GOING ON THE GRID: SECONDARY TEACHERS' IMPLEMENTATION OF MOBILE HANDHELD DEVICES AS INSTRUCTIONAL TOOLS

by

Allison S. Berger

A Dissertation Submitted to the Faculty of

The College of Education

in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

Florida Atlantic University

Boca Raton, Florida

August 2016

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This dissertation was prepared under the direction of the candidate's dissertation advisor, Dr. Roberta K. Weber, Department of Curriculum and Instruction, and has been approved by the members of her supervisory committee. It was submitted to the faculty of the College of Education and was accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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ACKNOWLEDGEMENTS

There are so many people without whom I could never have completed this dissertation. Words cannot express how grateful I am for each and every one of you.

First, I would like to thank my dissertation chair, Dr. Roberta Weber, for everything. Above and beyond your wisdom and brilliance within the fields of education and instructional technology, you taught me about thinking critically, having support, and the value of always keeping a positive attitude, even when things seemed to be going awry. I would also like to thank the other esteemed members of my committee. Dr. Emery Hyslop-Margison, thank you for your help and support, and for coming to the rescue when I needed it. Dr. Ilene Allgood, thank you for lending a critical eye to my work, for all of the valuable feedback, and for encouraging me to think beyond the status quo. Dr. John Hardman, thank you for helping me to dig deeper, for teaching me how to look at the data from countless angles, and for always being there with an idea or a quick word of encouragement. I would also like to thank Dr. Dan Morris for his steady support, consistent help, and for his willingness to share a little of his genius with us grateful doctoral students. To Dr. Michelle Vaughan, thank you for lending your technology expertise. I look forward to having the chance to work with you someday. Finally, thank you to Dr. Victoria Brown, for your guidance and mentorship, and for always going out of your way to help your students.

Thank you to my Owls, the most amazing cohort any person could hope to have. Thank you for being the only ones to get me a lot of the time, for your commiseration,

and above all, for your friendship. I will always be grateful for the hours and days and weeks and months we spent working…you made this fun. Courtney, I so appreciate the countless times you were on the other end of a chat when I needed a friendly word or a laugh. Thank you for always being there. Eva, your incredible attitude never fails to make me smile. Thank you for inspiring me that way. Christina, I don't know what I would have done without your pep talks. They meant the world to me. And Katie, thank you for talking me down and cheering me up more times than I can count. I am immensely grateful for you.

To the administrators, department chairs, and teachers who took part in my study, thank you for being so generous with your time, your help, and your wise words. I learned a great deal from every one of you.

To my amazing family, thank you for your love and support, and for picking me up when I thought I was down and out. Meeting this lifelong goal wouldn't mean nearly as much without you.

Finally, I offer thanks to my wonderful husband-to-be, Ian. Thank you for your patience, your love, and your unwavering faith in me. I couldn't have done this without you, and I wouldn't have wanted to. I can't wait to marry you.

ABSTRACT

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Title: Going on the Grid: Secondary Teachers' Implementation of Mobile Handheld Devices as Instructional Tools

Institution: Florida Atlantic University

Dissertation Advisor: Dr. Roberta K. Weber

Degree: Doctor of Philosophy

Year: 2016

This mixed methods study examined secondary teachers' technology self-efficacy, their professional development activities regarding mobile handheld devices, and how those activities affect their use of mobile devices as instructional tools. Additionally, this study also explored teachers' perceptions of other factors that act as barriers or enablers to their use of such devices. The study included 104 middle and high school teachers who taught in a large, urban public school district in the Southeastern United States. Data were collected through the administration of an electronic survey and semi-structured interviews. The researcher utilized multiple regression and moderator analyses, as well as qualitative analysis of the interview data.

The results of the multiple regression analysis revealed teachers' technology-related self-efficacy to be a significant predictor of their instructional use of mobile handheld devices. However, secondary teachers' level of professional development was

found not to contribute significantly to the model. The moderator analysis too revealed professional development to be a nonsignificant factor. The findings of the qualitative phase of the study revealed secondary teachers' awareness of their varied and fluid technology-related self-efficacy, as well as those factors that modify it. Qualitative data also revealed four categories of essential elements that teachers must have in order to most effectively implement mobile handheld devices within their pedagogy: intellectual capital, emotional capital, social-cultural capital, and technological capital. When lacking, these elements can represent barriers to teachers' implementation of mobile handheld devices. Targeted professional development and increased funding to minimize the digital divide are recommended to reduce these barriers. The findings of the study inform designers of professional development programs, school and district and secondary teachers, as they are all stakeholders in the process of increasing the effective implementation of mobile handheld devices as instructional tools.

DEDICATION

This dissertation is dedicated to my mom, Adrienne Berger, who was always there for me then, and who is always with me now.

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CHAPTER 1. INTRODUCTION

The integration of technology within K-12 education is a topic that has held a longstanding position at the forefront of the educational landscape; due to the constant emergence of newly available resources, instructional technology remains an ever-changing field. According to Project Tomorrow (2013), the state of instructional technology within K-12 schools is at a crucial tipping point. As educators work to implement new educational standards, such as Common Core, alongside new and innovative technological resources, they are faced with the significant challenge of how to most effectively leverage available resources in order to transform the ways in which their students learn. Critics of instructional technology use point out that the incorporation of innovative devices within education does not guarantee an improved educational experience; existing literature includes both potential benefits and possible risks (Blazer, 2008). When resources are available, it is the educators' ability to most effectively utilize such tools that determines their value (Dunleavy, Dexter, & Heinecke, 2007).

The current study aims to explore mobile handheld devices as one such available resource that could be leveraged in order to improve instruction. According to West (2012), the transformative potential of mobile handheld devices as instructional tools is due to their ubiquity, ease of use, and convenience. Liu et al. (2014) asserted that, since the introduction of the iPhone in 2007, the scope of mobile learning has grown significantly. Though much of the research has explored the effects of the use of mobile

technologies, little research exists that examines the existing barriers and enablers to teachers' implementation of mobile devices in their classrooms.

Statement of the Problem

Research has indicated that teachers' attitudes greatly influence their willingness to learn about and to incorporate technology within their classrooms (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurer, & Sendurer, 2012; Russell, Bebell, O'Dwyer, & O'Connor, 2003). Of particular importance, according to the literature, is a feeling of self-efficacy regarding the use of technology. Teachers who have greater expectations of success with technology utilize it more often and are better able to persist when faced with a challenge (Bandura, 1997; Bandura & Cervone, 1986; Bauer & Kenton, 2005; Ertmer, Ottenbreit-Leftwich, & York, 2006; Wozney, Venkatesh, & Abrami, 2006). Conversely, for some teachers, a lack of technology self-efficacy can translate into fear, which can then lead to a reluctance to use technology or a tendency to avoid it altogether (Honey & Moeller, 1990). Research also shows that professional development plays a powerful role in teachers' implementation of innovative technologies within their classrooms (Ertmer et al., 2006; Hew & Brush, 2007; Wozney et al., 2006).

In their review of empirical studies regarding mobile learning, Liu et al. (2014) found that when studies involved a comparison between traditional learning environments and those that involved mobile technologies, 75% of those that included mobile handheld devices as instructional tools reported positive learning gains for students. Engel and Green (2011) studied a pilot program in which the use of cell phones was incorporated into a secondary mathematics class. The researchers found that the use

of the mobile devices resulted in increased student participation and reflection, as well as improved results on assessments.

According to West (2012), mobile handheld devices such as cell phones carry a stigma that discourages their use as instructional tools. Many individuals do not recognize the educational potential of such resources, citing them as purely for entertainment and associating them with negative behaviors. West challenges educators at every level to instead think toward the future and to embrace mobile devices' potential as ubiquitous learning tools. K-12 students have also expressed the need for mobile devices in school. According to Pearson's (2014) nationwide mobile device survey, 71% of elementary school students, 67% of middle school students, and 56% of high school students want to use mobile devices in the classroom more often than they currently do, and the most commonly used mobile device in school is a laptop. According to Project Tomorrow (2015), a national survey of educational technology integration, 82% of high school students and 68% of middle school students own a smartphone. However, only 10% of middle school and 26% of high school students reported using those devices at school, with 19% of middle school students and 15% of high school students reporting daily use of tablets in school (Pearson, 2014). Despite the fact that some literature suggests the potential benefits of using mobile handheld devices such as smartphones and tablets as instructional tools, it is clear that teachers do not incorporate them as often as they could. Therefore, the current study examined the problem that secondary teachers are reluctant to incorporate mobile handheld devices as instructional tools.

Theoretical Framework

The following section will include a description of the three main theories that informed the current study. First, Mishra and Koehler's (2006) technological pedagogical content knowledge (TPACK) provides a framework for K-12 teachers' technology integration. Next, Bandura's (1977, 1997) Self-efficacy Theory describes primary sources for self-efficacy. Finally, Knowles, Holton, and Swanson's (2005) Andragogical Model represents the foundation of teachers' professional development.

Technological Pedagogical Content Knowledge

The notion of technology knowledge includes more than a simple understanding of the tools themselves; rather, the larger goal is an understanding of how the technology can merge with the teacher's own pedagogical style and classroom management techniques (Ertmer & Ottenbreit-Leftwich, 2010). According to Shulman (1987), pedagogical content knowledge represents teachers' understanding of how to merge subject matter with effective teaching techniques. This seamless fusion of content and pedagogy is what distinguishes a content specialist from a true educator. Building upon Shulman's notion of pedagogical content knowledge, Mishra and Koehler (2006) defined the interplay of technological resources, teaching, and subject area knowledge as *technological pedagogical content knowledge* (TPACK), and they argued that it is the basis upon which technology integration is built. Figure 1 illustrates the relationship between the three elements of TPACK.

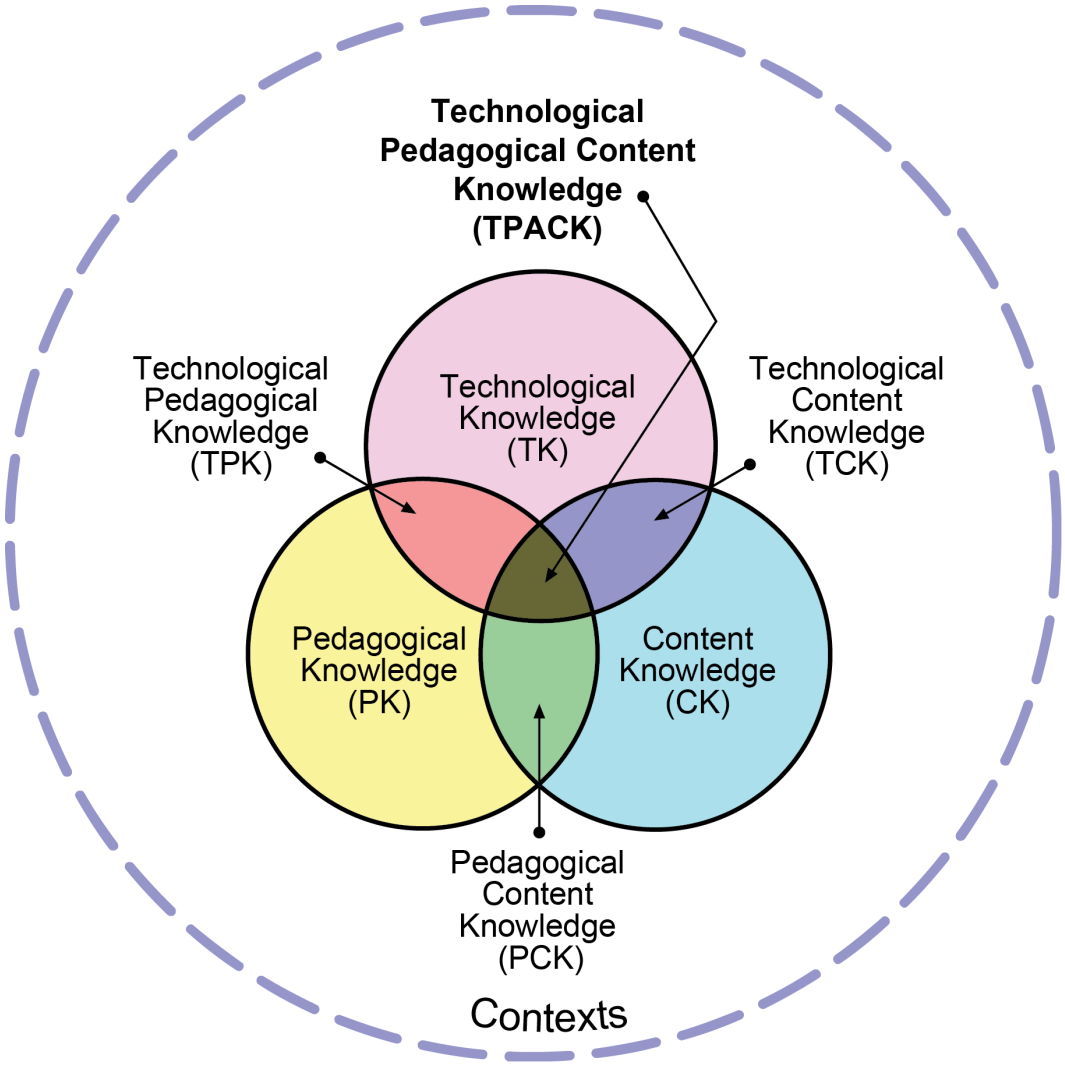


Figure 1. Components of technological pedagogical content knowledge. This figure illustrates the intersection of the three components of TPACK. Reproduced by permission of the publisher, ©2012 by tpack.org (Appendix A).

