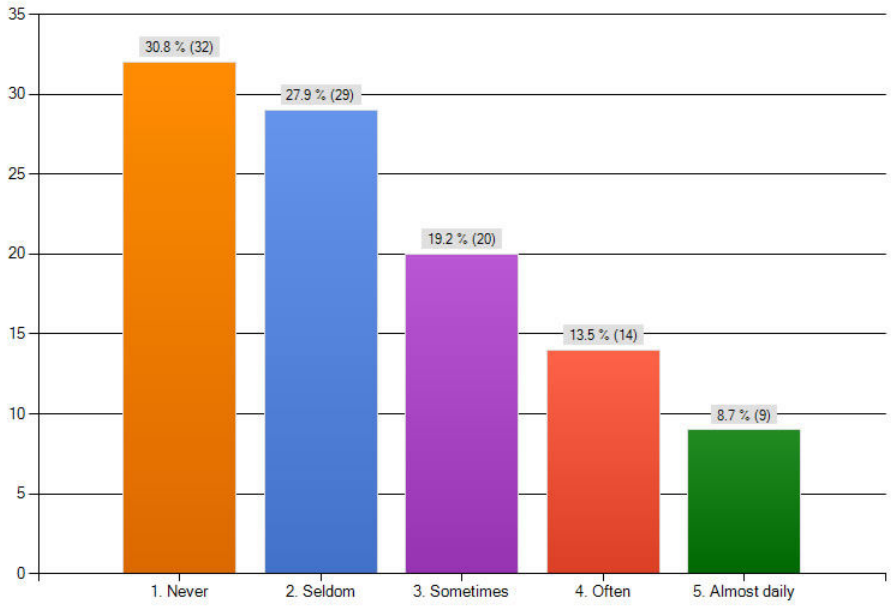

Figure M12. Student responses to Item 12 (%)

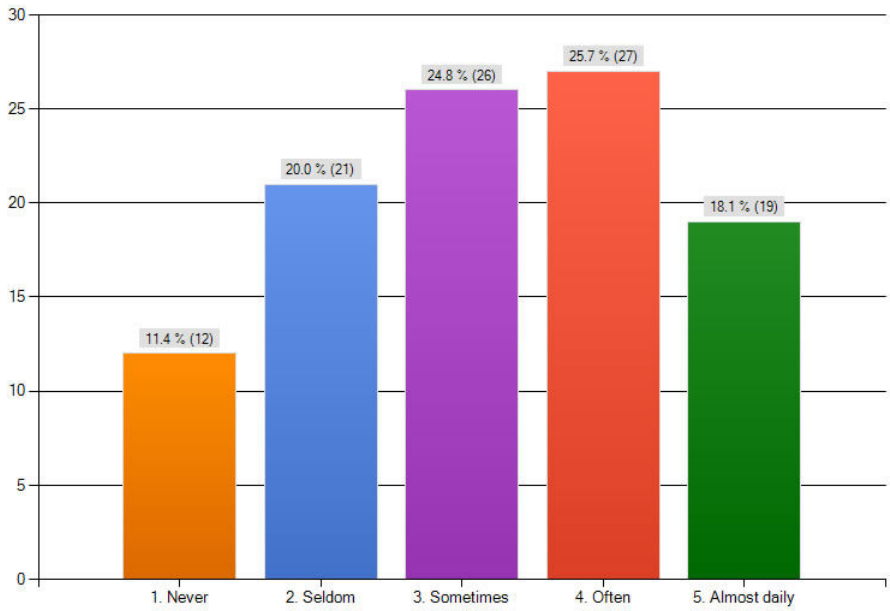

Figure M13. Student responses to Item 13 (%)

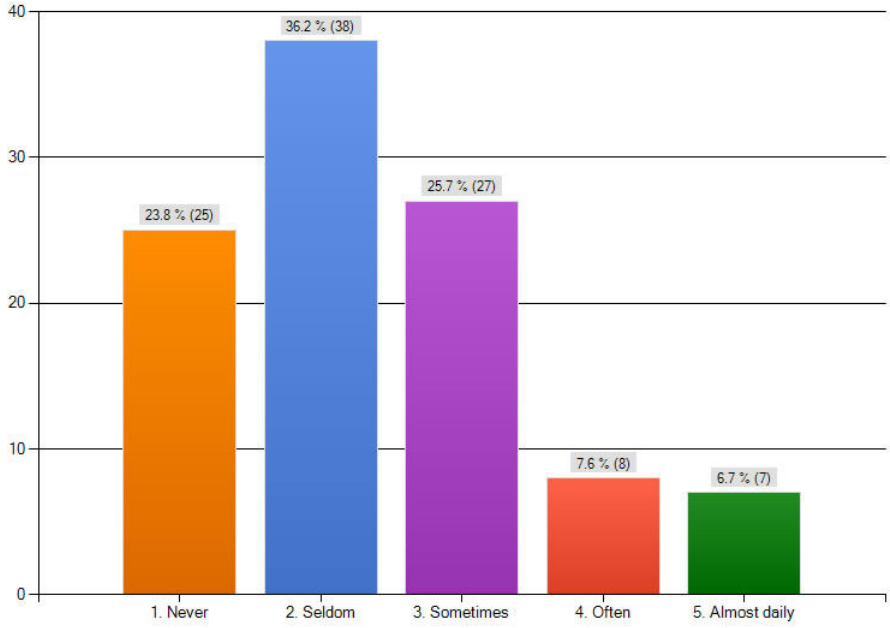

Figure M14. Student responses to Item 14 (%)

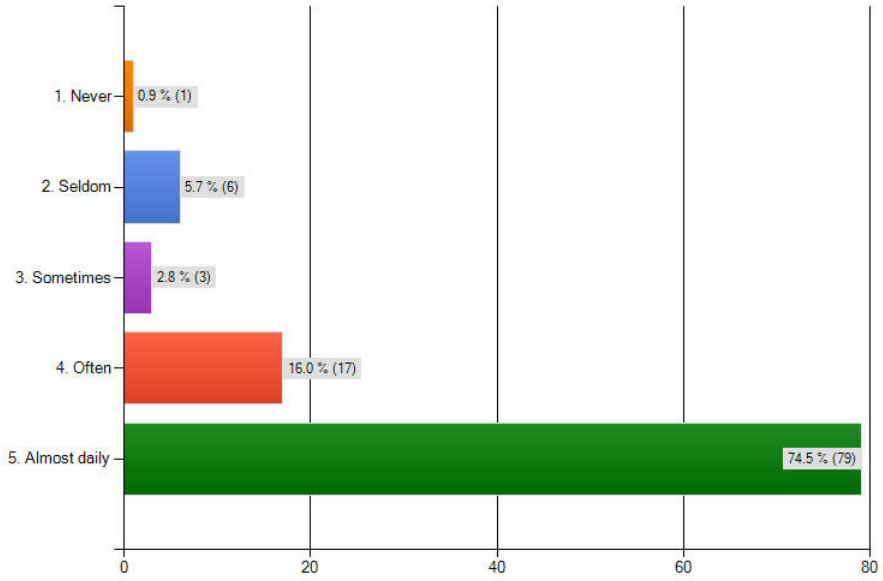

Figure M15. Student responses to Item 15 (%)

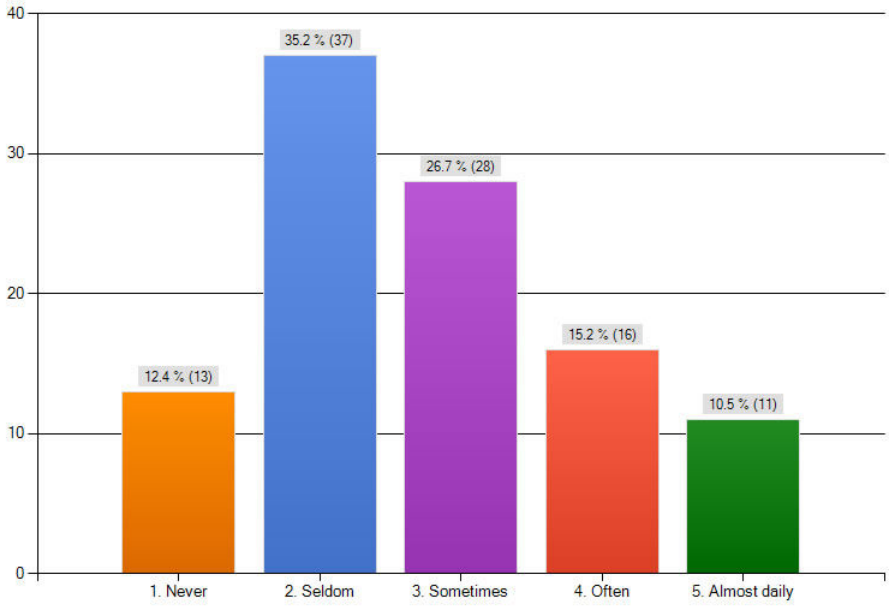

Figure M16. Student responses to Item 16 (%)

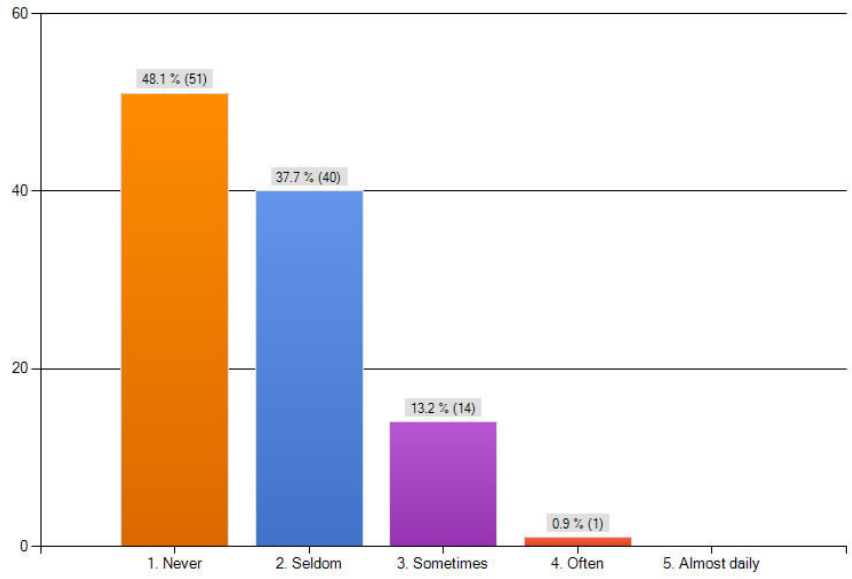

Figure M17. Student responses to Item 17 (%)

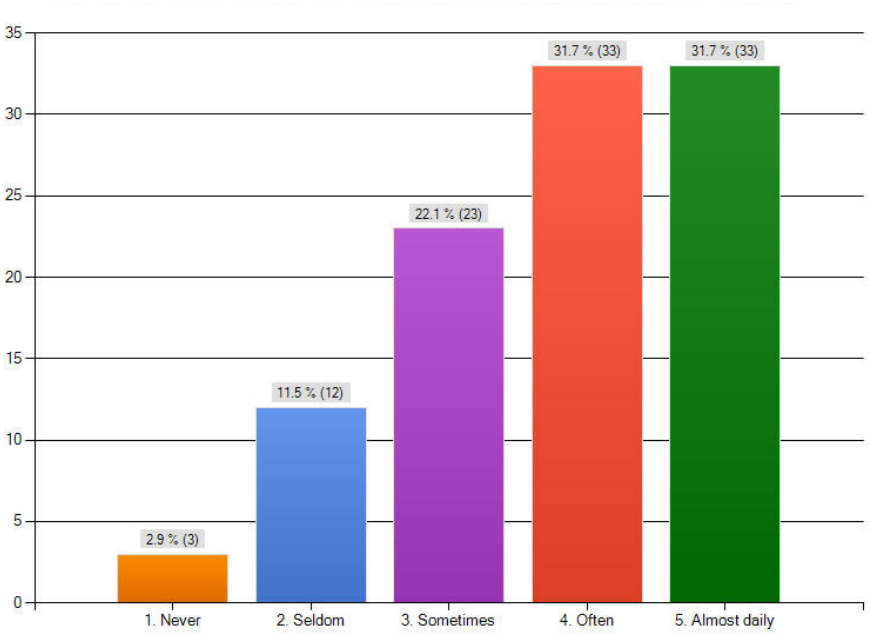

Figure M18. Student responses to Item 18 (%)

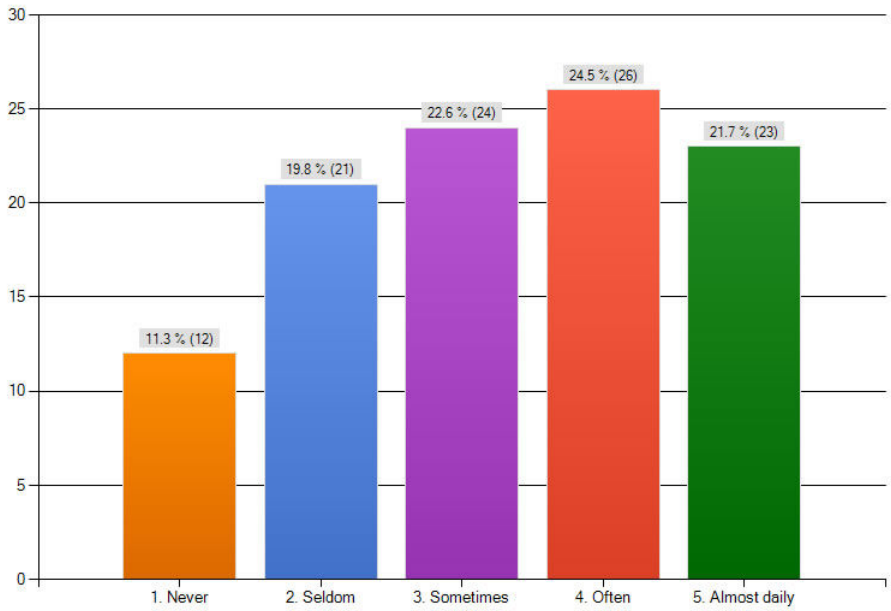

Figure M19. Student responses to Item 19 (%)

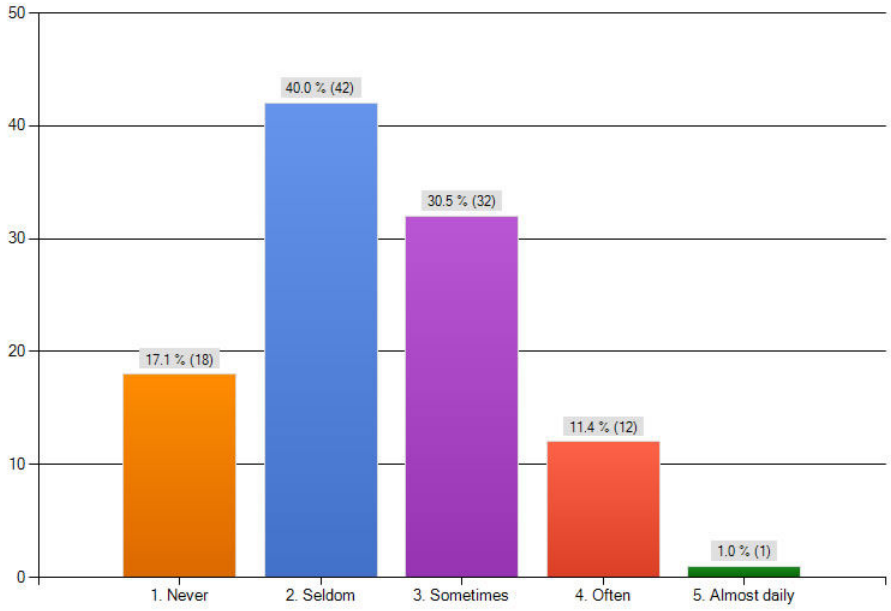

Figure M20. Student responses to Item 20 (%)

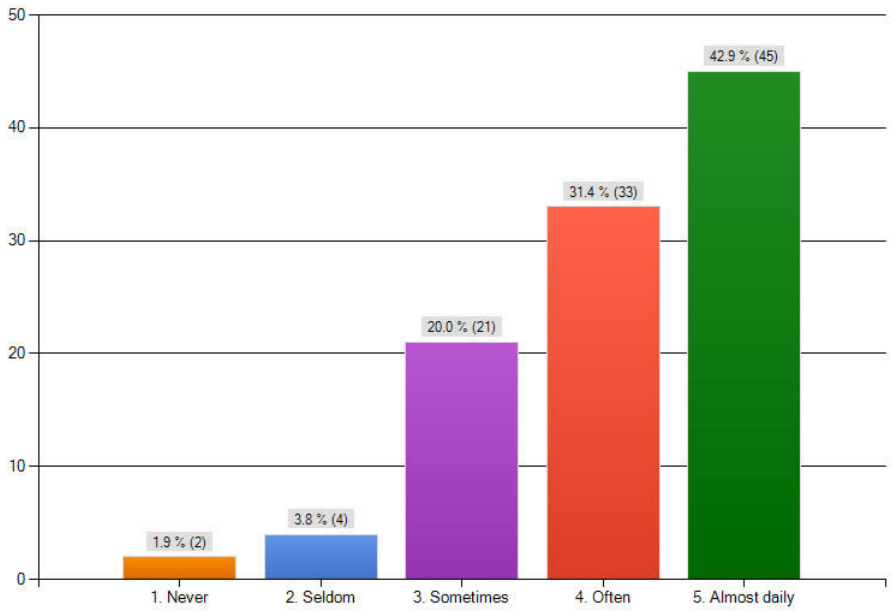

Figure M21. Student responses to Item 21 (%)

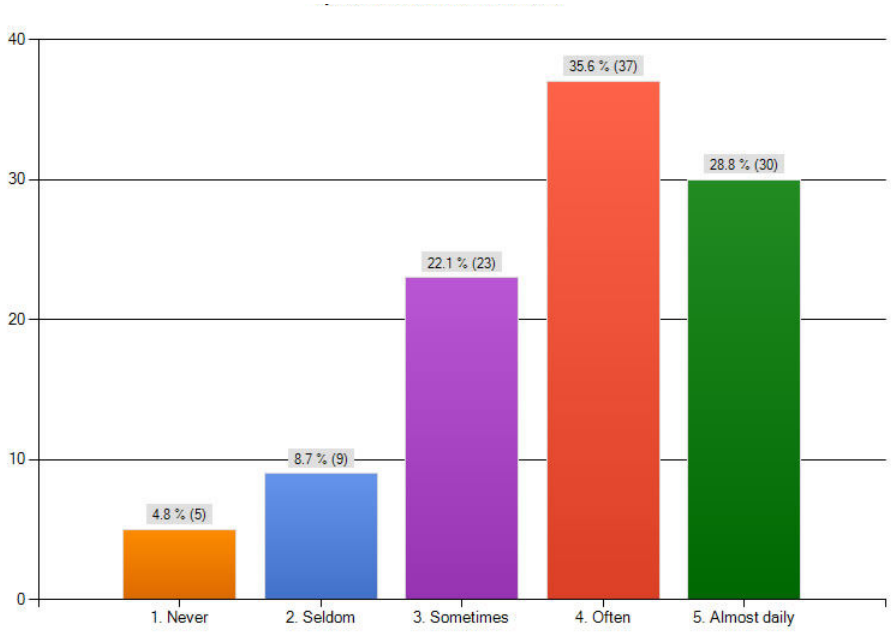

Figure M22. Student responses to Item 22 (%)

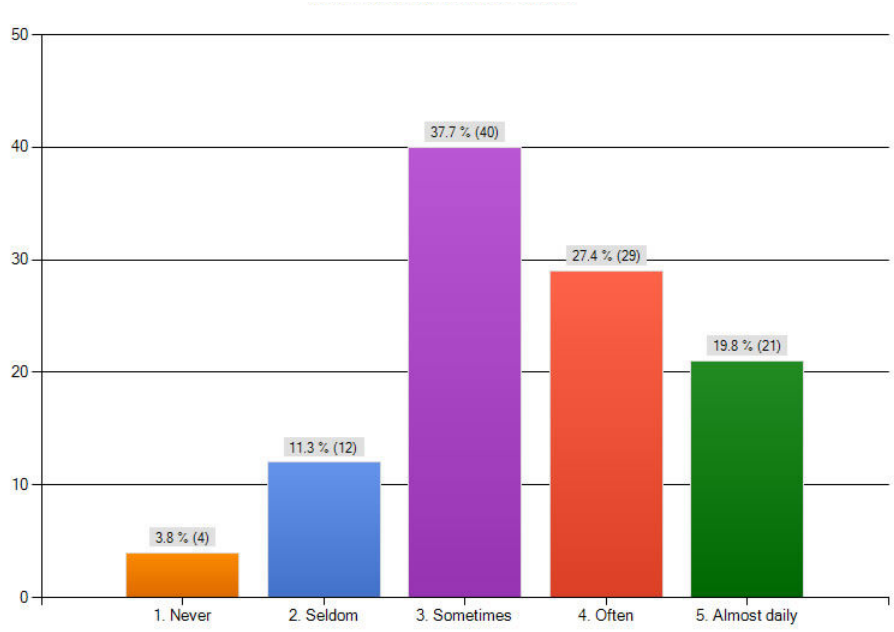

Figure M23. Student responses to Item 23 (%)

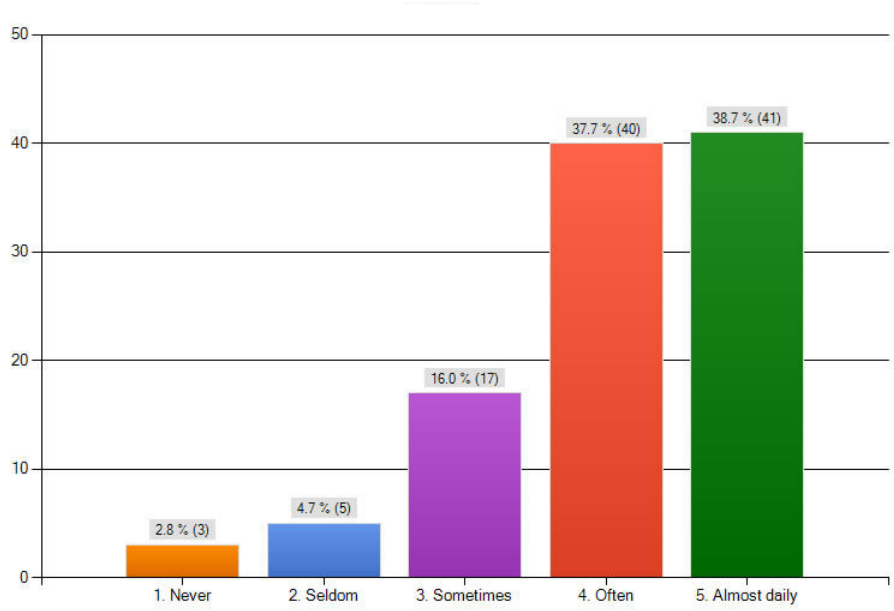

Figure M24. Student responses to Item 24 (%)

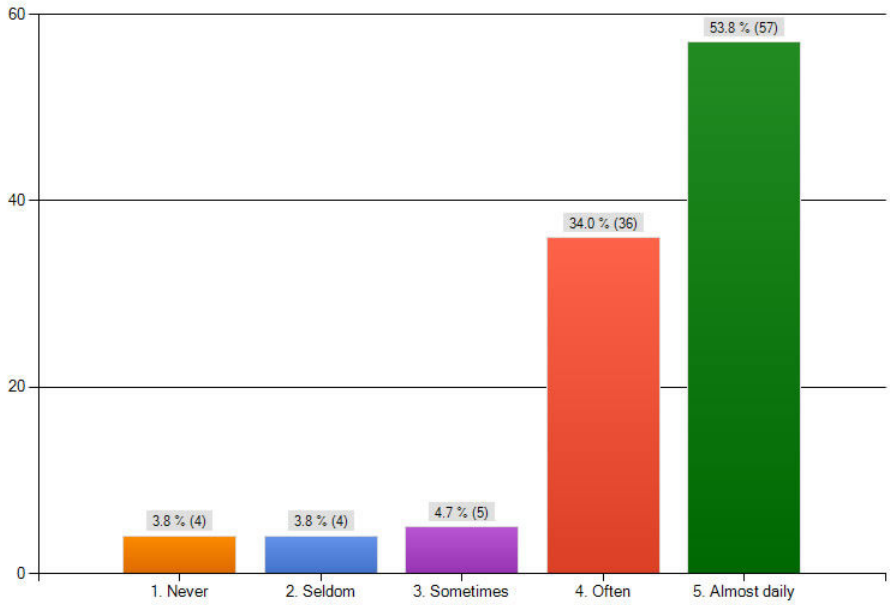

Figure M25. Student responses to Item 25 (%)

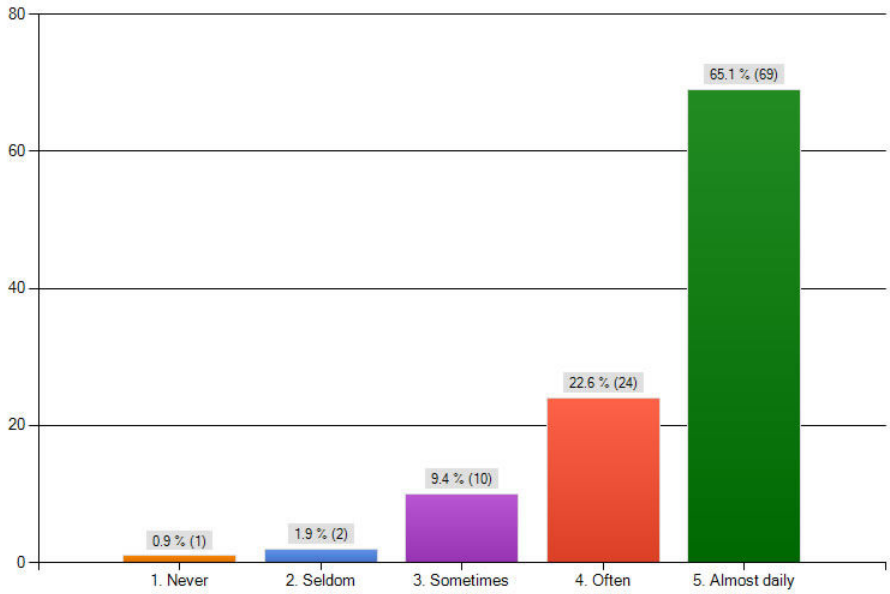

Figure M26. Student responses to Item 26 (%)

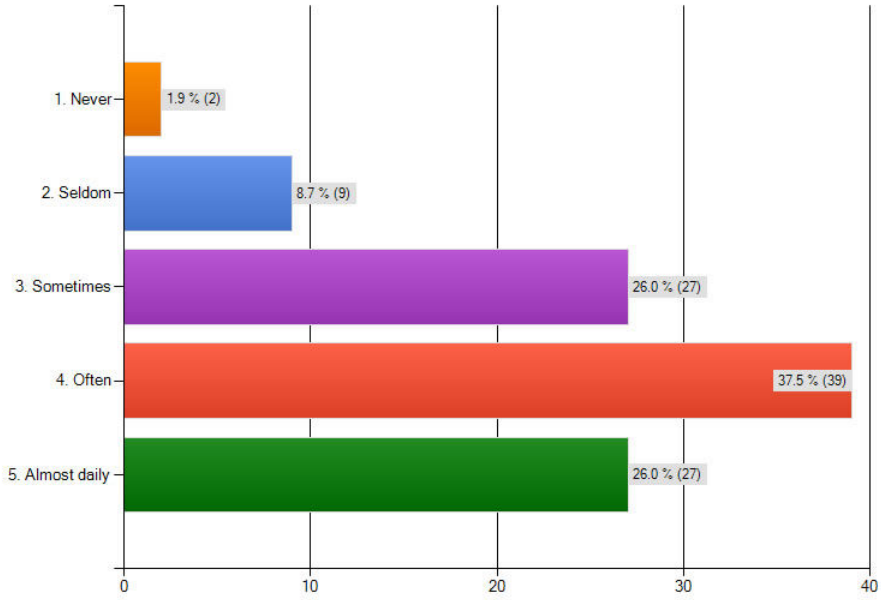

Figure M27. Student responses to Item 27 (%)

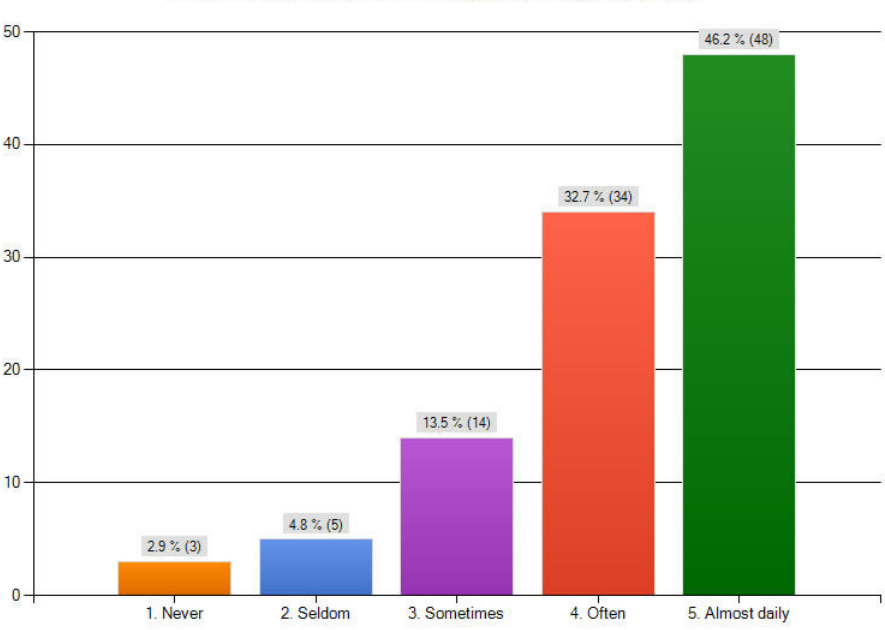

Figure M28. Student responses to Item 28 (%)