In the figure, content knowledge represents an understanding of the subject matter itself, while pedagogical knowledge encompasses the instructional strategies that are employed to teach that content. Technological knowledge represents the specific innovative resources that are utilized. While the three separate areas do overlap in pairs as illustrated, Koehler and Mishra (2008) claimed that, "solutions lie in the ability of the teacher to flexibly navigate the space defined by the three elements of content, pedagogy,

and technology and the complex interactions among these elements in specific contexts" (p. 18).

Self-efficacy Theory

Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). It is significant to note that he described self-efficacy as a perception, not as true fact. Whether or not a person can actually perform the task at hand is irrelevant; it is the perception of capability that either spurs an individual to action or curbs any attempts. Further, self-efficacy beliefs also play a part in how much a person persists when faced with a challenge. Those who have a high expectation of their own capabilities will show more perseverance, a quality that will in turn increase their chance of success (Bandura, 1977, 1997). These beliefs are thus directly related to the concept of teachers' technology integration within the present study; self-efficacy can be viewed as either an intrinsic enabler, acting as encouragement for a teacher to attempt new technology, or as an intrinsic barrier, hindering any such effort.

Bandura (1977, 1997) described four main sources of an individual's sense of self-efficacy. Active mastery experiences, he asserted, are the most powerful source of self-efficacy, because they provide the individual with firsthand knowledge of their ability to succeed at a particular task. Vicarious experiences, when successful endeavors are modeled rather than personally experienced, are not as potent as active experiences. Verbal persuasion is another source of self-efficacy. In verbal persuasion, another person expresses faith in an individuals' capability to perform a task. Physiological and affective states can be defined as conditions of arousal or stress that affect an individual's belief in

their capabilities (Bandura, 1977, 1997). Figure 2 illustrates the four sources of self-efficacy and examples of each source. Within the context of the current study, Bandura's four sources of self-efficacy provide a holistic framework for teachers' technological self-efficacy.

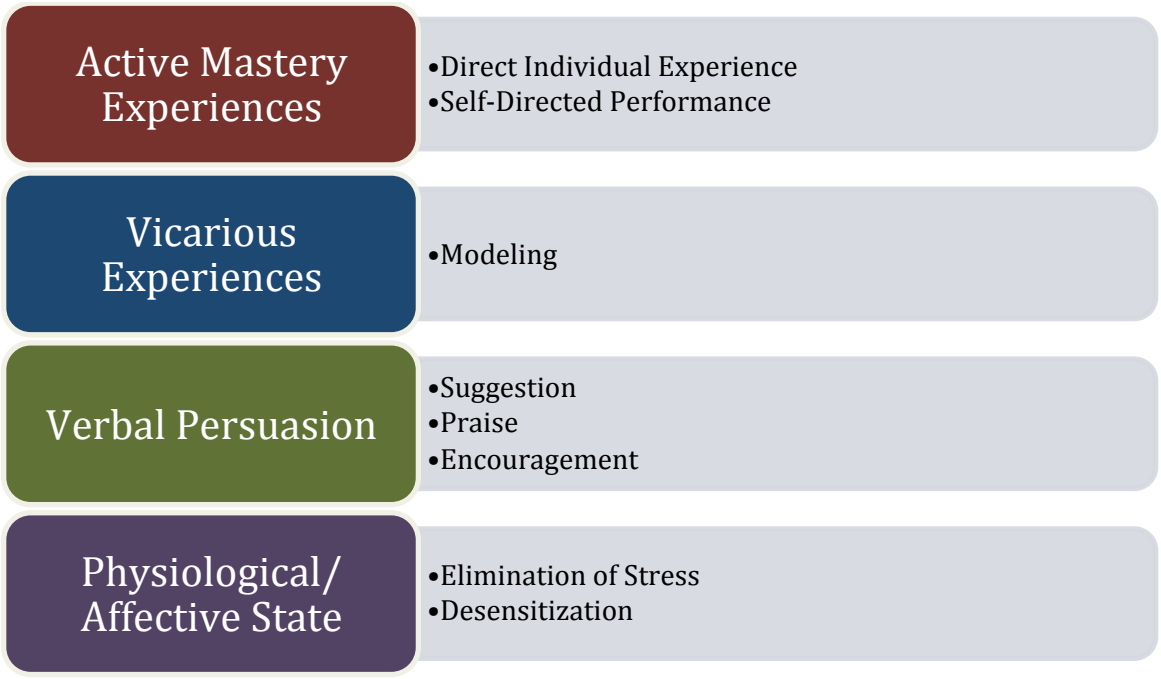


Figure 2. Primary sources of self-efficacy with examples. This figure illustrates Bandura's four sources of self-efficacy. Adapted from "Self-efficacy: Toward a Unifying Theory of Behavioral Change," by A. Bandura, 1977, Psychology Review, 84(2), p. 195. Used with permission from publisher (Appendix B).

Adult Learning and Professional Development

Although educators may be skilled in teaching children, due to the fact that they are adults, their requirements for learning are very different than those of their students. Andragogy, or the education of adults, represents the foundation of teachers' learning through professional development (Knowles et al., 2005). Knowles et al.'s (2005) andragogical model is comprised of several assumptions about the ways in which adult

learning differs from children's learning that provides a model for any technology-related professional development program.

The first assumption in Knowles et al.'s (2005) model is that adults must fully understand why they should learn something new. They must see the purpose and significance for the proposed knowledge in order for them to devote time and energy to mastering it. Within the context of the current study, if teachers are not aware of the importance and relevance of a new technology, it will be difficult for them to engage in learning about it. The andragogical model also emphasizes the importance of the adult learner's self-concept as an independent and self-directed learner. Rather than treating adult learners in the same ways as children, which often results in conflict and resentment on the part of the learner, adults' independence must be fostered. This independence is linked to another tenet of Knowles et al.'s andragogical model, the tendency for adults to have a much broader and more varied set of experiences than that of children. These differences translate into their need for more individualized learning, with more experiential methods.

Adults' readiness to learn is another central piece of the andragogical model (Knowles et al., 2005). Within the framework of technology integration, teachers who are not comfortable utilizing even basic technologies within their classroom are likely not prepared to integrate more advanced technological resources. Adults' orientation to learning is another key piece. Knowles et al. asserted that adults learn most effectively within a real-world context, because it is within such realistic situations that teachers can best understand how the new knowledge applies to a problem within their life. The final

tenet of the andragogical model is the importance of motivation, which includes an emphasis on both internal and external sources of motivation.

According to Elmore (2004), the consensus view of effective professional development states that it must include a focus on adult learning. Consequently, many of the tenets of Knowles et al.'s (2005) andragogical model are stated within the consensus view, such as a clearly stated purpose for learning, a focus on collaboration, active participation, and meaningful feedback. Additionally, the consensus view of effective professional development incorporates a focus on model practices, continuous improvement, and a clear plan for assessment and evaluation. Because the current study incorporated professional development as a possible factor in teachers' utilization of mobile handheld devices as instructional tools, Knowles et al.'s andragogical model and Elmore's (2004) consensus view of effective professional development encompass the foundation for such programs.

Figure 3 provides a visual representation of the three separate components of the current study's theoretical foundation. Koehler and Mishra's (2008) TPACK model provides a framework for the implementation of mobile handheld devices as an innovative technology. Bandura's (1977, 1997) Self-efficacy Theory, Knowles et al.'s (2005) andragogical model, and Elmore's (2004) consensus view of professional development complete the framework through which teachers' use of mobile handheld devices will be examined.

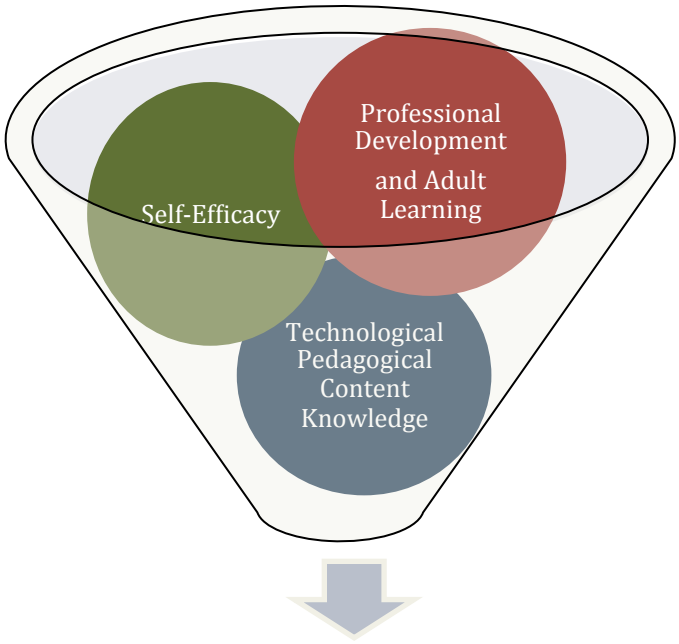


Figure 3. Theoretical framework. This figure illustrates the theoretical framework for the current study.

Purpose of the Study

The purpose of the current study was to examine secondary teachers' technology self-efficacy, their professional development activities regarding mobile handheld devices, and how they affect their use of such devices as instructional tools. The study also explored teachers' perceptions of other factors that act as barriers or enablers to their use of such devices. The results of the current study will help to inform designers of instructional technology programs about barriers and enablers to teachers' use of mobile handheld devices. If identified enablers can be enhanced and barriers can be minimized, such conditions will enhance the likelihood that teachers will utilize mobile handheld devices as instructional tools. The following research questions guided the study:

1. What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?
2. How do secondary teachers perceive their self-efficacy and professional development experiences regarding mobile handheld devices as they implement them as instructional tools?
3. What other factors do secondary teachers perceive as barriers and enablers to their implementation of mobile handheld devices as instructional tools?

Delimitations

Delimitations for the current study speak to the generalizability of the findings to the general population. Participants included middle and high school teachers. To ensure that participants had adequate classroom experience, they were limited to those who had at least three years of teaching experience. Participants were limited to full-time faculty members who taught in one of two pre-identified middle schools and one of four pre-identified high schools in a single public school district in the Southeastern United States.

Limitations

Because the researcher utilized surveys and interviews as data collection methods, one limitation of the study was that the data were entirely self-reported by participants. Due to this design, the researcher acknowledged that discrepancies may have existed between the participants' report of their technology usage and their actual use. However, because the researcher sought the perceptions of participants, the use of self-reporting was a necessary part of the research design. Additionally, because the participants had nothing to gain or lose based on their responses, the researcher expected that

discrepancies were minimized. Another limitation was the researcher's own bias as a passionate user of technology, particularly in the qualitative phase of the study. This bias was accounted for, and managed through the use of a semi-structured interview protocol, respondent validation, and peer review.

Significance and Benefits to the School District

The current study has made a number of contributions to the school district regarding teachers' implementation (or lack thereof) of mobile handheld devices for instructional reasons. First, it provided new and pertinent information about the relationship between teachers' self-efficacy, professional development and their use of mobile handheld devices. Second, in examining teachers' perceptions about barriers and enablers to their use of mobile handheld devices, the study provided a more complete understanding of barriers and enablers to overall technology use in school district schools. Ultimately, the current study provided information about why district teachers do or do not implement mobile handheld devices as instructional tools. A deeper understanding of this unique situation provides information about teachers' needs that can be leveraged in order to provide targeted and effective professional development and support for teachers as they work to implement innovative technologies within their pedagogy.

Definition of Terms

Active mastery experience: A source of self-efficacy in which an individual has a firsthand experience with success in a particular situation (Bandura, 1997).

E-reader: A device that stores and displays electronic books that is also capable of connecting to the Internet.

Instructional tool: Within the current study, an instructional tool was defined as a mobile handheld device that is used by students to aid in their learning.

Mobile handheld device: For the purposes of the current study, this was defined as any device that can be held in one hand that connects to the Internet and is capable of sending and/or receiving data, i.e. cell phone, smartphone, tablet, phablet, e-reader.

Perceptions: Secondary teachers' existing knowledge and beliefs that impact their pedagogical practices (Ertmer & Ottenbreit-Leftwich, 2010). In the current study, secondary teachers' perceptions of their experiences implementing mobile handheld devices were investigated, specifically with regard to factors that help or hinder such efforts.

Phablet: A mobile device that is a hybrid of a smartphone and a tablet.

Physiological/affective state: A source of self-efficacy in which a person experiences a sense of physical and mental comfort in a particular situation (Bandura, 1997).

Professional development: For the purposes of the current study, professional development was defined as any activity in which a teacher participates where he or she learns about how to use technology and/or to incorporate that technology within his or her pedagogy.

Secondary teacher: Within the current study, this was defined as a teacher of students in grades six through twelve.

Self-efficacy: An individual's perceptions of his or her capabilities to exercise control over his or her own success while using technology (Bandura, 1991).

Smartphone: A cellular phone that is capable of connecting to the Internet, performs many of the functions of a computer.

Tablet: A mobile device that functions as a touchscreen computer.

Technology integration: Using technology to support students as they construct their own knowledge through the completion of authentic, meaningful tasks (L. Wang, Ertmer, & Newby, 2004).

Verbal persuasion: A source of self-efficacy in which an individual receives meaningful spoken words of encouragement from others (Bandura, 1997).

Vicarious experience: A source of self-efficacy in which an individual witnesses another's success in a particular situation (Bandura, 1997).

CHAPTER 2. LITERATURE REVIEW

The overarching goal of the current study was to examine teachers' self-efficacy and professional development as factors that influence one another and ultimately impact teachers' integration of mobile handheld devices as instructional tools. The review of the literature includes peer-reviewed studies, literature reviews, books, reports, and conference proceedings that were chosen due to their inclusion of the themes of technology integration, self-efficacy, and professional development. Articles were chosen to include a particular focus on inservice teachers within the context of K-12 schools. Literature centered on preservice teachers, early childhood education, or higher education was excluded due to a lesser connection to the current study. Both recent research and seminal pieces were included within the review.

The first section of the literature review will focus on technology integration within K-12 schools, including technological pedagogical content knowledge, barriers and enablers to teachers' technology use, mobile technologies, and technology policies at all levels of government. The next section will explore self-efficacy as one factor that affects teachers' integration of technology and participation in professional development activities. The final section will examine professional development as a whole, effective technology-related professional development, and the effects of such professional development activities on teachers' attitudes and practices.

Technology Integration in K-12 Schools

Technology integration is a topic that has been discussed within the field of education for decades; yet, no universally agreed-upon definition of teachers' technology use exists (Bebell, Russell, & O'Dwyer, 2004). This may be because technology use appears in many different forms depending on the teacher, the students, the content area, and the context of the classroom. Some teachers may frequently use technology in varied ways while some do not utilize technological resources at all. The following section of the literature review is centered on the process of teachers' technology integration with a general consideration of how to improve this process. First, the researcher will describe the development of technological pedagogical content knowledge (TPACK) as a framework for effective technology integration. Next, the researcher will examine factors that are reported to either enhance or hinder the use of technology by teachers. Finally, the researcher will explore the types of technology use that are most commonly reported by K-12 teachers.

The Development of Technological Pedagogical Content Knowledge

Koehler and Mishra's (2005) technological pedagogical content knowledge (TPACK) framework represents the knowledge teachers must have in order to effectively incorporate technology within their pedagogy. Consequently, the development of TPACK skills is of key importance to technology integration. In their review of the literature regarding TPACK, Voogt, Fisser, Pareja Roblin, Tondeur, and van Braak (2013) identified teacher beliefs as a major contributor to the development of TPACK. They argued for an increase in research about the links between teachers' knowledge and beliefs and their development of TPACK. The authors also noted that in much of the

literature, active involvement in and authentic experiences with technology are cited as strategies in increasing teachers' TPACK. It is clear from these findings that teachers' use of technology in their classrooms is a key piece in the further development of technology skills. Therefore, it is important to examine the factors in play that either encourage or impede this continuing cycle of technology use and reinforcement.

Determining Factors for Teachers' Technology Use

In order to maximize the possibility that teachers will integrate technology within their classrooms, it is valuable to examine which factors facilitate such choices so that efforts can be made to increase them whenever possible. Conversely, it is equally valuable to examine the factors that act in opposition to technology use, so that such influences can be minimized or eliminated altogether. The studies to be discussed in this section contain such significant factors, and the identification of patterns among them reveals key information that can be leveraged in order to more effectively promote teacher technology use.

In their review of the literature, Ertmer and Ottenbreit-Leftwich (2010) identified teacher knowledge, self-efficacy, pedagogical beliefs, and culture as four central factors that affect teachers' ability to effectively incorporate technology within their classrooms. They asserted that knowledge of the technology itself, while important, is not solely sufficient for effective integration. Teachers must manage many factors at once, from choosing the appropriate technological tool to identifying the instructional strategies that are involved in successfully incorporating that tool. When she examined the attitudes of inservice teachers taking a course about integrating technology, Banas (2010) collected and coded teachers' responses to reflection questions in order to examine emergent

themes. As a result of her qualitative analysis, Banas reported that participants cited a lack of knowledge and skills as a barrier to technology use more than three times as often as any other factor. Furthermore, in a review of works centered on K-12 technology integration, Hew and Brush (2007) identified teachers' technology knowledge and skills as a barrier that appears repeatedly within the body of research. Throughout the literature, professional development emerges as a key factor in helping teachers to develop such technology integration knowledge and skills, qualities that increase the likelihood that they will then utilize technology in the classroom (Ertmer, et al., 2006; Hew & Brush, 2007; Wozney et al., 2006). One goal of the current study is to examine whether teachers' participation in valuable professional development activities centered on mobile technologies then increases their level of use within their classrooms.

Because technology is constantly evolving, even proficient teachers can feel as though they have fallen behind the times (Mueller, Wood, Willoughby, Ross, & Specht, 2008). Ertmer and Ottenbreit-Leftwich (2010) asserted that for this reason, self-efficacy is a crucial piece in effective technology integration. Time must be spent in raising the self-esteem of teachers so that they have the confidence to utilize new technological tools. Teachers who have a high expectation of success with technology were found to be more frequent technology users (Bauer & Kenton, 2005; Wozney et al., 2006). This may be due in part to the fact that more confident users of technology are more likely to find ways to triumph over existing barriers to technology use (Ertmer et al., 2006). This finding is supported by self-efficacy literature that states that individuals who have higher levels of self-efficacy also show more persistence when faced with a challenge (Bandura, 1997; Bandura & Cervone, 1986). Conversely, for some teachers, a lack of technology

self-efficacy can translate into an absolute fear of the technology. Such a fear can lead to a reluctance to use technology at all, an attitude that might result in complete avoidance (Honey & Moeller, 1990). This suggests that increasing teachers' self-efficacy with regard to technology can have positive implications for their openness to technology use. The current study examined whether existing levels of self-efficacy also affect teachers' willingness to learn about and to utilize mobile handheld devices.

Mueller et al. (2008) examined teachers with high and low levels of technology integration in an effort to determine which factors distinguish the two groups from one another. Using a survey design, the researchers did not find a link between self-efficacy and technology use. However, their study focused on teachers' general teaching efficacy rather than technology-related self-efficacy, which may account for the results. The researchers asserted that technology self-efficacy could be more important than general teacher efficacy, a finding that echoes Bandura's (1997) claim that self-efficacy is not generalized, but is instead subject-specific in nature.

Teachers must also see the value in using new technology. When faced with a new resource, teachers make decisions about the benefits of incorporating that tool into their instruction; these decisions speak to the teachers' personal beliefs regarding pedagogy (Ertmer & Ottenbreit-Leftwich, 2010). Teachers' views regarding technology as a practical resource have shown a strong correlation to the use of such tools (Russell et al., 2003). When asked how beliefs and attitudes act as a barrier to technology integration, teachers reported the opposite perspective: beliefs and attitudes actually function as an enabling factor in teachers' technology use (Ertmer et al., 2012). This finding suggests that the fostering of such positive beliefs and attitudes should be a major

consideration when planning technology-related professional development activities for teachers.

The aforementioned variables all concerned qualities that belong to the teacher as an individual; however, group culture and norms can also play a role in technology integration. In some cases, the culture of a school might influence a teacher to conform to a shared philosophy about increased technology integration. However, it is also possible that the perception that a teacher is straying from the established routines of a school could instead act as a hindrance (Ertmer & Ottenbreit-Leftwich, 2010). In their review of the literature, Hew and Brush (2007) identified school leaders, scheduling issues, and lack of planning as significant barriers to technology integration. Pan and Franklin (2011) found a positive correlation between administrative support and teachers' use of technology. It is therefore important that school leaders promote an environment in which teachers' technology use is supported and encouraged, in order to create an environment where technology use is maximized.

Teachers' level of experience with computers, whether through personal or classroom use, is also an important factor in technology integration. In their quantitative study that utilized surveys to determine teacher-reported enablers to technology utilization, Wozney et al. (2006) found that home use of computers was the chief predictor of classroom use. In addition to experiencing technology firsthand, teachers must specifically have constructive, affirming experiences that demonstrate why technology use in the classroom is beneficial. Positive technology-related experiences foster teachers' confidence and increase the chance that they will utilize technology (Mueller et al., 2008). Honey and Moeller (1990) found that teachers with a high level of

technology integration reported positive feelings toward technology and education. This finding supports Mueller et al.'s (2008) conclusion that positive experiences lead to increased technology use, and builds on Voogt et al.'s (2013) assertion that authentic experiences lead to increased TPACK. These studies generally indicate that teachers' experiences with technology must be actively engaging, involving the teacher in hands-on, authentic experiences, as well as positive in nature.

While experience with technology was found to be a key factor in several studies (Honey & Moeller, 1990; Mueller et al., 2008; Voogt et al., 2013; Wozney et al., 2006), age and overall teaching experience are not as crucial in determining teachers' level of technology integration. In their review of the literature involving technology use by individuals in differing age groups, Broady, Chan, and Caputi (2010) found that older individuals are just as capable as younger ones when learning about and using new types of technology. Mueller et al. (2008) also found that the number of years of teaching experience was not a determining factor in computer integration. Similarly, no correlation was found between teaching experience and technology integration in Ertmer et al.'s (2006) study of exemplary technology users. Instead they found that the higher the level of teaching experience of the individual, the more emphasis they placed on time, confidence, and support as facilitating factors. It appears from this finding that teachers with more experience are more self-reflective, more adept at identifying their own strengths and weaknesses, and better able to articulate what their needs are with respect to technology integration.

The aforementioned research paints an overall picture about what factors affect teachers' technology integration. In order to use such factors most effectively to create

conditions in which teachers have the best opportunity for integrating technology, it is important to distinguish between the factors that facilitate such endeavors, and those that instead act as hindrances. Ertmer et al. (2006) referred to these factors as either barriers or enablers. While such factors can be either intrinsic or extrinsic, teachers tend to place more emphasis on intrinsic factors such as beliefs and motivation than on extrinsic factors such as technology access and training (Ertmer et al., 2006; Ertmer et al., 2012). Table 1 summarizes two key studies that focused on the identification of factors that either enable or prevent technology integration, from the perspective of classroom teachers.

Table 1

Teacher-reported Intrinsic and Extrinsic Barriers and Enablers to Technology Integration

	Barriers		Enablers	
Research	Intrinsic	Extrinsic	Intrinsic	Extrinsic
Honey & Moeller (1990)	Lack of knowledge Lack of training Feeling fearful and inadequate Fear of a disruptive influence	Broken resources Small computer to student ratios Lack of time Strict purchasing guidelines Emphasis on standardized assessments	Pedagogical beliefs Motivation Overcoming personal fear	Administrative support District support Access to technology Mentors
Ertmer et al. (2012)	Attitudes and beliefs Knowledge and skills	Lack of time Lack of administrative support Lack of technical support Emphasis on standardized testing	Attitudes and beliefs Knowledge and skills	Professional learning networks Administrative support Student motivation and engagement

Table 1 reveals several patterns in the factors that affect technology integration. Overall, teachers reported more types of extrinsic barriers than intrinsic ones, a finding that might appear to suggest that the extrinsic factors are more of a concern. However, because teachers actually reported the intrinsic factors to be more important than the extrinsic ones (Ertmer et al., 2006; Ertmer et al., 2012), this suggests that more time overall should be spent on emphasizing those vital intrinsic enablers and minimizing the key intrinsic barriers. Another pattern that emerges from Table 1 is that many of the reported extrinsic barriers represent the "lack of" something, from time to resources to support. This suggests that key pieces to successful integration of technology are missing, and conditions might be quickly improved with their addition. Another interesting comparison between Honey and Moeller (1990) and Ertmer et al. (2012) is the fact that more than two decades had elapsed between them, and yet many of the same barriers and enablers were present in the later study, just as they were in the earlier one. This implies that while many important factors that either hinder or enhance technology integration were identified, more progress is needed in leveraging that information in order to maximize conditions for teacher technology use. The current study examined teachers' self-efficacy and professional development experiences as enablers to their integration of mobile handheld devices.

The Digital Divide

The digital divide refers to the "perceived gap between those who have access to the latest information technologies and those who do not" (Compaine, 2001, p. xi). Students in schools that are located in economically disadvantaged regions might not have the same level of access as those that are located in more affluent areas. According

to Park, Sinha, and Chong (2007), programs such as E-Rate are designed to bridge this gap by offering discounted Internet access to schools based on their level of need. The researchers asserted that E-Rate may have been successful in reducing the disparity with regard to basic access, but "startling gaps exist between the promise and reality of technology use in schools" (Park et al., 2007, p. 396). When teachers lack the technological knowledge and the necessary support to utilize the technology that is available, increased access means little toward actually bridging the divide.

Zhang, Trussell, Tillman, and Song (2015) studied patterns among Internet searches involving mobile technologies and educational apps. They found evidence of a higher need for information regarding mobile technologies within those states where a more significant gap exists in student achievement and in socioeconomic status. The researchers argued that this trend suggests the development of a digital divide within the field of mobile technology.