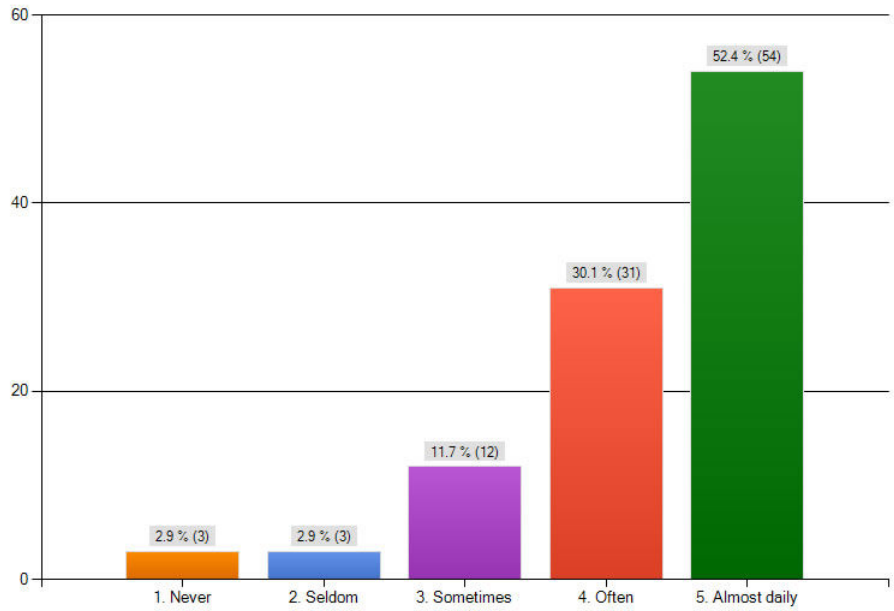

Figure M29. Student responses to Item 29 (%)

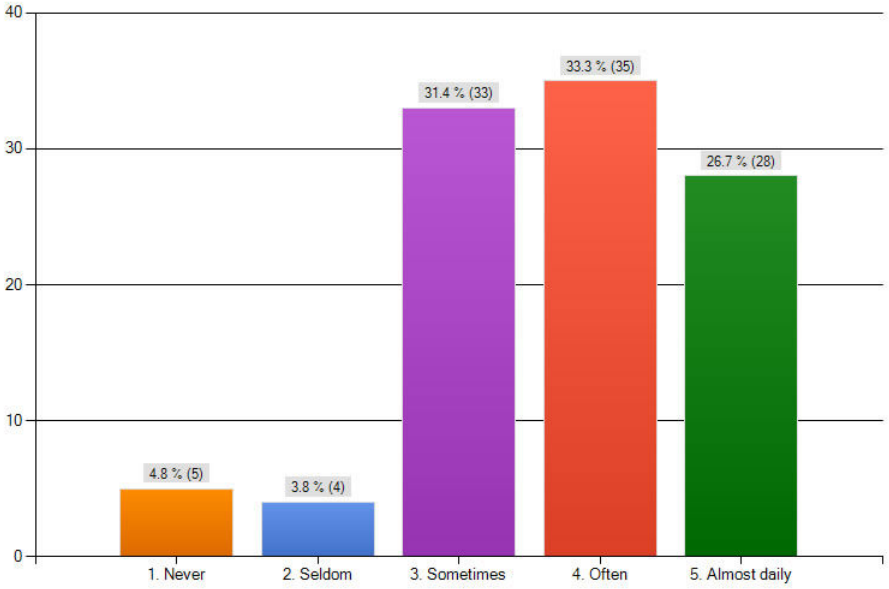

Figure M30. Student responses to Item 30 (%)

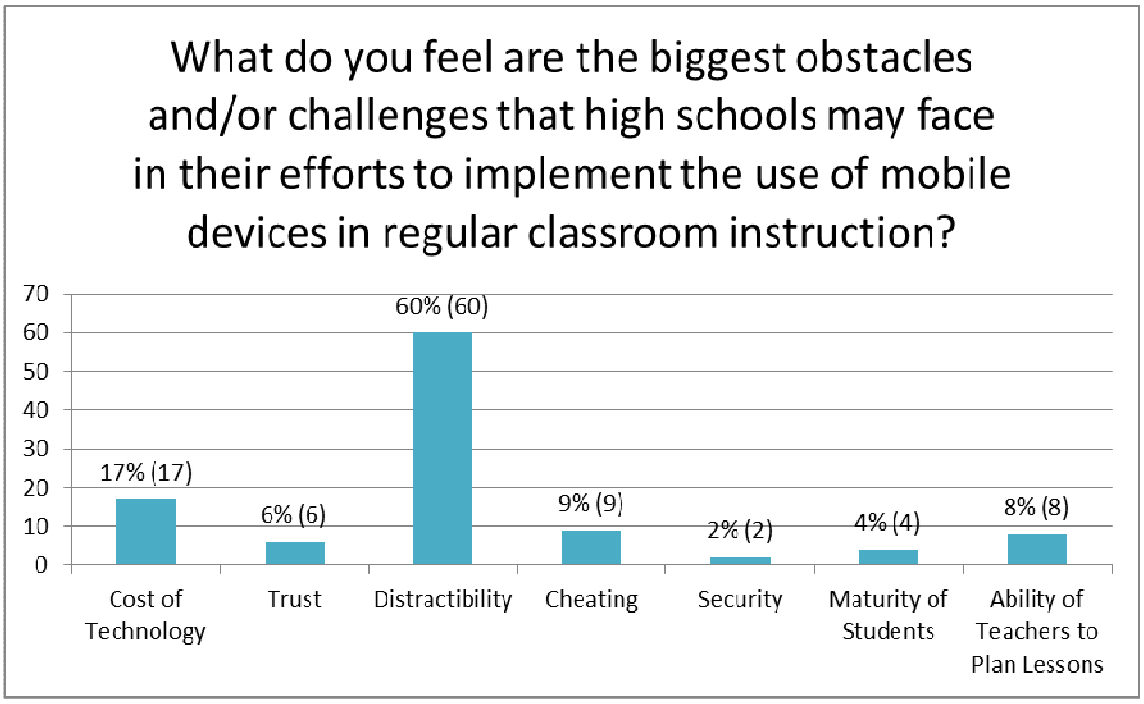

Figure M31. Student responses to open-ended Item 1 (%)

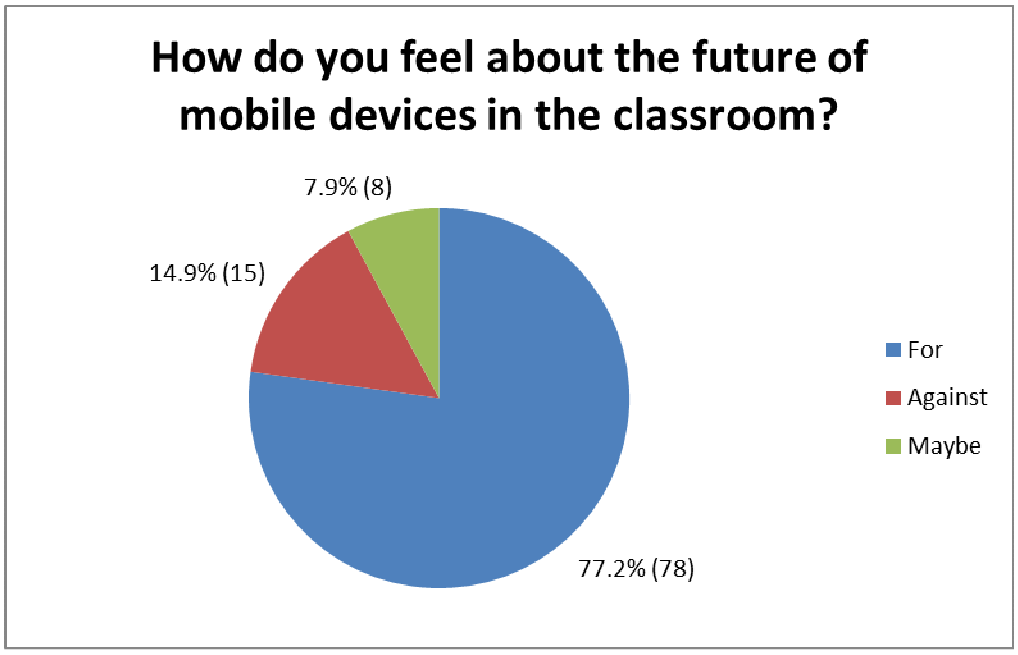

Figure M32. Student responses to open-ended Item 2 (%)

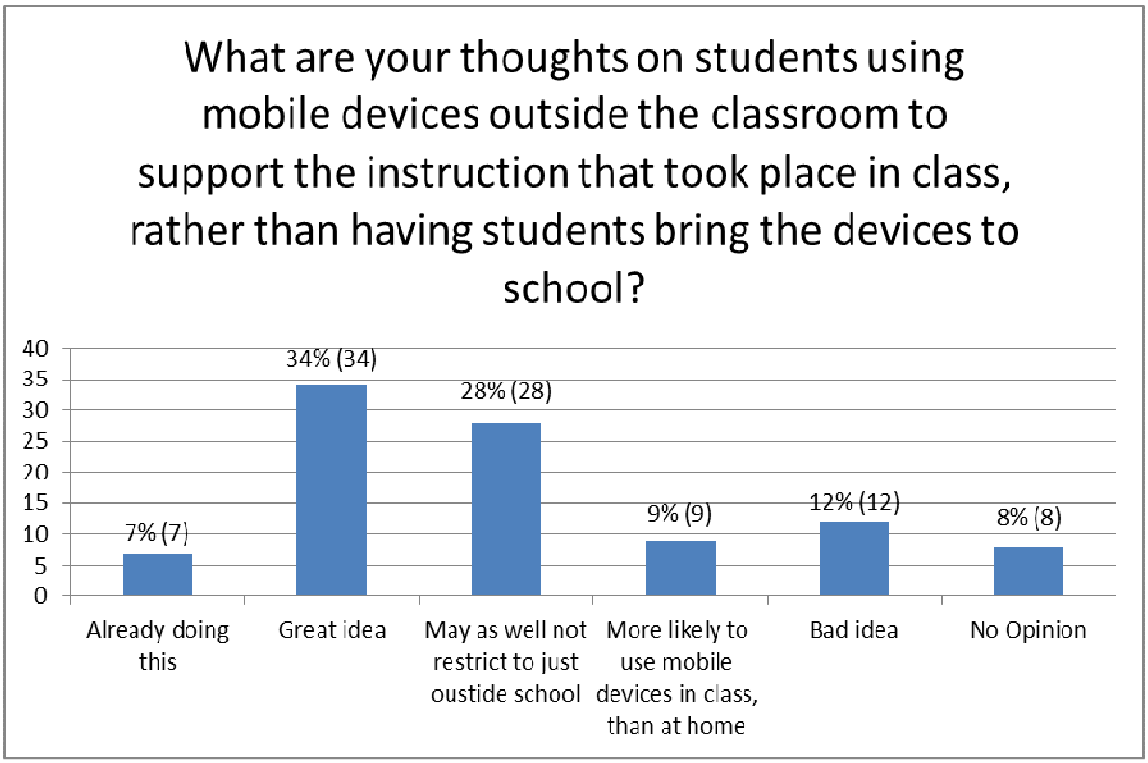

Figure M33. Student responses to open-ended Item 3 (%)

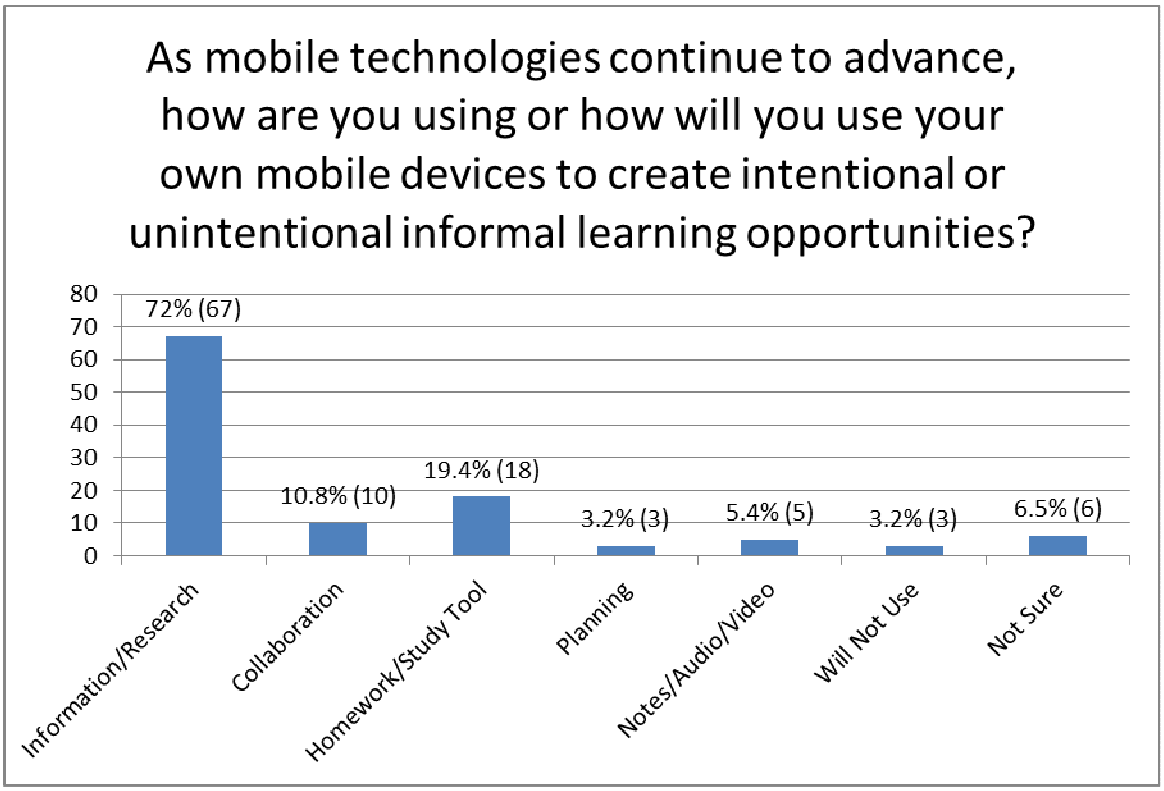

Figure M34. Student responses to open-ended Item 4 (%)