Chapman, Masters, and Pedulla (2010) also examined whether a digital divide still exists, comparing high needs schools with non-high needs schools. The researchers defined a high needs school as one that is eligible to receive funds under the federal Title I program. Title I funds are allocated to schools with a higher percentage of economically disadvantaged students for the purpose of improving students' academic achievement (Florida Department of Education [FLDOE], 2015). In the study, teachers from both high needs and non-high needs schools participated in an online technology-related professional development program. At the conclusion of the program, teachers from high needs schools reported a lower level of overall skill and openness to the use of instructional technology than those teachers from non-high needs schools. The

researchers concluded that, when examining the existence of a digital divide, it is just as important to examine the teachers' backgrounds and skill levels as it is the students' (Chapman et al., 2010).

Hohlfeld, Ritzhaupt, Barron, and Kemker (2008) examined the presence of a digital divide within schools in the state of Florida, particularly as it related to the socioeconomic status (SES) of the schools' populations. The researchers argued that the digital divide is actually comprised of three levels. The first-level divide refers to a lack of access, while the second-level divide signifies a deficiency in the use of technology. The third-level digital divide concerns the school's role in empowering students to use technology in order to reach their personal and educational goals. According to the researchers, reducing each level of the divide is dependent upon bridging each of the levels that precede it. The existing problem that was examined within the current study is related to Hohlfeld et al.'s (2008) concept of a second level digital divide, as it concerned a lack of a specific educational technology use by teachers.

In their study, Holhfeld et al (2008) found evidence of a first-level digital divide in Florida's schools. Specifically, they noted a higher level of access to computer software for students who attended schools with a higher SES. They also found evidence of a second-level divide, claiming that technology use by teachers was significantly greater in high SES schools, which mirrors the findings of Chapman et al. (2010). However, Hohlfeld et al. (2008) also noted higher levels of support within low SES schools. The researchers argued that the second-level divide could be bridged by such support in the future. These findings were consistent with their conclusions about the third-level digital divide that they discovered in Florida's schools. They found that in low

SES schools, students were more likely to use content delivery software such as drill-and-practice games or ready-made tutorials, which the authors argued is an entry-level technological skill. Conversely, students in high SES schools used more production software, such as multimedia authoring programs or web design, which requires more advanced technological skill. The researchers argued for more support for teachers, specifically in the form of professional development, in order to reduce the gap between these three levels of the existing digital divide. Consequently, the current study examined whether a relationship exists between teachers' professional development and their educational use of mobile handheld devices.

Mobile Devices

Mobile technologies can be defined as "all those technological devices which are portable and lightweight and either through the data cables or through wireless connections have Internet capabilities, such as mobile phones, PDAs, iPads, and smartphones" (Keengwe & Bhargava, 2014, pp. 737-738). Kim, Mims, and Holmes (2006) stipulated that mobile wireless technologies can be considered to be "technology that provides continuous accessibility to users anytime, anywhere without using wire or cable to connect to networks (like the Internet) transmit data or communicate with others" (p. 55). Cheung and Hew (2009) further specified that mobile handheld devices must be small and portable, fitting within one's hand. According to West (2012), mobile devices hold the potential to transform education due to their ease of access and ubiquity.

In their review of empirical studies regarding mobile learning, Liu et al. (2014) found that much of the research began in 2007 when smartphones such as the iPhone became more common. Their examination revealed a number of findings that support the

positive effects of the use of mobile devices. In studies that involved a comparison between traditional learning environments and those that involved mobile technologies, 75% reported positive learning gains for students as a result of the inclusion of mobile technologies.

Though mobile devices have become commonplace tools in students' everyday lives, their inclusion within the field of education is still an emerging field. Still, research has emerged that explores the benefits of the use of mobile devices in educational settings. Positive aspects of this use can be grouped into three main categories: improved student learning, increased student engagement and motivation, and enhanced communication and collaboration (Pollara & Broussard, 2011). Ultimately, the culmination of these benefits results in an improved educational experience for the student.

In Liu et al.'s (2014) review of existing empirical studies that centered on mobile learning, the authors reported an increase in literature surrounding mobile devices, which suggests that the field is growing in popularity. However, more than half of the literature cited was conducted in Asia, which suggests a need for similar research in the United States. Another concern noted by the researchers was the lack of literature regarding the use of mobile devices that was conducted at the secondary level; most studies were conducted in the elementary level or in higher education. This may be due to the conflict between the use of mobile devices for educational purposes and district policies regarding their use during the school day.

Among the studies included in Liu et al.'s (2014) meta-analysis that employed a comparison between traditional learning environments and those that involved the use of

mobile devices, the researchers found that 75% of those studies reported an increase in student learning gains. Other positive outcomes that were reported due to the use of mobile devices include increased communication and collaboration among students and teachers, as well as the extension of student learning and the school day itself to the world outside of the classroom. Lai, Yang, Chen, Ho, and Liang (2009) conducted a study in which groups of students engaged with a science lesson with and without the use of a mobile device. In the project, two groups of students progressed through five levels of activities, with one group using paper-based guides and the other using mobile handheld devices. The learning activities, assessment goals, and reference materials given to the groups were identical, other than the fact that one group utilized solely paper-based activities while the other group accessed electronic versions on their devices. At the conclusion of the activity, the group that employed the use of a mobile device was found to score significantly higher on the post-test than the group who participated in the traditional activity. Additionally, observations and analysis of students' work revealed that students who took part in the mobile device group exhibited higher levels of reflective observation and active experimentation with their new knowledge.

Lai et al.'s (2009) findings paralleled those of Huang, Lin, and Cheng (2010). In their study involving the Mobile Plant Learning System (MPLS), students used mobile devices to engage in a location-aware learning environment. Through the use of their devices, students were able to search for information, which required them to first identify what they needed to know. This gave the students the opportunity to take charge of their own learning by allowing them to seek and discover new information. Students then shared that knowledge with others, which resulted in increased collaboration among

the learners. Additional benefits of the program included increased levels of engagement, enthusiasm, and motivation for the students who participated in the MPLS, as opposed to those who utilized a traditional paper guidebook. Ciampa (2014), in his study involving classroom tablets as a specific mobile handheld device utilized for instructional purposes, also found motivation to be a benefit of their use. Specifically, the researcher's analysis of interviews and observations revealed that students' motivation was increased by the tablets' ability to provide instant feedback, increase cooperation among students, offer personalized scaffolding, and to foster a sense of teamwork between student and teacher.

Vani and Permanand (2011) measured the effects of a mathematics application designed to increase high school students' achievement in an algebra course. Students engaged with the app, titled MobileMath, using their mobile phones. At the culmination of the program, students showed significant improvement from the pre-test to the post-test. Further, the group that received teacher support showed more improvement than the group that worked entirely independently, suggesting that the teacher's role in the incorporation of such devices could be key.

M. Wang, Shen, Novak, and Pan (2009) examined a large, blended (partially live and partially online) English course that employed the use of mobile phones within the instructor's learning management system. Students used their phones to receive information, as well as to communicate with the instructor and other students. At the conclusion of the course, analysis of discussion board posts and survey results revealed that the students' interaction with their classmates, instructor, and teaching assistant were greatly improved as a result of their use of mobile devices, which demonstrated

participants' higher level of engagement with the course. Students indicated high levels of satisfaction with and interest for the course as well.

"Bring Your Own Device" initiatives are one way in which mobile devices can be utilized in schools, provided students have access to their own personal devices. Song (2014) examined one such program in which sixth grade students used their own mobile devices to achieve seamless science inquiry. As students progressed from a fish market, to a school lab, to home, and back to school, they used their mobile devices to remain engaged with the information and with each other throughout their changes in location. Analysis of pre- and post-test results, student artifacts, and observations allowed the researchers to conclude that students' knowledge of the material was extended beyond what they experienced in the textbook. They also exhibited higher levels of engagement and more positive attitudes about learning. In this case, it is important to consider the importance of the seamless inquiry pedagogical method that was employed in tandem with the use of mobile devices, because it is not possible to pinpoint which of those innovations had the larger impact in this case.

Furió, Juan, Seguí, and Vivó (2015) examined the effects of incorporating an iPhone game within a teacher's pedagogy. Though the results of pre- and post-tests revealed higher post-test scores for students who used the game, those results were not found to be statistically significant. However, students who engaged with the game did so independently, without any guidance from the teacher, and they scored as well as those students who received traditional instruction. Additionally, students who participated in the mobile game exhibited far higher levels of motivation for learning with this method.

It is clear from the breadth of the aforementioned studies that the incorporation of mobile devices can provide teachers and students with the opportunity to take part in a variety of classroom activities, including games and apps, whole methods of instructional delivery, devices that enhance experiential learning activities, and resources that scaffold learning for students who need assistance. Regardless of the specific instructional use, research has shown that the use of mobile devices, when students have access to them, can improve students' educational experience by improving their learning, increasing their opportunity for communication and collaboration, and increasing their motivation and engagement (Pollara & Broussard, 2011).

Cheung and Hew (2009) described seven ways in which mobile handheld devices can be utilized by teachers and students. These uses include multimedia access, communication, data capture, knowledge demonstration, analysis of data, assessment, and organization. Additionally, Kolb (2011) and Nielsen and Webb (2011) described a number of case studies in which a teacher incorporated the use of mobile devices within their pedagogy. Cheung and Hew (2009) cited several studies that described the positive effects of mobile technologies, such as student achievement and positive student attitudes, but no mention was made of teachers' reception to and perceptions of the use of mobile technologies. One of the goals of the current study was to add to the literature by filling that gap.

According to West (2012), many people consider the use of mobile devices such as smartphones to be the very opposite of education. Individuals view the devices as purely for entertainment, or as tools that lead to dangerous or inappropriate behavior by students. This stigma cripples mobile technologies' potential to be utilized in meaningful

ways. The author calls for innovative and forward-thinking researchers and educators to challenge such negative attitudes. The current study aimed to add to the conversation about the factors that either foster or hinder the use of mobile devices in an effort to further remove the stigma that surrounds them. According to Liu et al. (2014), school administrators must consider their policies surrounding the use of mobile devices in order to open classrooms to their transformative possibilities. The following section will therefore review technology policies at the national, state, and local level.

Technology Policies

In the landscape of the national K-12 education system, instructional technology has maintained a definitive presence with regard to policy. Culp, Honey, and Mandinach (2005) analyzed 28 key policy reports from over two decades. Their investigation included reports nominated by leaders in the educational technology field. These reports met a strict list of requirements including relevance to a wide audience, a focus on the K-12 arena, and the presence of recommendations about improving the state of educational technology, and revealed a pattern of emphasis on both the requirements and difficulties that teachers face as they incorporate technology. The authors asserted that this emphasis directly impacts the ways in which technology policy is written, because new programs are not effective if they do not take the needs of teachers into consideration (Culp et al., 2005). Technology policy exists in the form of technology plans at the national, state, and local levels; though differences exist among the different policies, the theme of maintaining a focus on teachers' needs echoes throughout all levels. This theme links to the current study in that it examined the needs of teachers with regard to their implementation of instructional technologies.

National Technology Policy

In 2016, the United States Department of Education Office of Educational Technology (USDOEOET) released its most recent National Education Technology Plan (NETP). The plan is comprised of five main focus areas: learning, teaching, leadership, assessment, and infrastructure. One of the overarching goals of the NETP is "making possible…everywhere, all-the-time learning" (USDOEOET, 2016, p. 2). The NETP references the educational potential of mobile devices; furthermore, the plan calls for action to utilize such devices effectively. The NETP also contains a clear focus on teachers' needs, just as Culp et al. (2005) asserted. One of the five main focus areas, teaching, is dedicated to the needs of educators and calls for more effective support in order to both inspire and empower individuals to become better teachers (USDOEOET, 2016). The NETP specifically states that professional development initiatives must be cognizant of challenges that teachers face when they learn about and incorporate instructional technologies. The current study related to this idea in that its goal was to identify such challenges, so that they can be addressed and minimized.

Florida's State Technology Policy

Florida's Department of Education (FLDOE) released a new technology plan beginning in 2014 that contains four overarching goals linking students, teachers, infrastructure, and access. Just as in the national technology plan, the development of teachers' skills with regard to technology integration is one of the main tenets of the plan (FLDOE, 2014). Florida's technology integration matrix (TIM) is comprised of five levels of technology integration for teachers, ranging from entry skills, to adoption, adaptation, infusion, and transformation (Florida Center for Instructional Technology,

2011). The existence of such a matrix and the overarching goal that teachers will progress through the levels suggests not only that teachers are assumed to be at vastly different levels of technology integration, but also that their skills are expected to improve. These expectancies mirror the technology integration goals for teachers that were stated in the national technology plan (USDOEOET, 2016).

District Technology Policy

The school district's technology plan also contains a focus on teachers' needs as a key component to technology integration, which mirrors the national and state plans. Accordingly, the district plan calls for an improvement in teachers' knowledge and skills regarding technology integration (Orange Blossom School District website, 2014). This trend is significant because not only does it suggest that teachers do, in fact, need to strengthen their technology skills, but the plan for professional development that is described and the levels of support that are reported suggest, as predicted by Culp et al. (2005) that in order to effect change with regard to technology integration, a focus on teachers' needs is warranted.

It is clear from the existing policies at local, state, and national levels that teachers' use of technology remains an area that needs improvement. The literature that focuses on barriers and enablers to technology use suggests that increased technology integration has both been a goal and an area of concern for some time. In order to effect change with regard to teachers' TPACK, which will in turn increase their integration of educational technology, it is necessary to further explore those factors that either hinder or facilitate technology use by local teachers. The following section will focus on self-

efficacy as one specific intrinsic factor that appears frequently in the aforementioned literature.