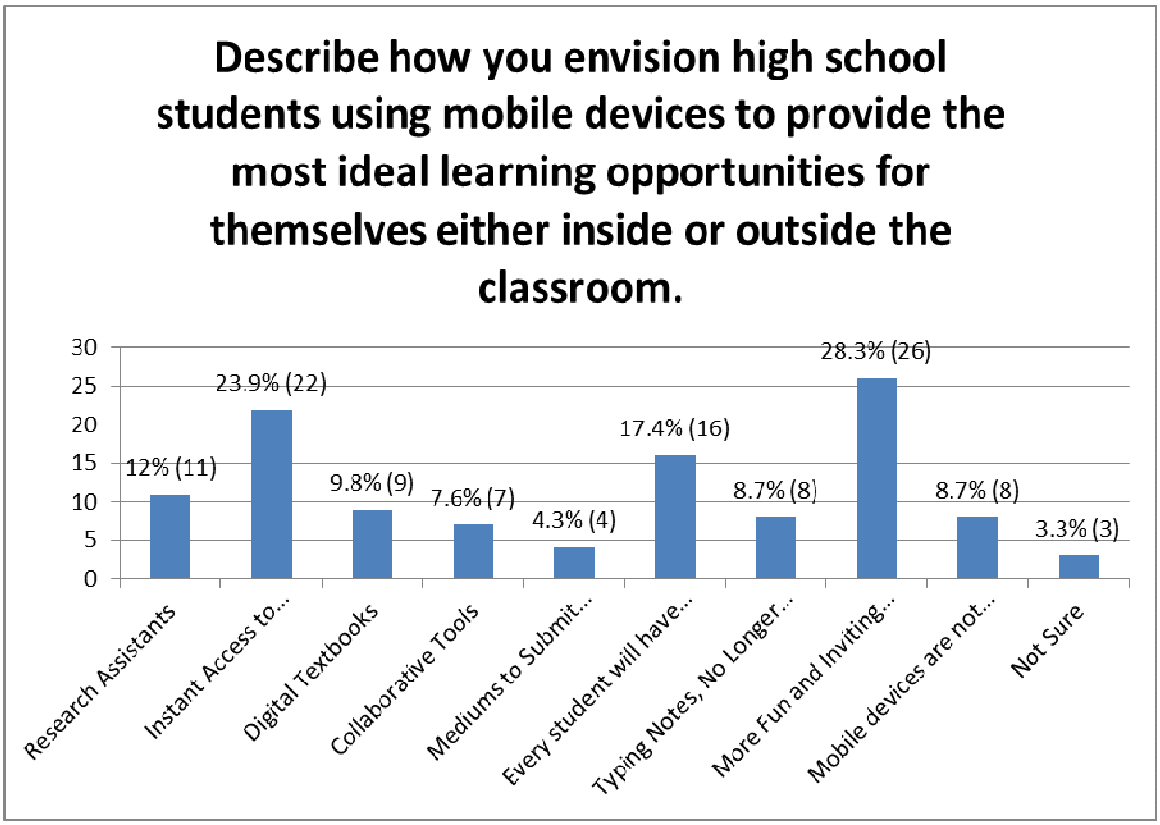

Figure M35. Student responses to open-ended Item 5 (%)

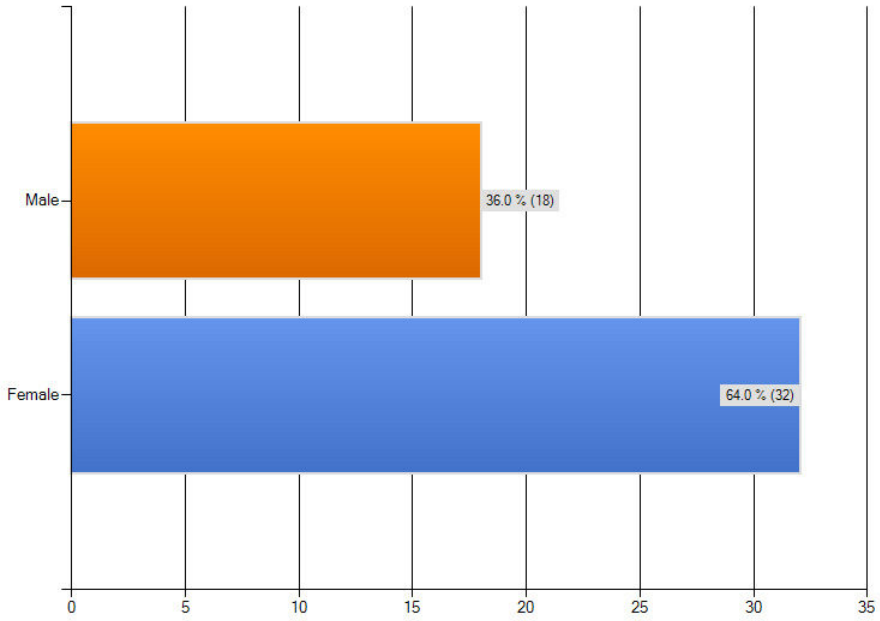

Figure M36. Teacher gender (%)

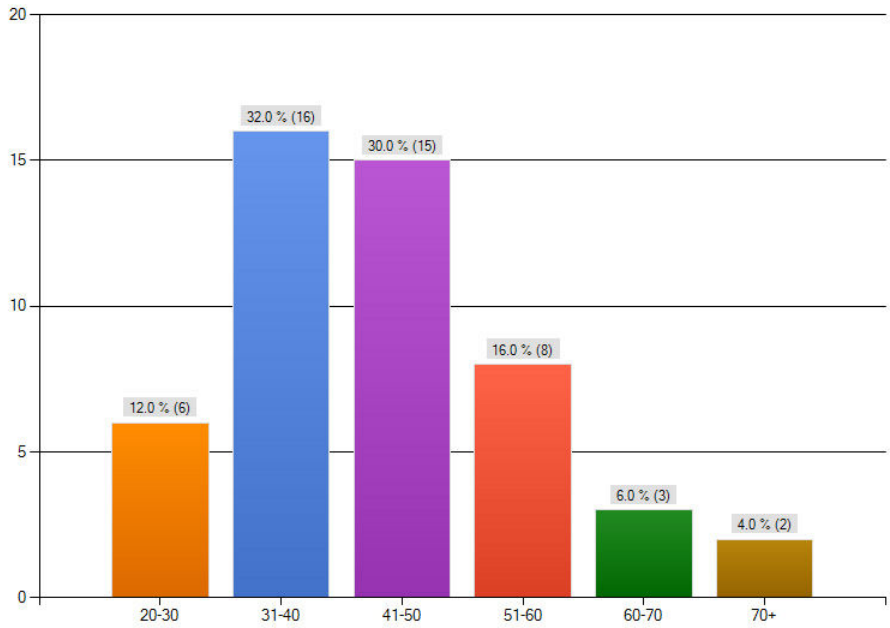

Figure M37. Teacher age (%)

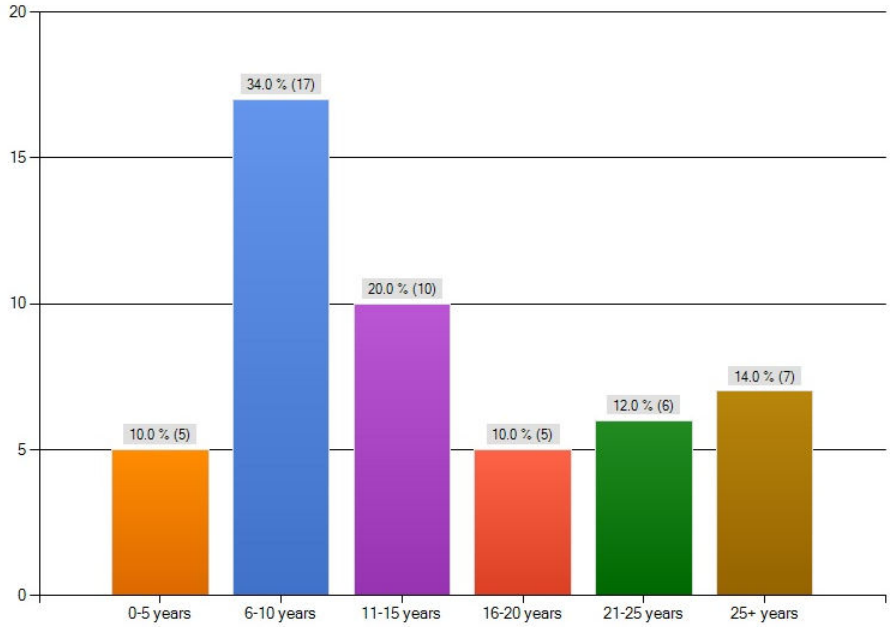

Figure M38. Teacher number of years in education (%)

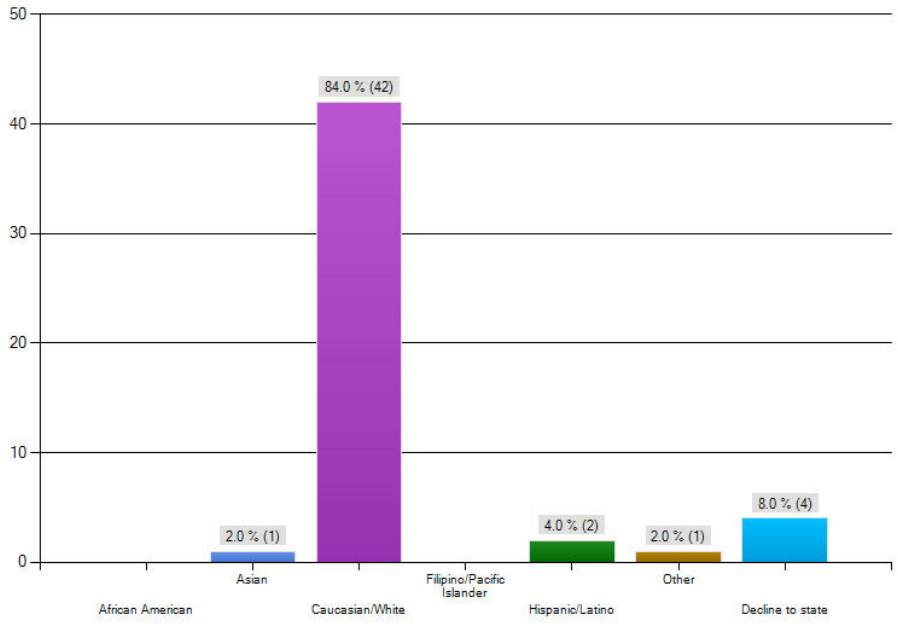

Figure M39. Teacher nationalities (%)

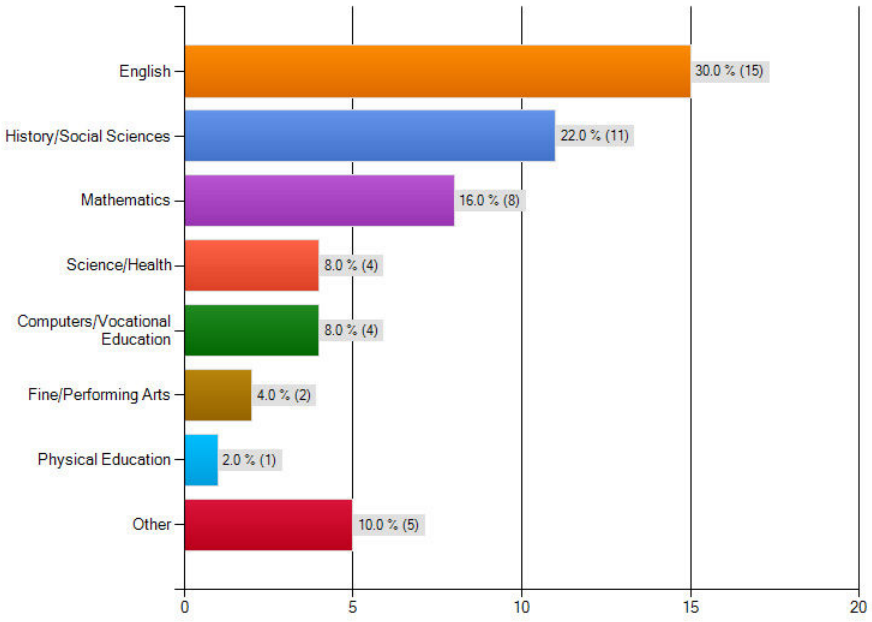

Figure M40. Primary subject taught by teachers (%)

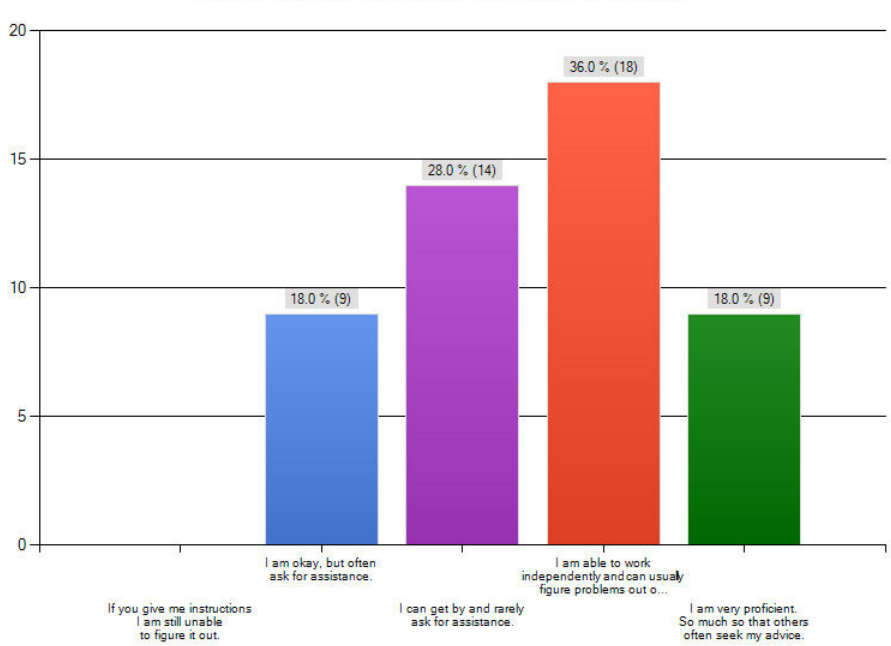

Figure M41. Teachers' comfort with technology (%)