Self-efficacy

While the previous section of this review focused on the effects of certain factors on teachers' integration of instructional technology, the following section will focus on one intrinsic factor that is central to the current study: self-efficacy. First the researcher will explore the definition of self-efficacy with regard to education. The researcher will then review the similarities and differences of subject-specific self-efficacy and general teacher efficacy. Finally, the section will conclude with a review of the literature about how efficacy beliefs directly impact teachers' classroom behaviors regarding technology use.

An individual's self-efficacy, or the expectation of their future level of success, plays a powerful role in their willingness to take action. In his seminal work, Bandura (1977, 1997) reported four possible sources of self-efficacy: active mastery experiences, vicarious experiences, verbal persuasion, and physiological/affective state. Tschannen-Moran and Hoy (2007) reevaluated these four sources to determine their effects on the self-efficacy of teachers who possessed diverse levels of experience. As a result of this examination, though the researchers reported that Bandura's sources of self-efficacy were impactful, they found that different sources could have a different impact on the self-efficacy of novice teachers than that of veterans. In the case of mobile devices, teachers who have a great deal of experience in the classroom might be novices in the implementation of innovative types of technology; therefore, their self-efficacy regarding

that technology might be affected differently than their self-efficacy regarding general pedagogical skill.

According to Bandura (1977, 1997) higher levels of self-efficacy lead to increased tendencies for persistence and perseverance, even when an individual encounters difficulties along the way. Within the context of the current study, teachers' technology self-efficacy was examined as a factor that either encourages or hinders teachers' use of mobile handheld devices as instructional tools. Compeau and Higgins (1995) directly applied Bandura's theory to technology integration when they found in their study of adults' computer use that self-efficacy is a powerful predictor of the level of individuals' level of technology use. The researchers' quantitative analysis utilized partial least squares in an effort to examine the relationships among variables, such as computer use, encouragement, and self-efficacy. Though the researchers also explored the relationships between other variables, self-efficacy is the factor that is most relevant within the context of the current study, as its focus was to explore the types of relationships that exist between self-efficacy, professional development, and technology use. Compeau and Higgins (1995) also concluded that encouragement affected individuals' computer use, but primarily because it increased their self-efficacy, which correlates to verbal persuasion, one of Bandura's (1977, 1997) sources of self-efficacy.

Another of Bandura's (1977, 1997) sources of self-efficacy, active mastery experiences, are the most powerful source of self-efficacy, because they allow the individual to personally experience a feeling of success with the task. Tschannen-Moran and Hoy's (2007) findings echoed Bandura's assertion for both novice and veteran teachers; active mastery experiences were found to be the most impactful sources of self-

efficacy for teachers with all levels of experience. This idea echoes the aforementioned need for teachers to have authentic experiences with technology that are positive in nature (Honey & Moeller, 1990; Mueller et al., 2008; Voogt et al., 2013; Wozney et al., 2006). In the context of the current study, professional development can provide teachers with such active mastery experiences. Although vicarious experiences are not as potent as active experiences, they can be influential in situations where the individual has very little prior experience, and thus might be particularly effective for teachers who have little to no skill in utilizing technology (Bandura, 1977, 1997). Compeau and Higgins's (1995) finding that encouragement by others improved adults' self-efficacy, which in turn increased their computer use, is an example of verbal persuasion, another source of self-efficacy, according to Bandura. Tschannen-Moran and Hoy (2007) also reported that verbal persuasion can be an effective source of self-efficacy, but more so for novice teachers than for those with additional experience. Physiological/affective states, or feelings of stress or discomfort, can also affect individuals' self-efficacy (Bandura, 1977, 1997). In the case of technology integration, stress often acts as a barrier. When an individual experiences fear at the prospect of utilizing technology, such a feeling could result in complete avoidance (Honey & Moeller, 1990), a response that would eliminate the possibility that the person would participate in active mastery experiences that could raise their self-efficacy. This results in a cycle of evasion and a subsequent lack of growth with technology integration. In exploring teachers' beliefs about instructional technology, the current study examined how individuals viewed the different types of experiences they have had with mobile technologies, and how those beliefs shaped their decision-making processes about utilizing those resources.

Teacher Efficacy

Bandura (1997) asserted that self-efficacy beliefs are not necessarily generalizable; that is, just because an individual feels efficacious in one particular area does not necessarily mean that the feeling also extends to other disciplines. Therefore, it is useful to examine if a connection exists within the literature between an individual's general teacher self-efficacy, a term that is commonly referred to as simply *teacher efficacy* (Dellinger, Bobbett, Olivier, & Ellett, 2008) and technology self-efficacy. In their seminal mixed-methods study that identified the link between teaching efficacy and specific effective classroom behaviors, Gibson and Dembo (1984) offered several conclusions from their factor analysis of a number of teacher effectiveness variables. First, a general sense of teaching efficacy can be distinguished from other variables such as communications skills and adaptability, a finding that suggests that teaching efficacy is a unique construct. Second, as a result of classroom observations, the researchers found a link between teaching efficacy and effective teachers' behaviors, such as persistence, academic focus, and feedback. If a sense of teaching efficacy leads teachers to adopt behaviors that are regarded as especially effective, it may be reasonable to expect that individuals with higher teaching efficacy might also be more apt to utilize technology within their instruction. An individual's general sense of self-efficacy shows a positive correlation to their technology self-efficacy (Paraskeva, Bouta, & Papagianni, 2008). According to Bandura (1997), "teachers' beliefs in their efficacy affect their receptivity to, and adoption of, educational technologies" (p. 241).

Critiquing the work of Gibson and Dembo (1984), Tschannen-Moran and Hoy (2001) called for an improved measure of teacher efficacy. While they stated that Gibson

and Dembo's (1984) scale has historically been the most widely utilized, they also argued that it results in inconsistent findings, and that the measure could be both clarified and abbreviated. They asserted that one way in which Gibson and Dembo's (1984) instrument needs improvement is in the area of specificity. Therefore, the authors called for research that focuses more on subject-specific types of teacher efficacy, and they argued that such results have been found to be meaningful (Tschannen-Moran & Hoy, 2001). The current study explored technology self-efficacy, a concept that fits the description of a subject-specific type of teacher efficacy. Because the terms teacher efficacy and self-efficacy have been used synonymously in much of the literature (Dellinger et al., 2008) the following section will therefore review the existing literature involving both teacher efficacy and technology-related self-efficacy, and how they affect teachers' classroom practices.

Efficacy's Effects on Classroom Practices

Guskey (1988) argued that teachers with high levels of self-efficacy are more open to the implementation of new practices within their classrooms. In his quantitative study of K-12 teachers, Guskey administered a questionnaire that contained items regarding teacher efficacy, attitudes toward teaching, self-concept with regard to teaching behaviors, and participants' opinions about mastery learning, an innovative instructional strategy at the time of the study. Product-moment correlations revealed relationships between some of the variables. For example, Guskey found that participants with high levels of teacher efficacy were more open to instructional innovations. Efficacious teachers opt to involve themselves in new programs in the hope that their pedagogy might be improved. Conversely, individuals with low levels of teacher efficacy tend to avoid

such programs if possible. This condition results in a self-fulfilling cycle, where teachers who view themselves as effective improve; thereby further enhancing their sense of efficacy. Those teachers who doubt their effectiveness only continue to do so as a result of a situation in which they are not open to change. Guskey's findings support the link between self-efficacy and openness to technology use; for those teachers for whom technology is an area of strength, self-efficacy acts as an intrinsic enabler. Conversely, for those teachers for whom technology is an area of weakness, self-efficacy instead functions as a barrier to technology use (Bauer & Kenton, 2005; Ertmer et al., 2012; Honey & Moeller, 1990; Wozney et al., 2006). The current study relates to Guskey's (1988) research in that it further explored the influence that a teacher's self-efficacy has on their decision to participate in instructional innovations; in this case, instructional technology.

Paraskeva et al. (2008) studied Greek teachers' receptivity to technology integration as a result of their level of self-efficacy. They examined the link between general self-efficacy and computer-related self-efficacy, as well as the link between general self-efficacy and computer use. In the study, participants completed a survey that was constructed from elements of existing scales centered on general self-efficacy, self-esteem, and computer self-efficacy. The Spearman Rank correlations method was utilized in order to examine relationships between the variables. The researchers found a significant positive correlation between general self-efficacy and computer self-efficacy. They attributed this relationship to the fact that teachers who feel that they are efficacious are more likely to be inspired to learn about new things, a finding that supports Guskey's (1988) similar conclusion about the motivations of efficacious teachers. It is important to

note, however, that both Guskey (1988) and Paraskeva et al. (2008) reported a generally high level of teacher efficacy by all of their participants; therefore, they did not include the technology-related beliefs of teachers with a lower level of teaching efficacy. Tschannen-Moran and Hoy (2007) explored the link between teaching experience and age, and their results revealed that novice teachers have a lower sense of teaching efficacy. However, Bunch, Robinson, and Edwards (2012) noted that novice teachers reported higher levels of self-efficacy with regard to the use of interactive whiteboards, an innovative technology. It is clear that the link between teacher efficacy and technology-related self-efficacy is not necessarily clear, and more research is needed to further describe the connection.

Smylie (1988) explored the link between teachers' efficacy beliefs and their openness to innovation and change through professional development programs. His methods included classroom observations, structured interviews, and surveys; findings revealed that efficacy beliefs were the most powerful predictor of change in teachers' practice. Smylie's results suggested that the basis for a teacher's ability to change is their own self-perception, which is influenced by experiences they have within their classroom and with colleagues. While Smylie's research did not specifically involve technology-related change, his findings are relevant to the current study in that they involve teachers' capacity for innovation.

The aforementioned literature supports the view that efficacy beliefs have a strong effect on teachers' willingness to incorporate technology within their classrooms. Albion (1999) argued that teachers' feelings of self-efficacy play an important part in their general belief systems about technology, and those beliefs directly impact their predicted

level of success with technology integration. While much of the literature focuses on the link between self-efficacy and general technology use (Bauer & Kenton, 2005; Compeau & Higgins, 1995; Ertmer et al., 2012; Honey & Moeller, 1990; Paraskeva et al., 2008; Wozney et al., 2006), several studies instead examined the link between self-efficacy and the implementation of one specific type of technology (Bunch et al., 2012; Pan & Franklin, 2011; Van Acker, van Buuren, Kreijns, & Vermeulen, 2013). As Mueller et al. (2008) argued, because technology is a field that is ever growing, even experienced teachers can feel uncomfortable with new technologies. It is possible that a teacher's self-efficacy regarding one new type of technology might differ from their perceptions of another, more familiar, tool. Table 2 provides a comparison of these studies.

Table 2 reveals several key pieces of information that are common among the studies. All share a similar methodology, with a survey or questionnaire having been presented to the participants. The current study utilized a similar strategy as a means of data collection. Another commonality is the link between self-efficacy and the use of each technology, despite the fact that the three tools are different. It is clear that teachers' self-efficacy powerfully influences the process of technology integration, whether it acts as a positive or as a negative force. Another noteworthy similarity among the studies is the mention of professional development as a means to improve teachers' self-efficacy. This recommendation appears frequently throughout the literature (Ertmer et al., 2006; Hew & Brush, 2007; Wozney et al., 2006).

Table 2

Selected Literature Concerning the Link Between Self-efficacy and Specific Technologies

Descriptor	Pan & Franklin (2011)	Bunch et al. (2012)	Van Acker et al. (2013)
Purpose	Determined factors that predict K-12 teachers' use of technology Identified barriers to technology use Used a theoretical framework based on self-efficacy theory	Descriptive-correlational study Examined K-12 teachers' self-efficacy, predictions of success, and interest for technology Used a theoretical framework based on self-efficacy theory	Used a framework based on the Integrative Model of Behavior Prediction (IMBP); the model includes self-efficacy as one of its basic tenets Explored the link between IMBP and K-12 teachers' use of technology
Technology Involved	Web 2.0 tools	Interactive Whiteboard (IWB)	Digital learning materials (DLMs)
Methods	Quantitative study Modified surveys from previous studies, one focused on tool integration, the other on self-efficacy for the tool	Quantitative study Modified a previously used survey that was modified Computer-based questionnaire	Quantitative study Used a survey created especially for the study, which was validated first
Results	Use of Web 2.0 tools found to be very low Lack of self-efficacy in Web 2.0 tools Self-efficacy found to be the main predictor of Web 2.0 technology use	High levels of self-efficacy with IWB Positive outcomes with IWB expected Self-efficacy and outcome expectation positively related Experience with IWB found to be linked to high self-efficacy levels	Teacher attitude and self-efficacy found to predict teachers' intention to use DLMs Attitude and self-efficacy also linked to positive outcome expectations with DLMs
Conclusions	Self-efficacy must be raised for teachers to integrate Web 2.0 tools more Professional development is recommended	Professional development is key in providing experience with IWBs	Positive attitudes and self-efficacy must be fostered in teachers through targeted professional development

Self-efficacy is an intrinsic factor that directly affects teachers' integration of instructional technology. The previous section described the concept of self-efficacy, explored its link to teacher efficacy, and examined the ways in which it can affect classroom practices. Because professional development activities have been recommended throughout the literature as a means to raise teachers' self-efficacy (Bunch et al., 2012; Ertmer et al., 2006; Hew & Brush, 2007; Pan & Franklin, 2011; Van Acker et al., 2013; Wozney et al., 2006), the next section of this literature review will explore the types of professional development that are found to be most beneficial, as well as the effects they have been found to have on teachers' technology integration.