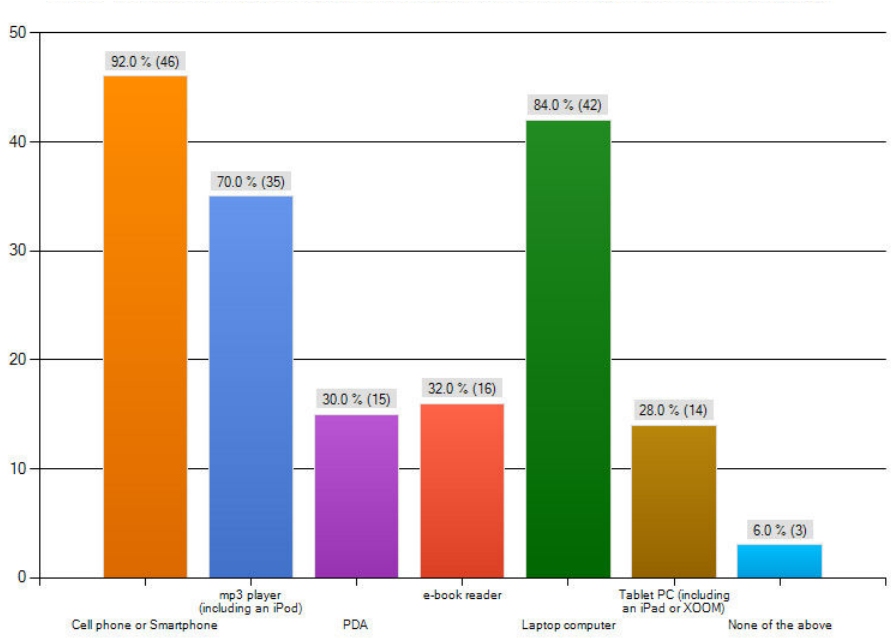

Figure M42. Mobile devices used by teachers (%)

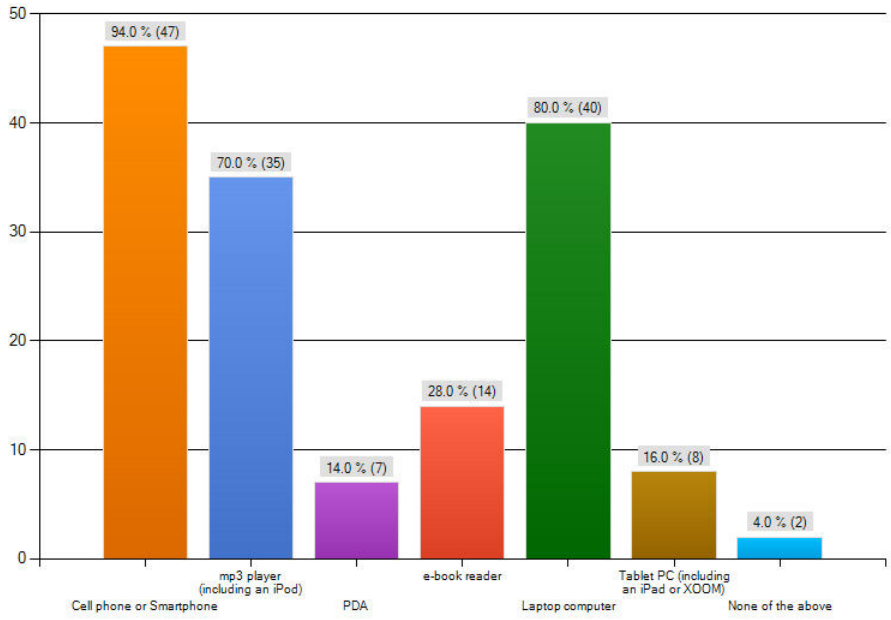

Figure M43. Teachers mobile devices owned (%)

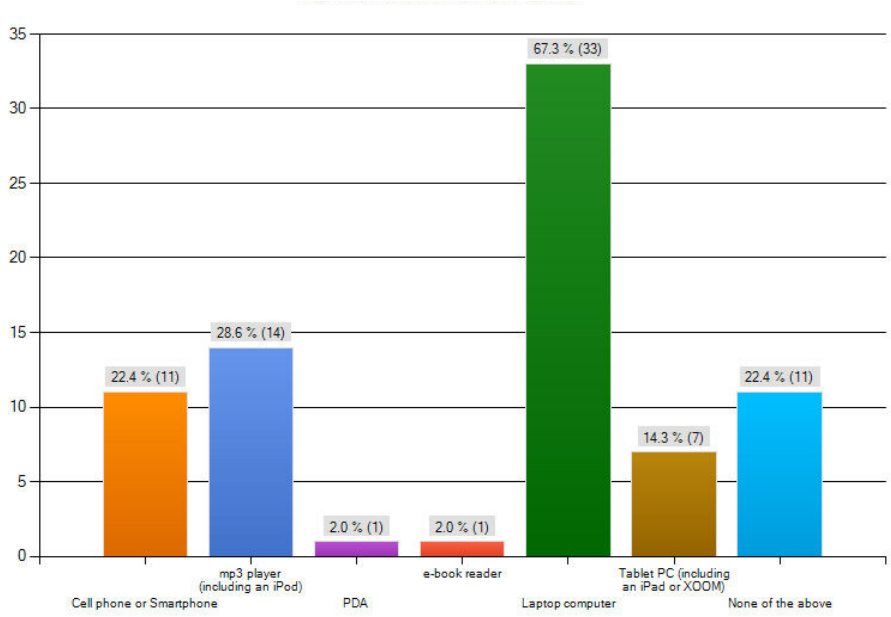

Figure M44. Mobile devices used to create lesson plans by teachers (%)

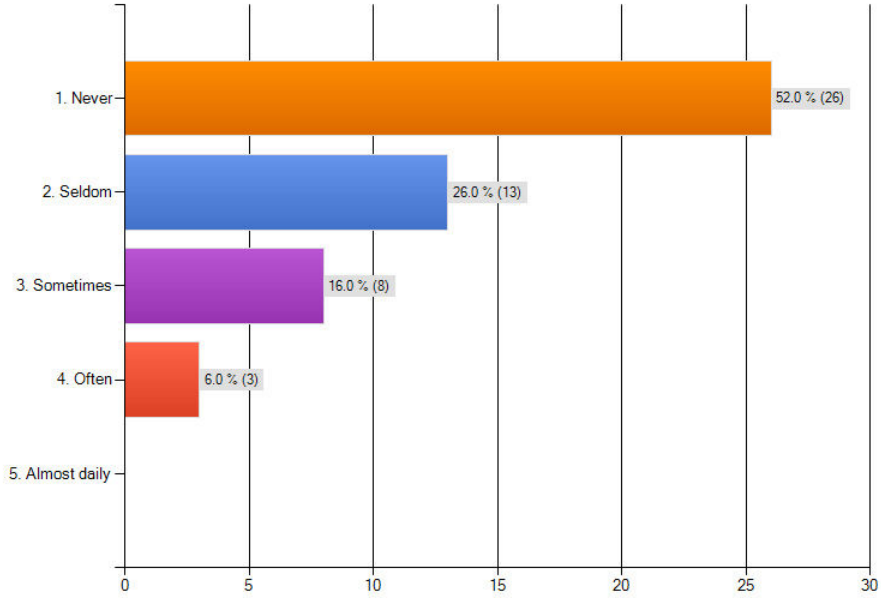

Figure M45. Teacher responses to Item 10 (%)

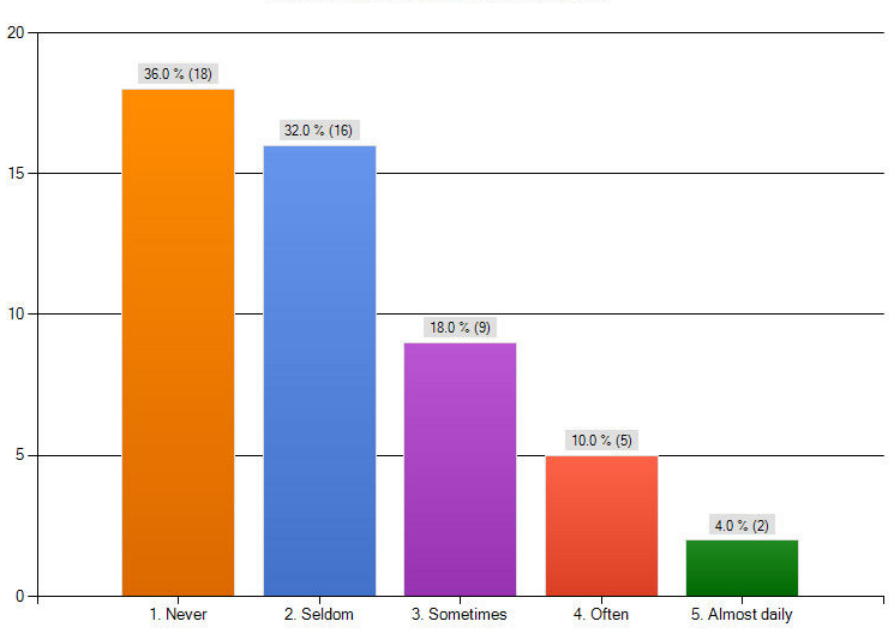

Figure M46. Teacher responses to Item 11 (%)

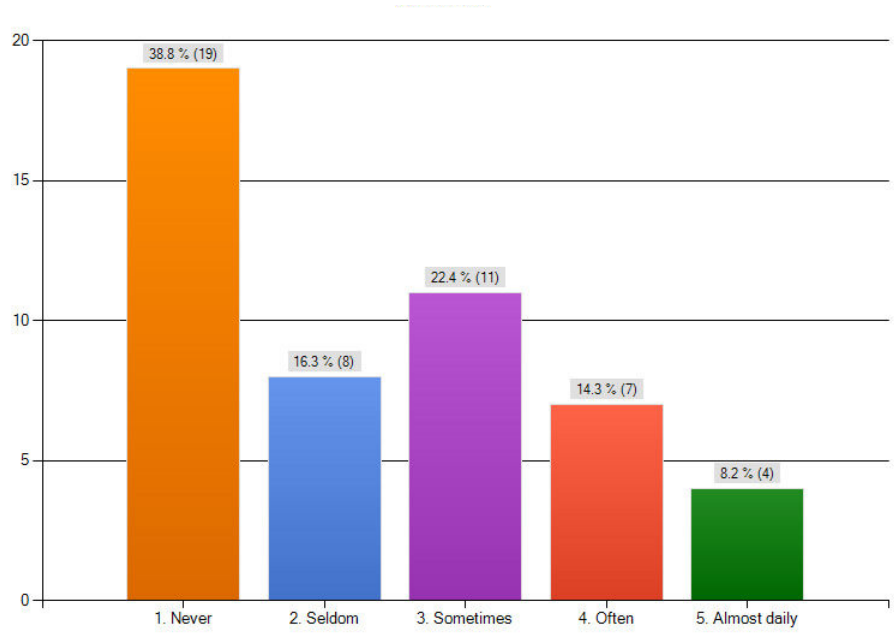

Figure M47. Teacher responses to Item 12 (%)

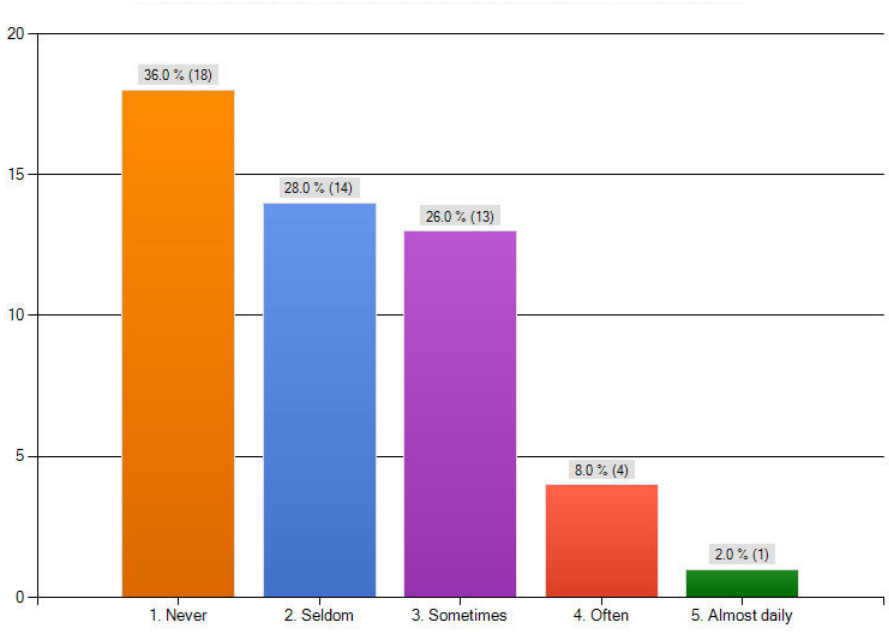

Figure M48. Teacher responses to Item 13 (%)

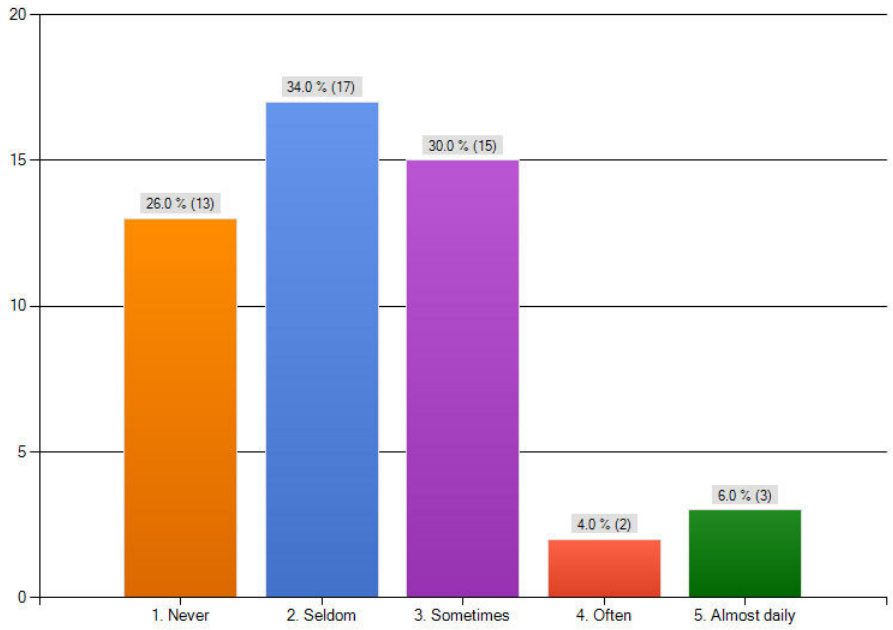

Figure M49. Teacher responses to Item 14 (%)