Professional Development

If teachers are expected to incorporate technology in their classrooms, it is essential that they possess the required knowledge about how to best achieve that goal. Because professional development is commonly noted as a necessary step in technology integration, it is reasonable to conclude that teachers who do not utilize technology in their instruction could benefit from more professional development (Ertmer et al., 2006, 2012; Hew & Brush, 2007; Wozney et al., 2006). Therefore, the following section will examine trends in the literature about technology-related professional development. First, the researcher will review literature about how adults learn most effectively. Next, the researcher will explore qualities of technology-related professional development programs that were found to be effective. Finally, the researcher will examine how those effective programs impacted teachers' self-efficacy and classroom practices.

Adult Learning

Knowles et al.'s (2005) andragogical model outlines the unique needs of adult learners. Exploring these differences is a crucial step in understanding how professional development can be crafted to be most effective for teachers. According to the andragogical model, adults require an understanding of the purpose and reason for learning a new topic. Within the context of the current study, if teachers do not fully understand the importance and relevance of a new type of technology, it will be difficult for them to buy in to its use. This echoes the emphasis placed on the importance of teachers' beliefs about technology that reoccurs through the literature regarding barriers and enablers to technology integration (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Russell et al., 2003). Another tenet of the andragogical model also emphasizes adults' tendency to be independent and self-directed learners, who must engage in significant experiences in order to learn (Knowles et al., 2005). The importance of teachers' meaningful experiences with new technology is reported throughout the literature as a crucial step in improving technology integration (Bandura, 1977, 1997; Honey & Moeller, 1990; Mueller et al., 2008; Voogt et al., 2013; Wozney et al., 2006). Knowles et al.'s (2005) andragogical model also incorporates adults' readiness to learn and their orientation to learning, which translates into an emphasis on real-life learning situations. Voogt et al.'s (2013) concept of authentic experiences as a means to increase teachers' technological pedagogical content knowledge and Bandura's (1977, 1997) concept of active mastery experiences as a way to improve self-efficacy are examples of learning that occurs within a real-world context.

Motivation represents the final tenet of the andragogical model (Knowles et al., 2005). While external motivators affect adults' enthusiasm for learning new skills such as innovative technologies, Knowles et al. (2005) argued that internal motivators are even more powerful. Ertmer et al. (2006) and Ertmer et al. (2012) made a similar argument when they reported that intrinsic factors are more influential than extrinsic factors with regard to barriers and enablers to technology integration. Due to the fact that it provides a framework for effective adult learning, Knowles et al.'s (2005) andragogical model relates to the professional development component of the current study. In order to provide professional development that is effective, the unique needs of adult learners must be considered. Because the current study involved technology-related professional development, the next section of research will focus on the characteristics of technology professional development programs that proved to be effective.

Effective Technology Professional Development

Throughout the literature centered on the improvement of technology integration, professional development appears frequently as a necessary step (Bunch et al., 2012; Ertmer et al., 2006; Hew & Brush, 2007; Pan & Franklin, 2011; Van Acker et al., 2013; Wozney et al., 2006). In their meta-analysis of 21 empirical studies involving technology-related professional development, Lawless and Pellegrino (2007) specifically cited teachers' lack of technology skills as the new digital divide. They asserted that that while access to technology has improved, the divide is actually worsening as a result of a lack of human capital. Lawless and Pellegrino's argument is at the heart of the current study, in that its overarching goal was to improve teachers' knowledge and subsequent use of instructional technologies.

Lawless and Pellegrino (2007) noted that much of the reported data in the field of technology-related professional development consists of teachers' perceptions and self-reported results, rather than empirical evidence. They argued that this trend results in a lack of understanding about what truly makes professional development effective. This assertion lies in contrast to the literature that emphasizes the importance of teachers' beliefs as a determining factor of teachers' technology use (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Honey & Moeller, 1990; Russell et al., 2003). Lawless and Pellegrino (2007) also noted that the goals of technology-related professional development programs could be vastly different based on their foci. Professional development that emphasizes how to use a particular technology differs from a program designed to explore its integration into classroom instruction. Within the context of the current study, teachers with varying levels of self-efficacy might have different needs with regard to professional development. Those who are altogether unfamiliar with technology may need more basic training about the tool itself, while those who have more experience might need to focus more on pedagogical methods.

Lawless and Pellegrino's (2007) analysis of literature regarding technology-related professional development programs allowed them to discover many similarities among the literature. One such parallel was the tendency for professional development programs to be short in duration and focused on only one particular type of technology, a practice they described as disconnected and fragmented. Borchers, Shroyer, and Enochs's (1992) study involving rural science teachers' adoption of microcomputers into their instruction also found short workshops with a singular focus to be less effective in changing teachers' practices. The researchers administered a survey to their participants

first after a short workshop and then again at the completion of a longer ongoing program. Teachers reported feeling a much more significant level of change as a result of the extended program than they had after just the first workshop. Kanaya, Light, and McMillan Culp (2005) found that intensity, rather than duration, is more important when designing technology-related professional development. In their study of K-12 teachers learning to incorporate new technologies, the researchers found that extending the overall time length, which resulted in a lower level of intensity, also resulted in a reduced level of implementation. Participants who completed the program in a standard or compressed time format were more likely to utilize the technology within their classroom. The authors attributed this result to a lack of focus that is the by-product of a long, drawn-out program.

Another similarity that Lawless and Pellegrino (2007) noted in their review was the tendency for professional development programs to be based in instructional design, which allows teachers to make connections between the technology and their particular pedagogical needs, and also to build communities of practice with their colleagues. The authors also found the inclusion of a peer mentoring component to be a successful theme that repeated in much of the technology professional development literature. A final similarity noted by the researchers was a prevalence of a train-the-trainers design, in which one teacher learned about a new technology and then disseminated their knowledge to others. The researchers argued that teachers might make the most effective instructors, because they best understand the needs of their peers. Lawless and Pellegrino's findings are relevant to the current study, because it was similar in its empirical nature to the studies they examined. The current study also examined the

implications of technology-related professional development in an effort to maximize the effectiveness of future mobile technology instruction.

In their examination of technology-related professional development literature, Bray-Clark and Bates (2003) argued that teachers' self-efficacy must be a key consideration in any effective program. The researchers alleged that teachers' self-efficacy beliefs create a cycle of influence in which self-efficacy positively impacts their willingness to participate in professional development, which in turn raises their self-efficacy, which further encourages professional development, and so on. Bandura 's (1977, 1997) sources of self-efficacy (active mastery experiences, vicarious experiences, verbal persuasion, and psychological stimulation) can be leveraged in an effort to raise teachers' self-efficacy. In order to provide active mastery experiences, professional development experiences should include challenging tasks that require teachers to apply new skills. Simulations that provide hands-on, real world experiences are valuable tools for teachers working to master a new technology. Tschannen-Moran and McMaster (2006) reported a similar finding in their study that examined the relationship between the format of a professional development program and changes in teachers' self-efficacy. In the study, participants experienced professional development activities that involved Bandura's four sources of self-efficacy. The researchers discovered that the most effective professional development program was one in which teachers took part in an active mastery experience with the new instructional strategy within the context of their own classrooms. The argument for a real-world context is one that also appears in literature about adult learning and teachers' development of technological pedagogical content knowledge (Knowles et al., 2005; Voogt et al., 2013).

Bray-Clark and Bates (2003) cited the use of vicarious experiences as another characteristic of technology professional development that allows for a focus on self-efficacy. Teachers must have the opportunity to witness both the successes and failures of their peers, so that they might learn from them. An additional benefit of vicarious learning is the collaboration that occurs when teachers work together. Peer support can then take the form of verbal persuasion, in which groups of teachers provide support to one another throughout the learning process. Psychological arousal can be maximized by providing feedback that is useful and positive, as well as fostering an environment in which teachers feel safe to learn without the threat of punishment, even if they have difficulty mastering new skills. The inclusion of peer support and verbal persuasion by Bray-Clark and Bates echoes Lawless and Pellegrino's (2007) suggestion that effective professional development programs include peer mentoring and a focus on building communities of practice.

Similar to Bray-Clark and Bates's (2003) argument that self-efficacy must be a key consideration when designing technology-related professional development, Scribner (1999) argued that teachers' efficacy beliefs affect their professional development experiences. In his qualitative study that explored the relationships between teachers' efficacy and their opinions of professional development, Scribner used interviews as the primary method in which to gain teachers' perceptions in their own words. From patterns that emerged as a result of axial coding, the researcher discovered that teachers with different levels of efficacy expressed different motivators for participating in professional development activities, as well as different ways in which they interacted with the new knowledge they acquired. Teachers who perceived themselves as efficacious were

motivated by intrinsic factors such as a sense of duty toward their students and the teaching profession, as well as a desire to increase their own knowledge. Such efficacious individuals proved to be more successful in applying the knowledge to their own practice, and in reflecting on it. Teachers who fell on the lower end of the self-efficacy scale were motivated by extrinsic factors such as classroom management issues, salary increases, and licensing requirements. Their comprehension of the new knowledge was fragmented, with a focus on the replication of a few basic skills, rather than a deep understanding that could transform their classroom practices. Scribner's findings suggest that professional development could be much more beneficial for those teachers who already have higher preexisting levels of self-efficacy, which supports Bray-Clark and Bates's (2003) argument for a focus on improving self-efficacy within professional development itself. Within the context of the current study, the research examined both teachers' technology self-efficacy and their technology-related professional development experiences, which, according to the aforementioned literature, are two variables that continuously act as influences upon one another.

The Outcomes of Technology-Related Professional Development Programs

Professional development can be considered effective if it has a positive impact on teachers' beliefs or behaviors. Within the context of the current study, both types of change can be considered successful because such a strong relationship exists between teachers' beliefs about technology and their integration of technological tools within their instruction (Bauer & Kenton, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Ertmer et al., 2006; Honey & Moeller, 1990; Russell et al., 2003; Wozney et al., 2006). Therefore the following section will focus on outcomes of technology-related

professional development programs. The research will examine literature in which teachers' self-efficacy was impacted as a result of professional development, which will be followed by an exploration of literature in which teachers' classroom practices were changed.

Changes in Teachers' Self-efficacy

In their study of PK-12 teachers who participated in online professional development courses about technology integration, Overbaugh and Lu (2008) found that the program positively impacted teachers' self-efficacy levels regarding technology. The researchers utilized both quantitative and qualitative methods of data collection in order to triangulate their findings. Participants completed a self-efficacy survey before and after taking part in the online courses, which were offered over a six-week period. The participants then took part in a final survey several months after the completion of the course, which provided data after they had had enough time to begin implementation of the new technologies. The researchers utilized ANOVAs in order to compare survey results before the training, immediately after its completion, and after implementation of the technology. Overbaugh and Lu also utilized a structured interview protocol in order to collect qualitative data about teachers' perceptions of their own efficacy, and to triangulate their findings. The researchers discovered that participants reported a significant change in their self-efficacy immediately after they completed the course, and very little change from that level during the follow-up survey and interviews, which suggests both that the professional development positively impacted teachers' self-efficacy, and that the results appeared to be long-lasting. Overbaugh and Lu's research is relevant to the current study because not only did it examine the link between

technology-related professional development and technology self-efficacy, but it also involved both survey and interviews as methods of data collection. The current study utilized a similar methodology in its data collection and analysis.

While Overbaugh and Lu's (2008) study involved teachers of a mixture of subject areas, several studies examined the link between professional development and self-efficacy within a particular subject area (Borchers et al., 1992; Lau & Yuen, 2013; Shriner, Clark, Nail, Schlee, & Libler, 2010). Table 3 provides a summary of their findings. It is significant to note that, although the professional development programs involved disparate subject areas and different types of technologies, the overarching theme that links them is an increase in teachers' technology self-efficacy as a result of the professional development activities in which they took part. The findings of these studies are relevant to the current study because the included participants taught a variety of different subject areas.

The literature is inconclusive with regard to the length of time necessary to effect change in teachers' self-efficacy as a result of professional development. In Brinkerhoff's (2006) study of elementary and middle school teachers, participants took part in a professional development program that lasted for two years. Through his analysis of quantitative surveys and qualitative interviews, the researcher concluded that teachers' increase in self-efficacy was due to the extended time length of the program. When Brinkerhoff administered the survey to participants at the end of the first year, he found no substantial change in teachers' self-efficacy at that point. However, he then found a significant change when participants took part in surveys at the end of the second year.

Table 3

Selected Literature Concerning Self-efficacy and Professional Development Within a Single Subject Area

Descriptor	Lau & Yuen (2013)	Shriner et al. (2010)	Borchers et al. (1992)
Purpose	Determined the impact of technology-based professional development on teachers' perceptions about instructional technology	Examined how content-specific technology self-efficacy and skill level were impacted by a targeted professional development program	Documented and evaluated how teachers' beliefs and behaviors were affected by a professional development program
Subject area	Mathematics	Social Studies	Science
Methods	Quantitative methods Online surveys	Quantitative study Pre- and post-test surveys	Quantitative study Used surveys before, during, and after training
Technology	Dynamic geometry software Computer algebra systems Dynamic statistics software	Internet resources Personal response systems Presentation software	Microcomputers
Results	Higher levels of technology-self-efficacy reported More positive perceptions about incorporating technology reported	Higher perceived confidence about incorporating technology Instructor-modeled activities were reported to be particularly effective	Teachers' self-efficacy regarding the use of the computer was positively impacted Changes in teachers' self-efficacy affected their actions
Conclusions	Teachers and researchers must understand the changes involved in the implementation of instructional technology	Though teachers had access to technology all along, they required training and practice before they could utilize them effectively	Access to computers was not sufficient; training was needed Short workshops are not as effective and extended-length programs

Brinkerhoff's findings were synonymous with Borchers et al.'s (1992) conclusions. In their study involving science teachers who participated in training about the implementation of microcomputers, the researchers found that a two-day workshop did not provide sufficient time for a change in self-efficacy. However, in Shriner et al.'s (2010) study involving social studies technology implementation, the researchers concluded that teachers experienced changes in their self-efficacy in an equivalent period of time. In Ross, Ertmer, and Johnson's (2001) study involving K-12 teachers who participated in a semester-long technology professional development program, the researchers utilized surveys in order to gauge participants' self-efficacy levels, while interviews provided data about teachers' perceptions about the change in self-efficacy. The qualitative data revealed a variety of reasons cited by participants as to why their confidence improved, including an increase in knowledge, hands-on experience with computers in the training and in their classrooms, and support. This discrepancy suggests that time may not be the sole factor in determining the level of effectiveness of a professional development program; rather, it may be that longer professional development programs provide more opportunity for teachers to have more positive experiences. Such active mastery experiences are a necessity for adult learning, improving self-efficacy, and increasing technological pedagogical content knowledge (TPACK) (Bandura, 1977, 1997; Bray-Clark & Bates, 2003; Knowles et al., 2005; Voogt et al., 2013). The themes of TPACK, self-efficacy, and teachers' increase in skills were central tenets of the current study.

Changes in Teachers' Classroom Technology Practices

In Ross et al.'s (2001) study of K-12 teachers' change in self-efficacy and level of technology integration as a result of professional development, teachers reported an initial increase in their use of technology within their classroom. Interview data revealed that participants attempted to utilize within their instruction many of the new skills they had learned. It is not clear, however, whether those changes in practice were short-lived as a result of an immediate increase in motivation and excitement for the new technology, or truly long lasting. Brinkerhoff (2006) reported that, though his participants' professional development program resulted in immediate improvements in their self-efficacy, true change in classroom practices is a complicated process that can take several years.

When Overbaugh and Lu (2008) surveyed their participants several months after the technology professional development had taken place, many participants reported that they were more successfully utilizing technology within their classrooms. However, many participants expressed a desire for continued activities and support, which suggests that long-lasting change with regard to technology implementation might depend upon the implementation of such follow-up activities as an extension of the professional development program itself. More research is necessary in determining whether technology-related professional development programs lead to an increase in teachers' use of instructional technologies. This relates to the current study in that it explored teachers' perceptions about technology-related professional development, within the context of a need for increased technology integration.

Chapter Summary

The ultimate goal of technology integration is the development of technological pedagogical content knowledge, through which teachers can seamlessly incorporate technology into their classrooms in a meaningful way (Koehler & Mishra, 2008). Technology policies that extend from the national level through state and local policies demonstrate how technology integration is an overarching goal in the K-12 realm (FLDOE, 2014; Orange Blossom School District, 2014; USDOE, 2010).

It is clear from the examination of the literature surrounding technology integration, self-efficacy, and professional development that the three themes are closely intertwined. Both self-efficacy and professional development act as significant factors that affect teachers' use of instructional technologies within their classrooms. Self-efficacy can act as a barrier or an enabler to technology integration, depending on whether a teacher's existing sense of efficacy is high or low (Bauer & Kenton, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2006; Wozney et al., 2006). Effective professional development can either inspire a teacher to utilize instructional innovations, or a lack of such training can result in a dearth of knowledge and skills, thereby preventing the use of technology (Banas, 2010; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2006; Hew & Brush, 2007; Wozney et al., 2006). Self-efficacy is a powerful force that also affects teachers' willingness to even attempt professional development activities, as well as their reception to such new experiences. Consequently, effective professional development that incorporates a focus on the improvement of teachers' self-efficacy has been shown to be more powerful than that which excludes it (Bray-Clark & Bates, 2003; Scribner, 1999).

According to the literature, the relationship that exists between self-efficacy and professional development plays a powerful role in teachers' integration of technology within their classrooms. If teachers are to achieve true technological pedagogical content knowledge, then an improved awareness about how their perceived self-efficacy affects their technology-related professional development choices and activities is needed. The purpose of the current study was to further examine that relationship in an effort to better understand the factors that come into play when teachers make decisions regarding the use of instructional technologies.

CHAPTER 3. METHODOLOGY

The following chapter will describe the processes and instruments that were employed in the current study. First, the researcher will discuss the study's design. Next, an examination of the procedures is included. Finally, the researcher will describe the data analysis procedures.

Study Design

The purpose of the current study was to examine secondary teachers' technology self-efficacy, their professional development activities regarding mobile handheld devices, and how they affect their use of such devices as instructional tools. The study also explored teachers' perceptions of other factors that act as barriers or enablers to their use of such devices. Specifically, the following research questions directed the current study:

1. What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?
2. How do secondary teachers perceive their self-efficacy and professional development experiences regarding mobile handheld devices as they implement them as instructional tools?
3. What other factors do secondary teachers perceive as barriers and enablers to their implementation of mobile handheld devices as instructional tools?

In an effort to address these research questions, the current study utilized both quantitative and qualitative methods in a convergent parallel design. According to Creswell (2015), when a study incorporates both quantitative and qualitative designs, the result is a better understanding of the research problem than either design would provide on its own. In a convergent parallel design, both quantitative and qualitative data are collected, which "enables one to gain multiple pictures of a problem from several angles" (Creswell, 2015, p. 37). For the current study, the researcher administered a survey in order to quantify any relationship that existed between secondary teachers' technology self-efficacy, professional development, and their use of mobile handheld devices. For the qualitative phase, the researcher employed a phenomenological approach, in which she conducted interviews in order to examine teachers' perceptions of this relationship in their own words, as well as their perceptions of barriers and enablers to the use of mobile handheld devices as instructional tools.

Convergent Parallel Design

According to Creswell and Plano Clark (2011), when a researcher includes only qualitative methods of data collection with a small number of participants, the resultant findings cannot be extended to the general population. Conversely, the use of only quantitative data collection methods excludes the individual voice of the study's participants. Therefore, a mixed methods design is appropriate when a problem calls for the researcher to seek generalizable findings while also incorporating participants' perceptions. Within the context of the study at hand, quantitative survey results provided data regarding research question 1, the relationship between self-efficacy, professional development, and teachers' use of mobile handheld devices as instructional tools.

Qualitative data allowed the participants to offer their own unique views on questions 2 and 3.

In a convergent parallel design, the researcher conducts both independent components of data collection in a single phase, placing equal priority on the quantitative and qualitative stages. This is appropriate when neither phase of data collection depends on the other. In a convergent parallel design, data analysis for the quantitative and qualitative phases occurs independently of each other, with a comparison of the data occurring in the final stage of analysis (Creswell & Plano Clark, 2011). Such a research design was appropriate for the current study because the quantitative and qualitative data served to answer different components of the research questions, with the combined results providing a more complete understanding of the research problem.

Sample

Within the following section, the researcher will explain the sample for the quantitative phase of data collection. First, the site and participants will be described. Next, a discussion of the sampling strategies that the researcher utilized will be outlined.

Site

The site for the current study was Orange Blossom School District (pseudonym), an urban public school district in the Southeastern United States. The district is one of the largest in the state and in the nation, employing more than 12,000 teachers in total. The school district has a recently updated technology plan that includes the use of mobile handheld devices for instructional use.

Participants

Participants for the current study included teachers with three or more years of classroom experience, who taught in a middle school (grades 6-8) or high school (grades 9-12). Because the researcher's goal was to compare the data sets, the samples for the quantitative and qualitative phases included some of the same individuals. Specifically, participants for the qualitative phase were a subset of participants from the quantitative phase. In order to achieve "rigorous" quantitative data and "in-depth" qualitative data, a larger sample was utilized for the quantitative phase of data collection (Creswell & Plano Clark, 2011, p. 183). The topic of separate sample sizes will be explored in greater detail within each phase's section.

Sampling

Participating schools were identified through the use of purposive sampling. According to Fraenkel, Wallen, and Hyun (2012), in purposive sampling, a researcher uses existing information along with his or her judgment to choose a meaningful sample for the study at hand. For the current study, the researcher used the criteria of percentage of students eligible for free and reduced lunch, as well as percentage of schools deemed as Title I. These criteria mirrored those used in previous research that aimed to examine different levels of technology use across a region (Chapman et al., 2010; Hohlfeld et al., 2008). The researcher used information published freely on the Orange Blossom School District's website to determine the overall percentage of students who were eligible for free and reduced lunch, and the overall percentage of Title I schools for both middle and high schools in the school district. The researcher then chose four middle schools and four high schools so that the average of the percentage of students eligible for free and

reduced lunch at the four schools mirrored the overall average for the school district. These chosen schools also matched the overall district in terms of the percentage of those deemed Title I. The goal for this procedure was to obtain a representative sample of schools with regard to these criteria. Additionally, because Orange Blossom School District is divided into separate administrative areas, the researcher chose at least one school from each area, and no more than two schools from any one area, so that no area represented a significant majority of the sample over the others.

Once permission was obtained from Orange Blossom School District's Department of Research and Evaluation (Appendix C), the researcher was required to seek permission to conduct research from the principal at each of the eight schools chosen for the study's sample. The researcher first contacted the principal at each school via phone. She then followed up her initial request with a recruitment email (see Appendix D). Of the eight schools that were identified as part of the sample, seven principals agreed to allow the researcher to conduct her study at their site. The researcher was also required by the district office to obtain written permission from each principal. She received letters of cooperation from six of the seven principals who agreed to take part in the study. Therefore, the final sample for the study included a total of six schools: two middle schools and four high schools.

Procedures

This section provides an overview of the processes and procedures that the researcher employed to conduct the current study. The table includes preliminary procedures that took place before any data were collected, an outline of the data

collection process, and an overview of the analysis procedures. Table 4 outlines the procedures for the study.

Table 4

Study Procedures

Study Phase	Intended Timeline	Procedure
Before data collection	May 22, 2015	The researcher participated in a proposal hearing with all committee members in order to obtain permission to conduct the current study.
	Fall 2015	The researcher applied to Florida Atlantic University's Institutional Review Board.
		The researcher conducted a pilot study of the survey instrument
	Fall/Winter 2015	The researcher obtained permission from the school district, and subsequent permission from each school's principal.
Data collection	Winter 2016	Through each participating school's principal and department chairs, the researcher sent an invitation to participate in the survey to all teachers on staff.
		The researcher sent follow-up invitations one week after the initial email.
		The researcher chose interview participants from those individuals who consented to participate within the survey.
		The researcher conducted the interviews.
Data analysis	Winter/Spring 2016	The researcher analyzed quantitative and qualitative data separately.
		The researcher combined the two sets of data for final analysis.
		The researcher wrote up her findings, making conclusions and recommendations based on the results.

Pilot Study

Prior to the administration of the quantitative survey, after Florida Atlantic University IRB approval had been granted (Appendix E), the researcher conducted a pilot study with the intent to assess the readability and validity of the survey instrument, as well as to determine the length of time needed to complete the survey. During the pilot study, the researcher administered the pilot survey (Appendix F) to ten graduate students in a school of education at a local university. Of the ten individuals who were invited to take part in the survey, only one individual answered the survey in its entirety. Based on this response, the researcher reorganized the survey to make the items more readable and divided larger numbers of items into separate sections, so as not to overwhelm the reader. She also sent the survey instrument to three experts in the fields of social science research, and of instructional technology. Based on feedback from these experts, the researcher added examples to five of the items to add clarity. The feedback provided from technology experts ensured the content validity of the final survey instrument (Appendix G).

Quantitative Phase

In the following section, the researcher will first describe the power analysis that was completed in order to determine the appropriate number of participants. Next, the creation and administration of the current study's quantitative survey instrument will be discussed. Finally, data analysis techniques will be explained.

Power Analysis

In order to determine the appropriate sample size to achieve the desired levels for both alpha and power, the researcher performed an a priori power analysis using GPower

software (Faul, Erdfelder, Buchner, & Lang, 2009). As a result of the power analysis, with an alpha of .01, to detect a small effect size of 0.2, with power of 0.8, the researcher estimated that 103 subjects would be sufficient. Therefore, based on the number of potential participants, the researcher determined that it was both possible and reasonable to set the minimum number of participants for the quantitative phase of data collection at 103.