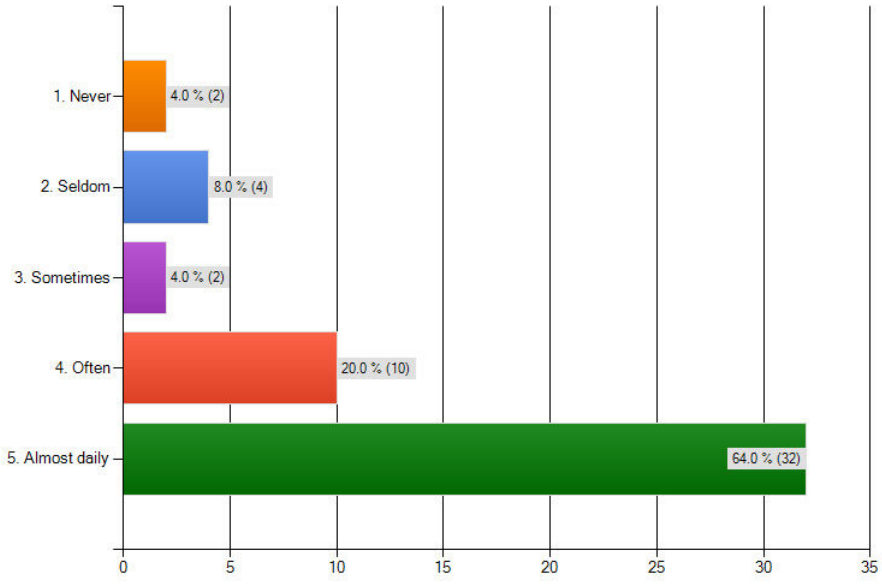

Figure M50. Teacher responses to Item 15 (%)

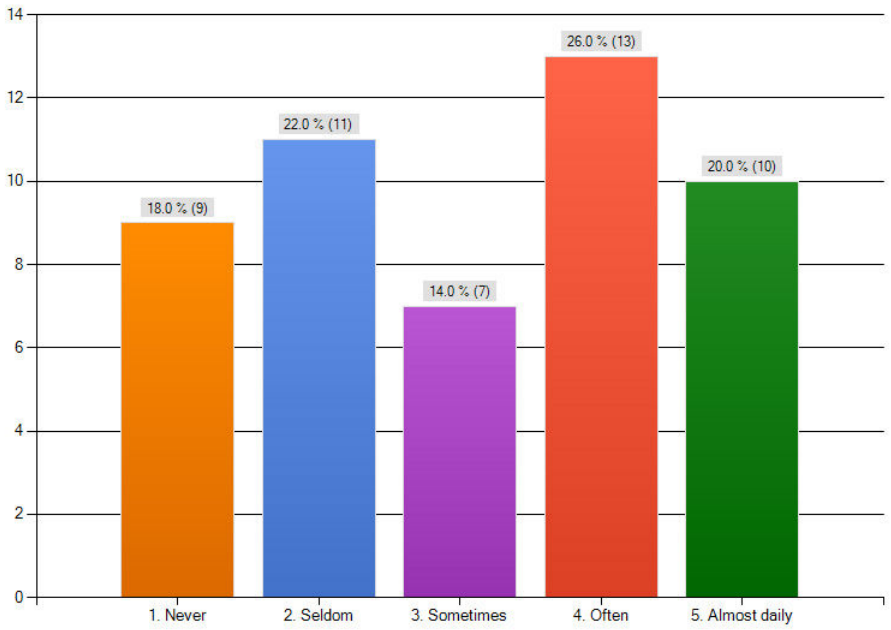

Figure M51. Teacher responses to Item 16 (%)

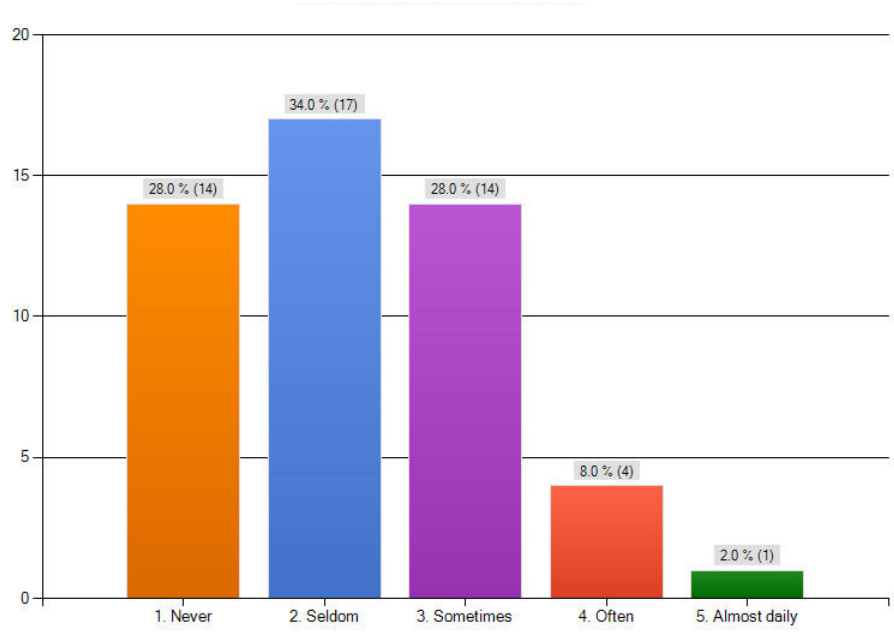

Figure M52. Teacher responses to Item 17 (%)

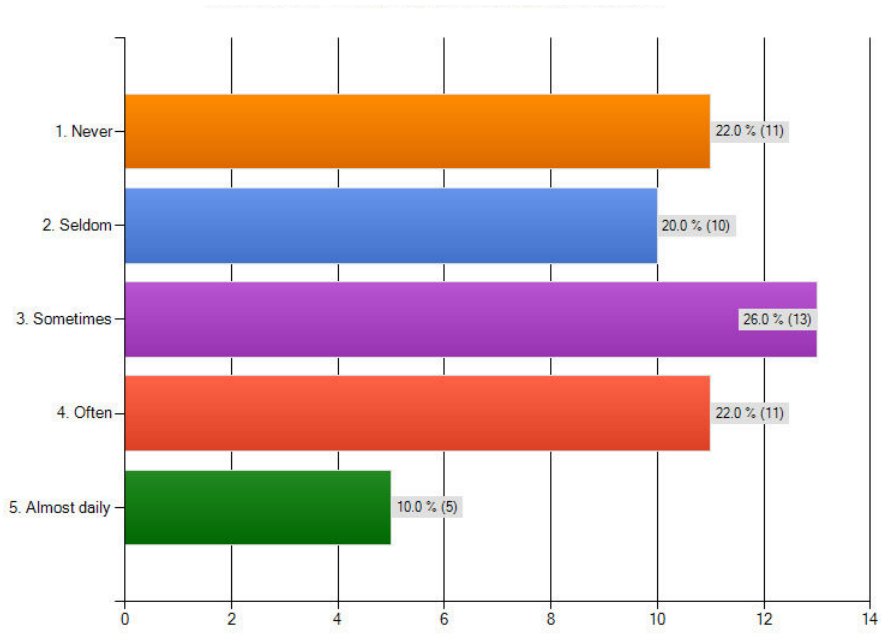

Figure M53. Teacher responses to Item 18 (%)

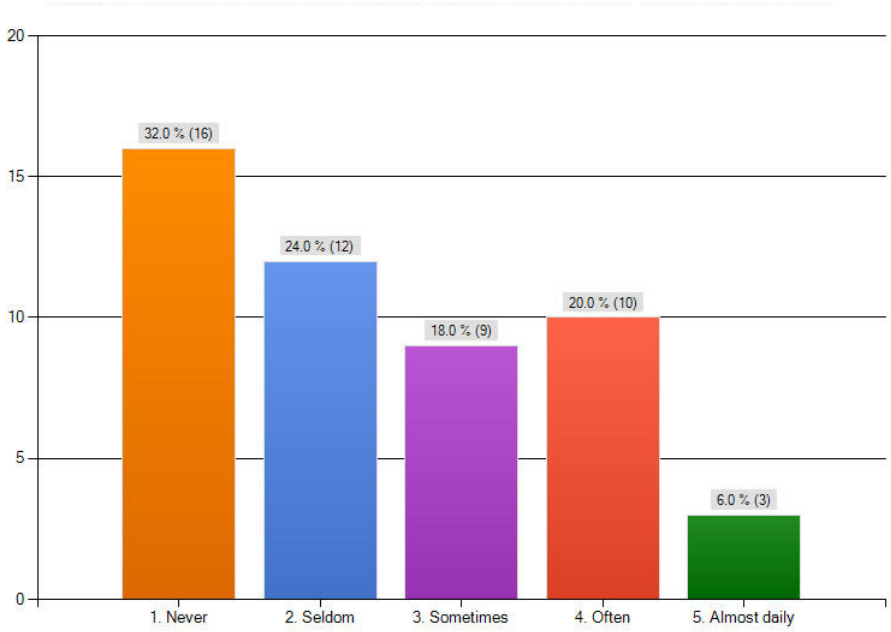

Figure M54. Teacher responses to Item 19 (%)

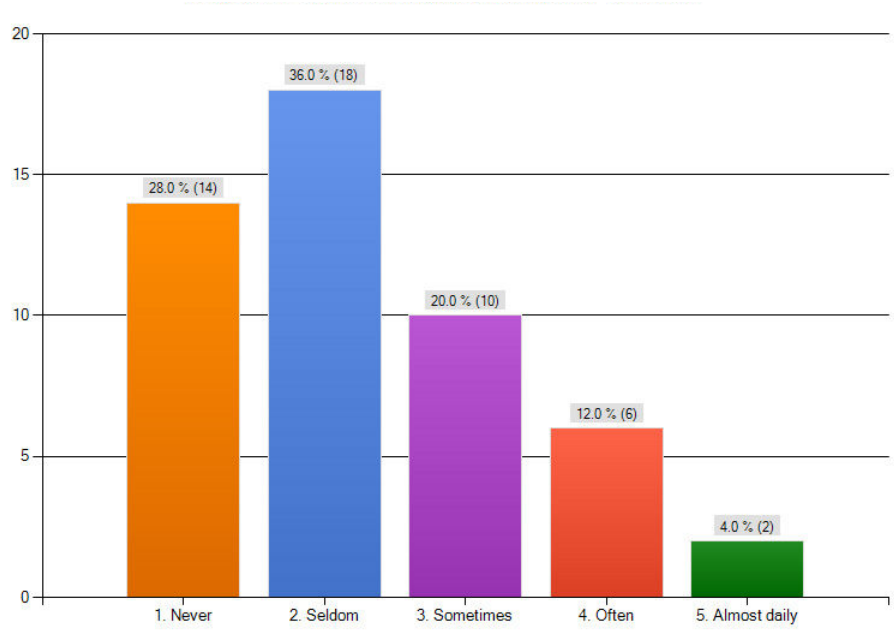

Figure M55. Teacher responses to Item 20 (%)

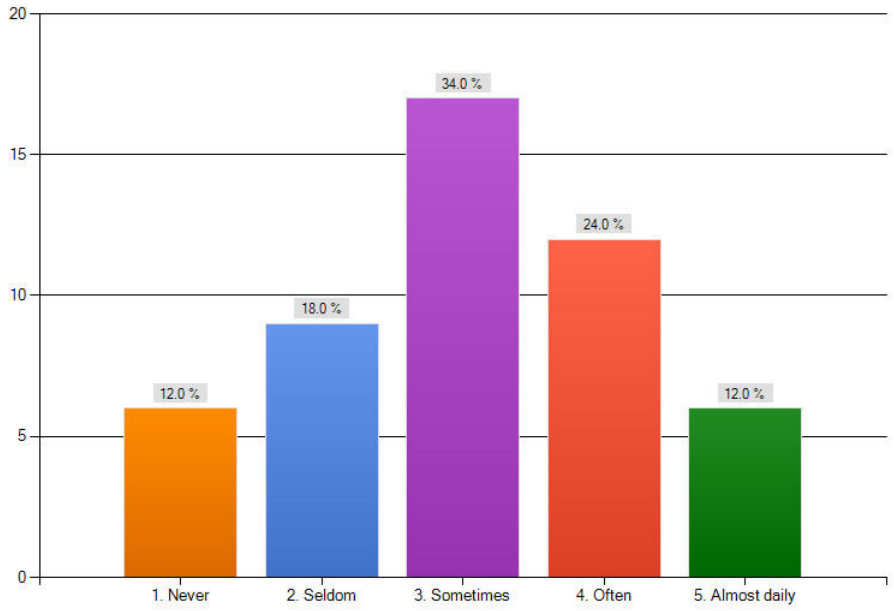

Figure M56. Teacher responses to Item 21 (%)

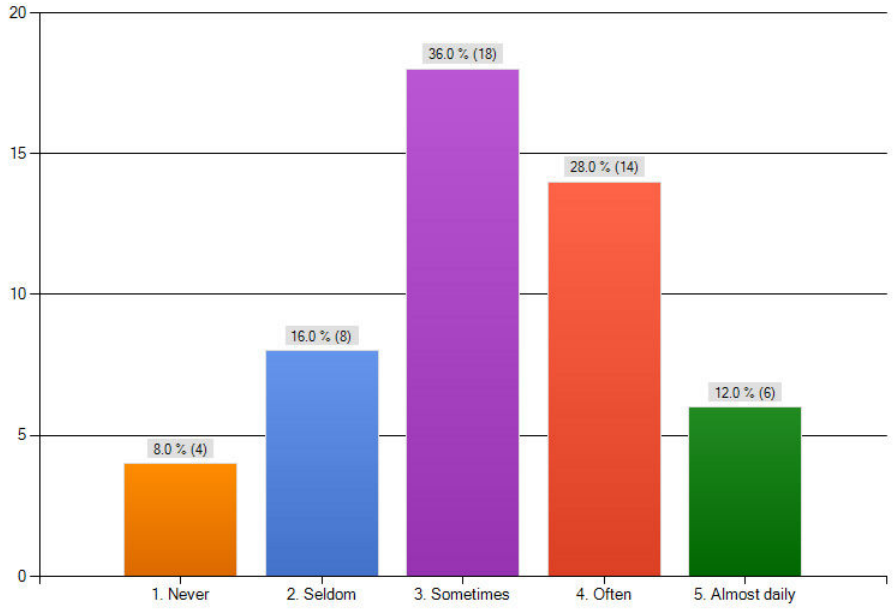

Figure M57. Teacher responses to Item 22 (%)

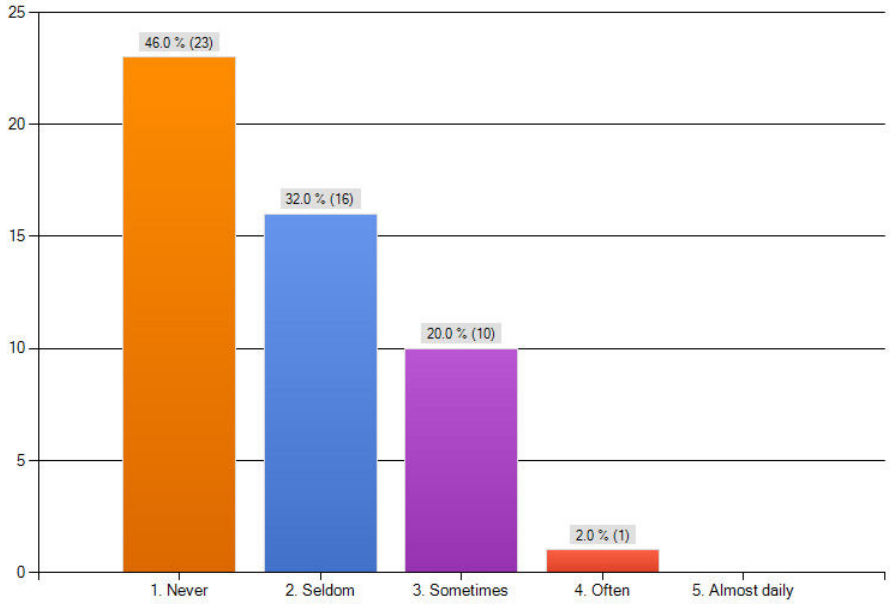

Figure M58. Teacher responses to Item 23 (%)

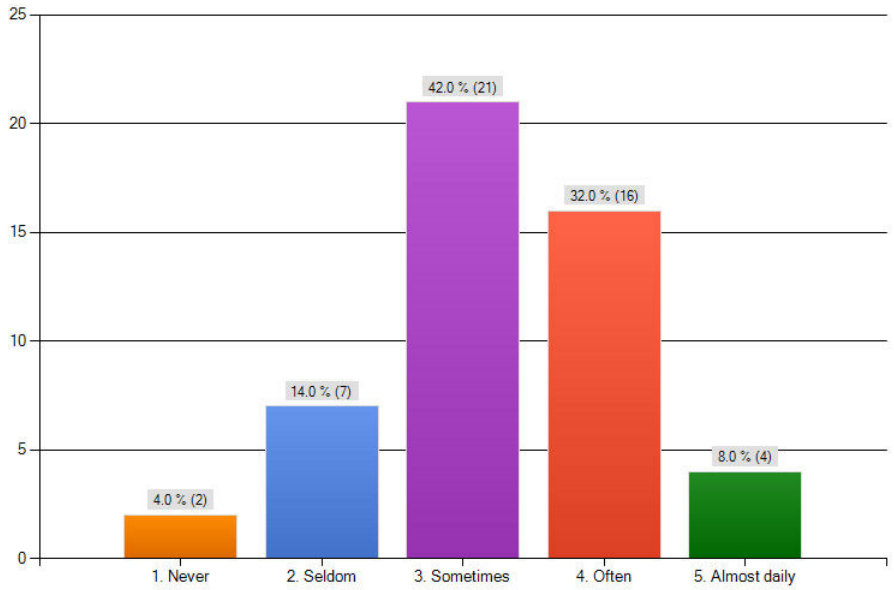

Figure M59. Teacher responses to Item 24 (%)

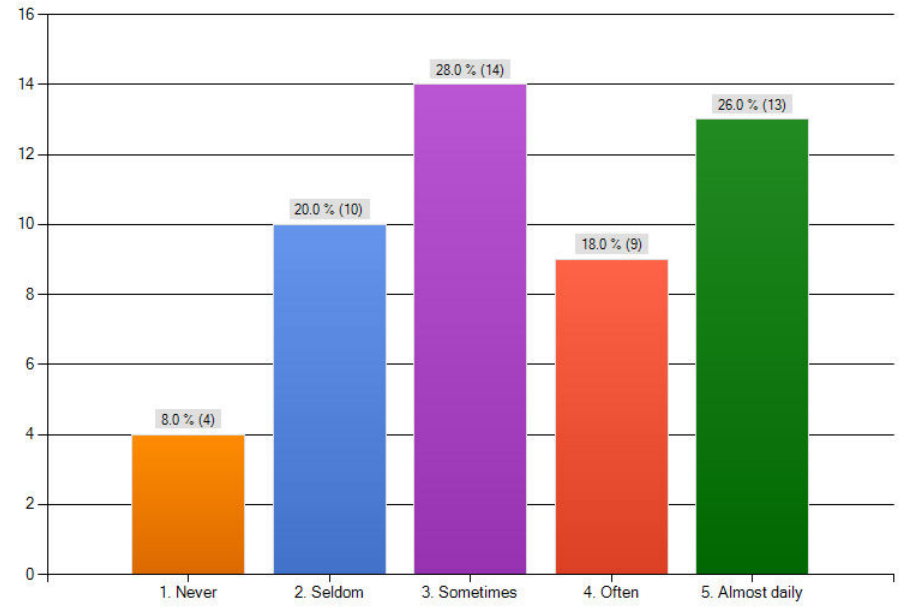

Figure M60. Student responses to Item 25 (%)

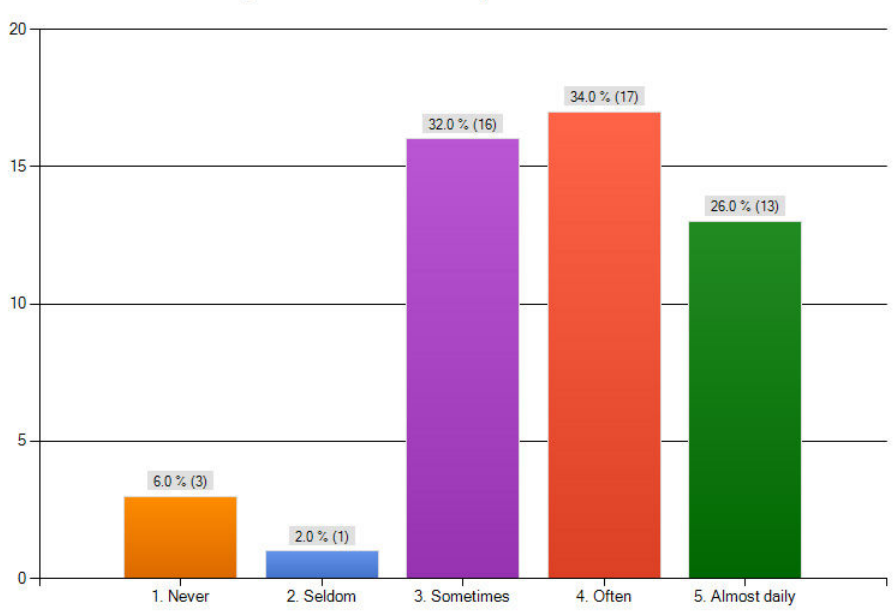

Figure M61. Teacher responses to Item 26 (%)

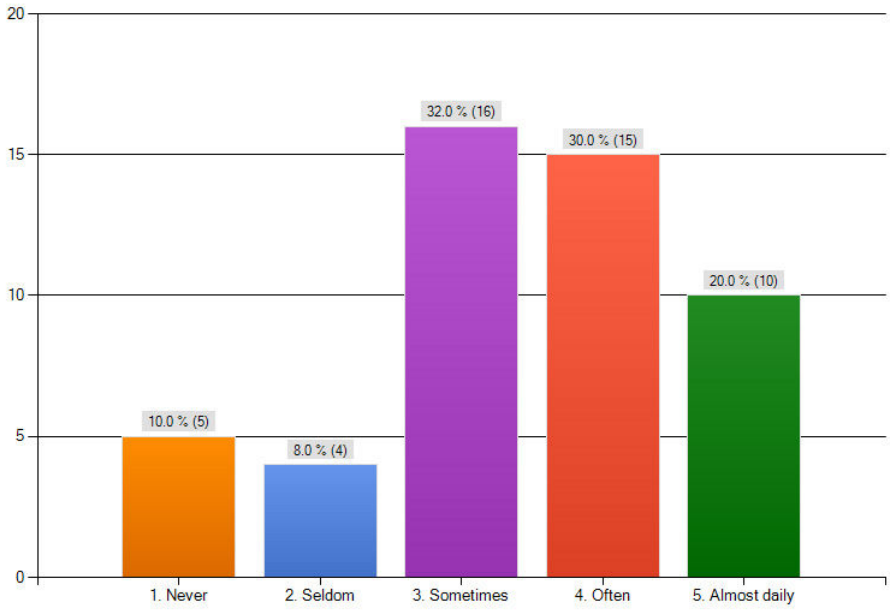

Figure M62. Teacher responses to Item 27 (%)

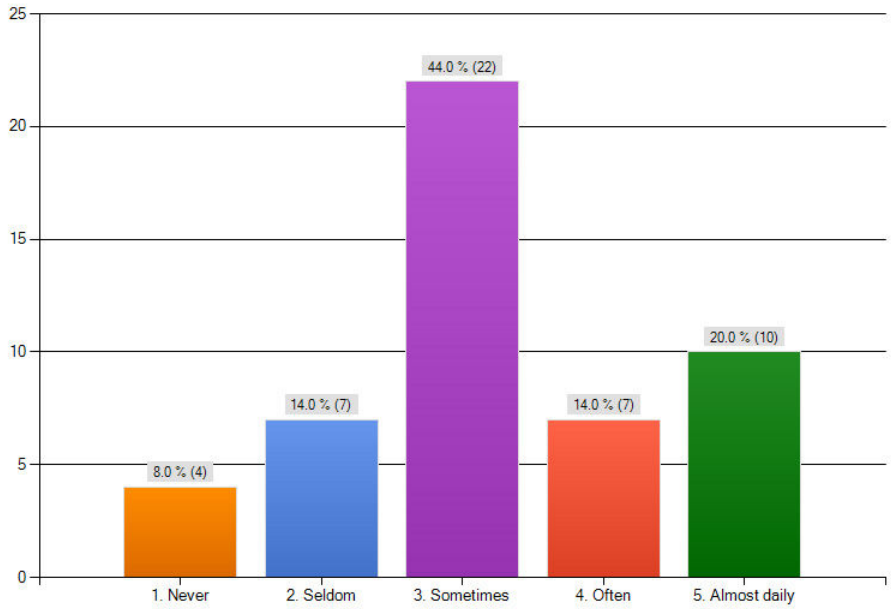

Figure M63. Teacher responses to Item 28 (%)

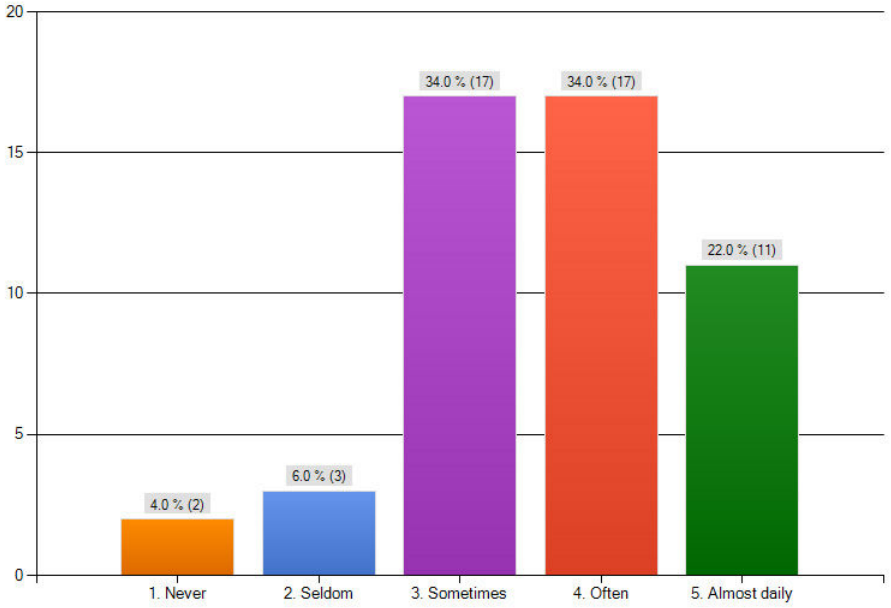

Figure M64. Teacher responses to Item 29 (%)

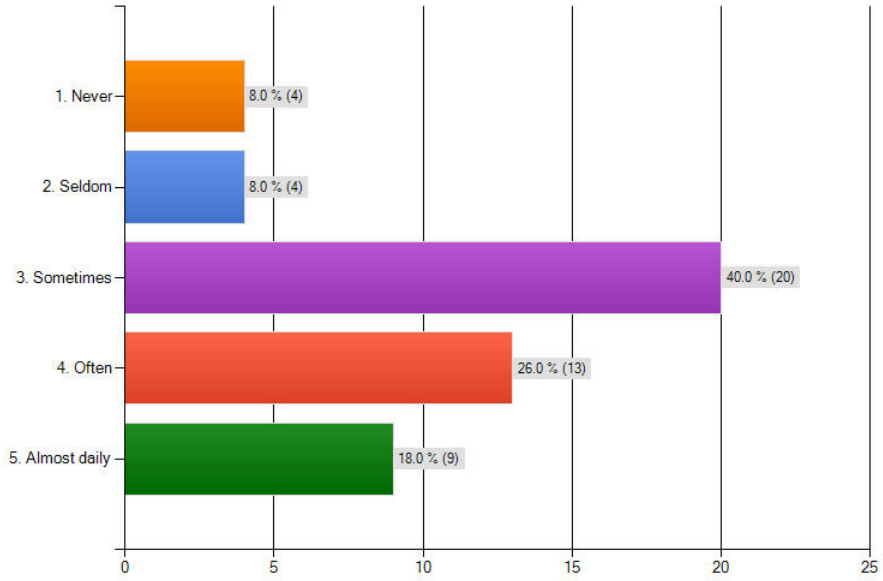

Figure M65. Teacher responses to Item 30 (%)

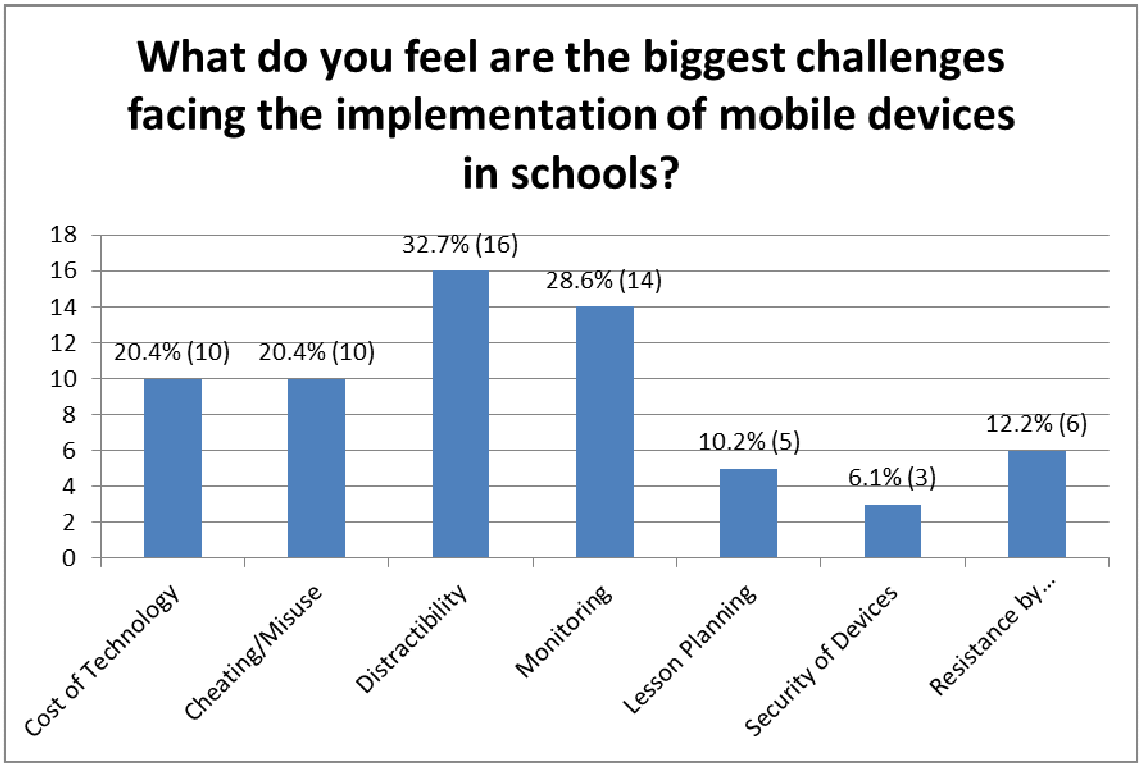

Figure M66. Teacher responses to open-ended Item 1 (%)

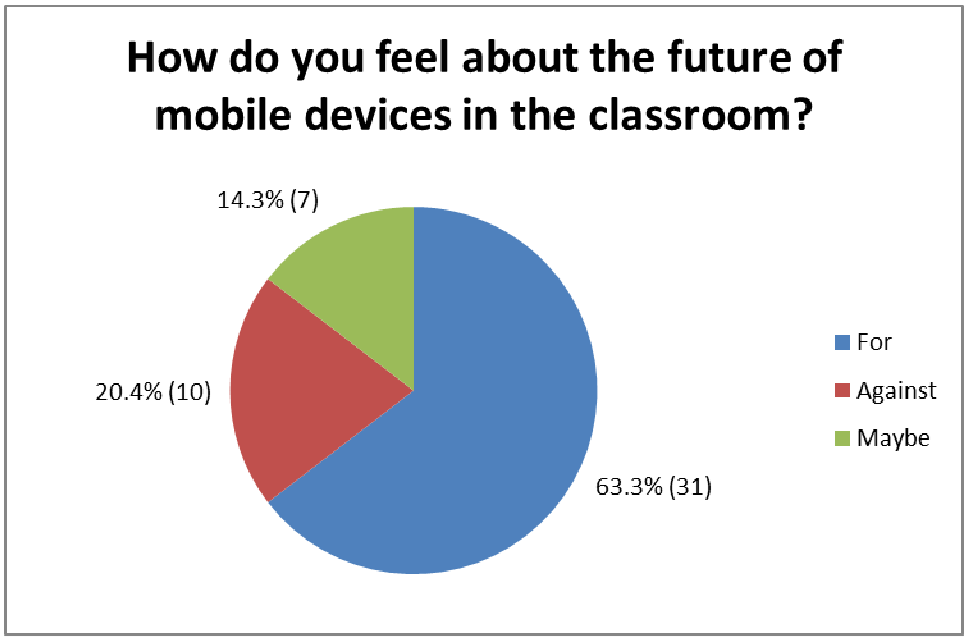

Figure M67. Teacher responses to open-ended Item 2 (%)

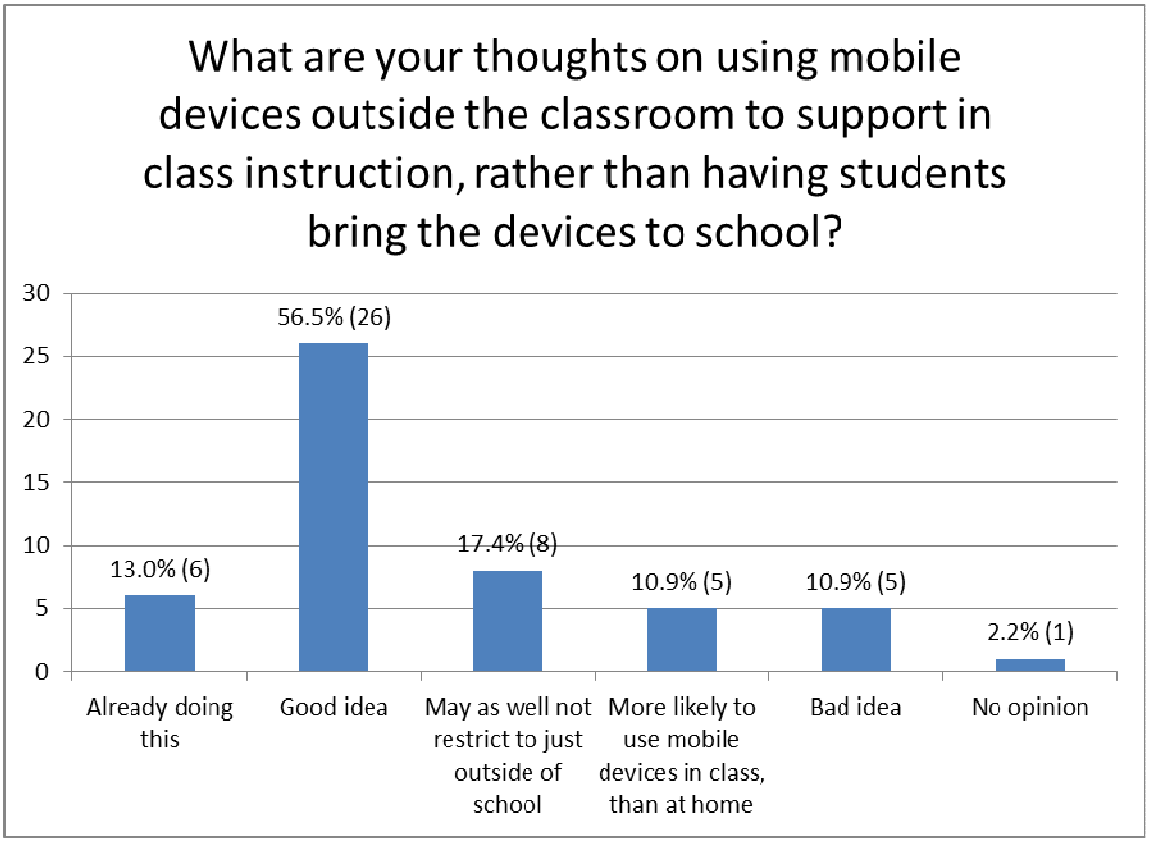

Figure M68. Teacher responses to open-ended Item 3 (%)

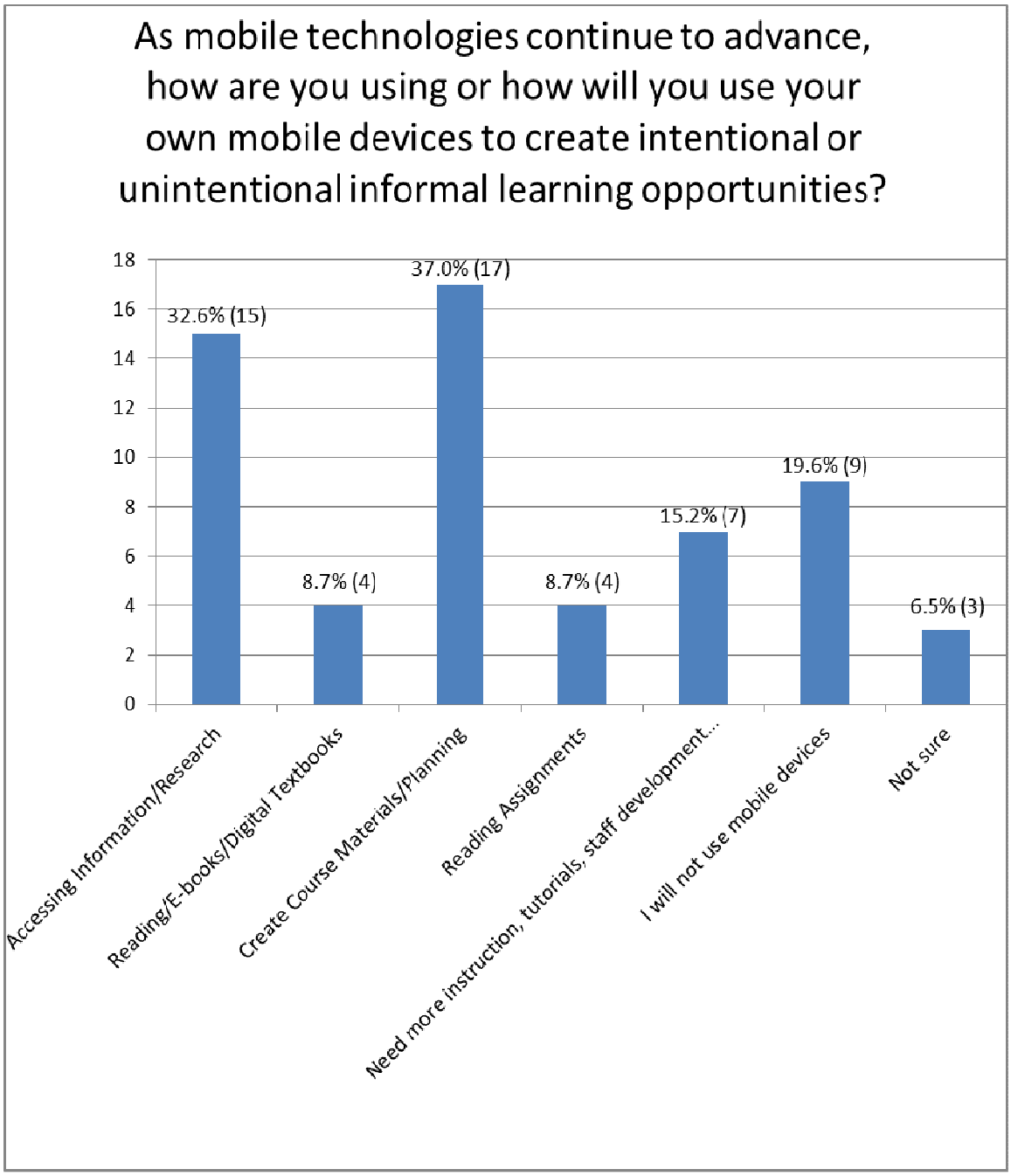

Figure M69. Teacher responses to open-ended Item 4 (%)

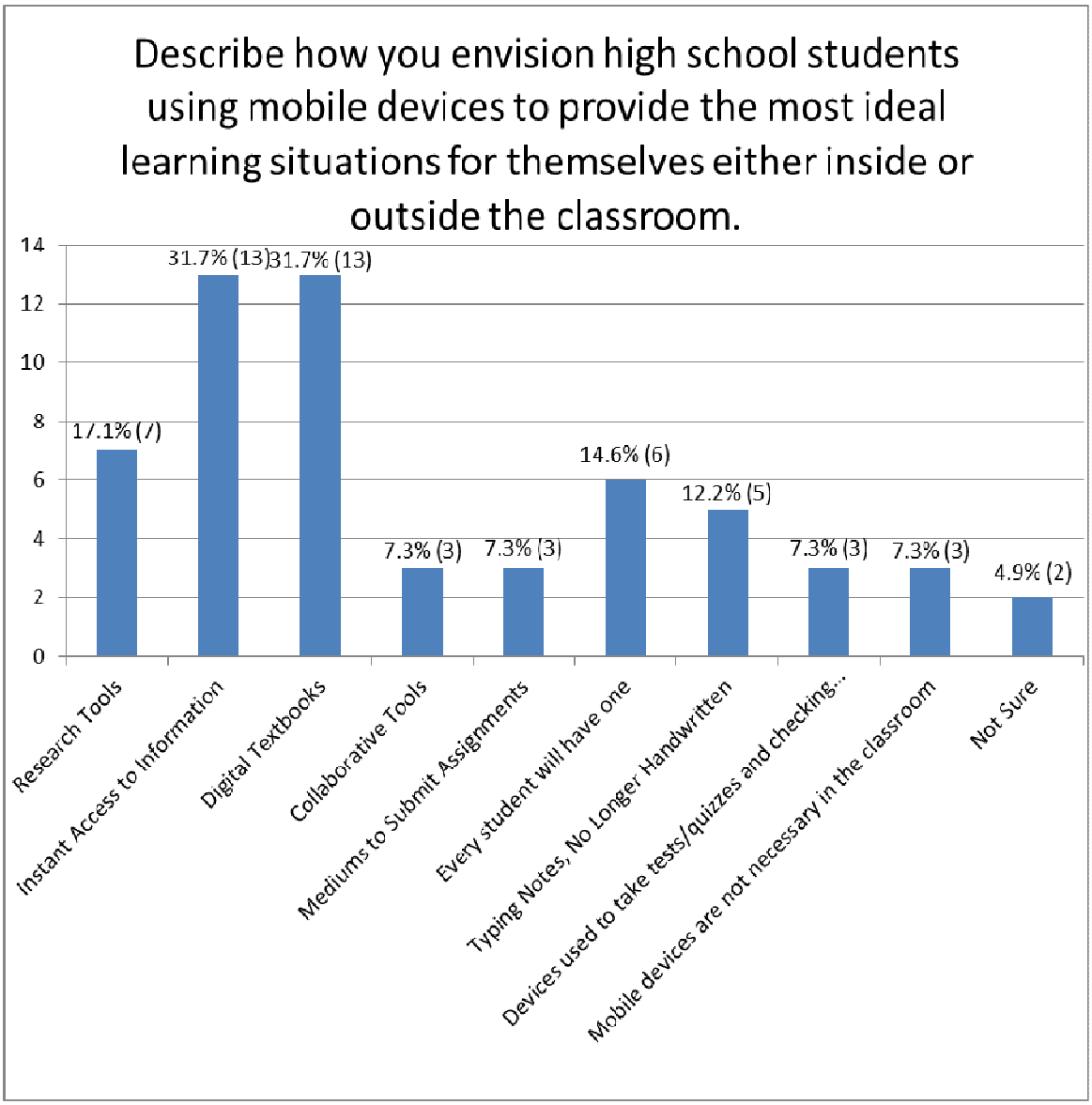

Figure M70. Teacher responses to open-ended Item 5 (%)