Survey Instrument

In the quantitative phase of data collection, the researcher utilized a survey in order to examine the relationship between self-efficacy, professional development, and secondary teachers' use of mobile handheld devices as instructional tools. The survey also contained demographic questions that were utilized to describe the study's sample. Demographic questions were designed to allow the researcher to determine participants' gender, level of education, years of teaching experience, and grade level taught. These data were utilized solely for descriptive purposes and were not included in the analysis. Participants also demonstrated their consent to participate in the study by choosing "yes" in the first question. The survey contained items from the Computer Technology Integration Survey (L. Wang et al., 2004), the Professional Development and Technology Integration Survey (White, 2014), as well as questions written by the researcher specifically for the purpose of the study. The Computer Technology Integration Survey was designed to measure participants' level of self-efficacy with regard to technology integration. The instrument was previously validated for both content and construct validity by its authors (L. Wang et al., 2004). The researchers performed a factor analysis of the original 21-item instrument to assess whether all items measured a single construct.

The results of that analysis revealed that 16 of the 21 items were valid. Therefore, the researcher included those 16 items in the survey for the current study. L. Wang et al. also utilized Cronbach's Alpha to determine the reliability of the instrument. As the values for Cronbach's Alpha for two phases of data collection were found to be .94 and .96, this analysis demonstrated that the instrument was highly reliable. For the current study, the researcher had to change "computer" to "technology" in some of the items so that they did not refer specifically to computer use, but rather to technology integration in general. The researcher obtained permission from Dr. Wang (Appendix H) to utilize the Computer Technology Integration Survey in the current study before incorporating it into her survey instrument.

The Professional Development and Technology Integration survey (White, 2014) contains Likert-type questions about professional development activities both in and outside of school. The researcher used items from the survey to inform the professional development item in the current study's survey instrument. The researcher also included demographic questions from the survey. The researcher obtained permission from Dr. White (Appendix I) to utilize the Computer Technology Integration Survey in the current study before incorporating it into her survey instrument.

Additionally, the researcher created questions specifically for the current study regarding the frequency of and purpose for utilizing mobile handheld devices in their classroom. To create these items, the researcher compiled a comprehensive list of instructional uses for mobile handheld devices, drawn from existing literature (Cheung & Hew, 2009; Kolb, 2011; Nielsen & Webb, 2011). The researcher then divided the list into six categories: communication, organization, research, archiving, educational tool, and

assessment. One survey item was created for each category. The survey instrument as a whole was assessed for validity and readability during a pilot study, as previously described.

The survey instrument was administered through an online survey program. Participants were invited to take the survey via an email invitation from the researcher (Appendix J) that was disseminated by each participating school's principal and department chairs. The researcher sent a follow-up reminder for participants one week after the initial invitation was emailed. To increase survey participation, the researcher made every attempt to make a personal contact at each school. Because responses were anonymous, the researcher sent the follow-up email to all potential participants within each of the schools.

Data Analysis

After the survey was administered, the researcher compiled the data within each individual predictor and criterion variable. For items 1-16 on the survey instrument, the researcher found the mean of the responses, which resulted in one overall "self-efficacy" score. For item 17, the researcher summed the number of affirmative responses and divided by the total number of possibilities to calculate a ratio, which represented each participant's overall "professional development" score. Finally, for items 18-23, the researcher found the mean of the responses, which resulted in an overall "use of mobile handheld devices" score. Using statistical software, the researcher utilized multiple regression analyses in order to determine the strength of the relationship between the predictor variables of technology self-efficacy and participants' level of professional development activities regarding mobile handheld devices, and the criterion variable of

teachers' use of mobile handheld devices. The purpose of this analysis was to determine to what extent teachers' use of mobile handheld devices can be predicted from their level of self-efficacy and their professional development activities. The product of the multiple regression analysis was a model that incorporated the predictor variables of self-efficacy and professional development in order to predict the criterion variable of teachers' use of mobile handheld devices as instructional tools. The researcher also performed a moderator analysis to determine whether the relationship between self-efficacy and the use of mobile handheld devices is changed as a result of professional development, as well as whether the relationship between teachers' professional development and the use of mobile handheld devices is changed as a result of self-efficacy.

Qualitative Phase

The qualitative phase of the study employed a phenomenological approach in order to explore teachers' perceptions of the relationship between self-efficacy, professional development, and their use of mobile handheld devices as instructional tools, as well as their perceptions of barriers and enablers to the use of such devices. In the following section, the researcher will first describe the qualitative phase of data collection. Next, the interview process and protocol will be detailed. Finally, the researcher will explain the coding techniques that were employed, including a discussion of reliability and validity.

Interviews

For the qualitative phase of data collection, the researcher utilized interviews to gain an understanding of participants' perceptions of their self-efficacy, professional development, and their use of mobile handheld devices, as well as their perceptions of

barriers and enablers to their use of such resources. According to Creswell (2013), interviews are a key source of qualitative data. For the current study, interviews were appropriate because they allowed participants to describe their unique perceptions of the experience in their own words. Polkinghorne (2005) asserted that interviews provide multiple perspectives of the problem under study. Because participants will have varying experiences, the researcher anticipated that the qualitative data would provide a rich understanding of the problem at hand.

Sample

According to Creswell and Plano Clark (2011), when a study's purpose is to synthesize two sets of findings, it is best to use the same participants from one phase of the study within the other. Therefore, participants for the qualitative phase of the current study were chosen from those who stated in the survey that they were willing to participate. In order to obtain interview respondents, the researcher asked survey participants to volunteer for the interview phase of the study. In order to obtain richness of data, the researcher anticipated including between five and ten interview participants, which represented approximately 5% to 10% of the quantitative sample. Interview participants were chosen so as to obtain maximum variation between participants, with regard to their use of mobile handheld devices in the classroom. Approximately hallway through survey data collection, the researcher examined the list of interview volunteers at that point. She sorted the list according to participants' use of mobile devices score. She then chose three participants at the beginning of the list, three participants from the middle of the list, and three participants from the end of the list. She contacted each of the nine identified participants via email (Appendix K) in order to arrange a date and time

for each interview. After three days, the researcher chose and contacted two additional replacement participants whose mobile device scores were close to those individuals who did not respond to the invitation.

Interview Protocol

The researcher utilized a semi-structured protocol (Appendix L) for all interviews. According to Merriam (2009), in a semi-structured interview, the guide includes both highly structured and more flexible types of questions. For the purpose of the current study, structured questions allowed the researcher to obtain specific data related to the problem, while flexible questions provided the ability to "respond to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic" (Merriam, 2009, p. 90). Interviews were estimated to last between 30 and 45 minutes, and were recorded by the researcher, using a digital recorder, in an effort to maintain the security of the data at all times.

Question Types

The researcher began the interview with a few demographic questions designed to provide a description of the interview respondents. Next, the interview protocol contained questions about participants' general level of self-efficacy with mobile handheld devices. The purpose of these questions was twofold: first, they allowed respondents to describe their general self-efficacy with mobile handheld devices. Additionally, these questions concerned relatively neutral, descriptive information. According to Merriam (2009), starting an interview with neutral questions is good practice, because "this information lays the foundations for questions that access the interviewee's perceptions, opinions, values, emotions, and so on" (p. 103). Next, the researcher asked experience and opinion

questions about participants' perceptions of their technology self-efficacy and their use of mobile handheld devices, both in their everyday life and as classroom tools (Merriam, 2009). Further, the researcher asked questions about professional development activities and how they have impacted participants' perceptions of their self-efficacy and their use of mobile handheld devices as instructional tools. Finally, the researcher asked experience and opinion questions about respondents' perceived barriers and enablers to the use of mobile handheld devices in their classrooms. The interview protocol also contained probes, which are follow-up inquiries designed to elicit deeper responses from participants. Though possible probes were included in the protocol, adjustments occasionally had to be made during the interview based on participants' responses (Merriam, 2009).

Data Analysis

After the interviews were conducted, they were transcribed for coding and analysis. According to Merriam (2009), "making sense out of data involves consolidating, reducing, and interpreting what people have said…it is the process of making meaning" (pp. 175-176). Therefore, in the first round of analysis, the researcher employed in vivo coding techniques in order to identify a comprehensive list of broad topics within the data (Appendix M). In the second round of coding, the researcher utilized pattern coding in order to condense the codes into categories, which enabled her to identify emerging themes (Miles, Huberman, & Saldaña, 2013). A more detailed account of the in vivo codes, categories, and identified themes will be further discussed in Chapter 4. The goal of the qualitative analysis was to portray the participants' experiences with self-efficacy, professional development, and their use of mobile

handheld devices, as well as to provide a deeper understanding of participants' perceptions about barriers and enablers to their use of such devices. Audio files, as well as their transcriptions, were housed on the researcher's audio recorder, password-protected laptop, and portable hard drive, all of which, when not in the researcher's possession, were kept in a secure location in her home.

Credibility and Trustworthiness

In an effort to strengthen the qualitative findings, the researcher employed a number of strategies designed to increase their credibility and trustworthiness. First, after clarifying any bias on the part of the researcher (Creswell, 2013), the use of a semi-structured interview protocol limited any existing bias while the researcher conducted interviews. Respondent validation, or the process of sharing interview transcripts with respondents to acquire their opinion about them, also lent reliability to the findings (Merriam, 2009). After each interview was conducted and transcribed, the researcher sent a copy of the transcript to each participant for his or her approval. Each respondent was encouraged to notify the researcher if they found any changes, additions, or deletions that their transcript required. None of the respondents made any such request.

The researcher also obtained inter-rater reliability through the use of a peer reviewer to ensure that codes were properly identified (Creswell, 2013). To achieve this goal, the researcher chose a peer reviewer that, though not an expert in the field of instructional technology, was skilled in coding and qualitative analysis. The researcher chose three transcripts that she had previously coded. She included a transcript from a low mobile handheld device user, one from a medium mobile handheld device user, and one from a high mobile handheld device user. She isolated five pages of each transcript.

The researcher then provided the peer reviewer with a list of categories and their corresponding codes. She also provided three examples of text that corresponded to each code that she obtained from the remainder of the transcripts. The researcher gave the categories, codes, and examples to the peer reviewer and discussed them with her as a method of training before the coding took place. Shortly after the peer reviewer began the coding process, it became clear to both individuals that the reviewer had not been adequately trained in the meaning of the codes. This appeared to be primarily influenced by the reviewer's lack of experience in the field of instructional technology. At that point, the reviewer and researcher stopped and re-trained, discussing the codes until both were confident that they were in agreement. Once the peer reviewer finished coding each excerpt from the three transcripts, the researcher compared the reviewer's results to her own. In all, the match rate between the researcher and the peer reviewer was 80%. Taking into account the reviewer's relative inexperience with some of the technological terms and classroom practices referenced in the transcripts, the researcher considered this match rate to be sufficient.

Additionally, the researcher utilized triangulation in order to strengthen the validity of the findings. According to Miles et al. (2013), triangulation by data source allows for substantiation, which increases the trustworthiness of a researcher's findings. The researcher examined the categories she had identified within the eight transcripts. Of the seven categories, six were identified in all (100%) of the transcripts, and one was identified in six (75%) of the transcripts. The fact that the categories were named by most or all participants is an example of triangulation, in that the patterns applied to multiple

sources within the data collection method. The specific categories and their frequency across participants will be discussed in further detail in Chapter 4.

Final Analysis

At the conclusion of quantitative and qualitative data analysis, the researcher combined the two sets of data. The goal of this final analysis was not to unite the data, as the goals for quantitative and qualitative analysis were different, but rather to compare them in order to gain as complete of an understanding of the findings as possible. The purpose of this comparison was to "interpret the extent to which the two databases converge, whether differences or similarities are found, and what conclusions can be drawn from the differences and similarities" (Creswell & Plano Clark, 2011, p. 232). To accomplish this comparison, the researcher utilized the discussion method, in which she reported the findings and their relationship to one another in a narrative style. She reported quantitative findings and paired them with supporting or explanatory qualitative findings. Overall, the inclusion of both qualitative and quantitative data allowed the researcher to provide a more comprehensive picture of the problem of secondary teachers' reluctance to incorporate mobile handheld devices as instructional tools than either design would provide alone (Creswell & Plano Clark, 2011).

CHAPTER 4. RESULTS

The goal of the current study was to examine secondary teachers' technology self-efficacy, their professional development activities regarding mobile handheld devices, and how those factors affect their use of such devices as instructional tools. A secondary goal of the study was to explore teachers' perceptions of other factors that act as barriers or enablers to their use of mobile handheld devices. Specifically, the following research questions directed the study:

1. What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?
2. How do secondary teachers perceive their self-efficacy and professional development experiences regarding mobile handheld devices as they implement them as instructional tools?
3. What other factors do secondary teachers perceive as barriers and enablers to their implementation of mobile handheld devices as instructional tools?

Methodology

The study employed both quantitative and qualitative research methods in a convergent parallel design. Such a design was appropriate for the study because it allowed the researcher to identify generalizable results in the quantitative phase, while also providing data about participants' unique perceptions in the qualitative phase. The researcher conducted the quantitative analysis through the administration of a 28-item

electronic survey. The results of the survey allowed the researcher to determine the relationship between the variables of teachers' technology self-efficacy, their level of participation in professional development activities, and their use of mobile handheld devices as instructional tools. In the qualitative phase of the study, a semi-structured interview protocol allowed the participants to describe their perceptions about their technology self-efficacy, their professional development experiences, and their use of mobile handheld devices in the classroom. The interviews also provided participants with the opportunity to describe additional barriers and enablers to their use of mobile handheld devices within an educational context.

Quantitative Phase

The following section will describe the results of the quantitative phase of the study. The researcher will define the research procedures and describe the survey participants. Additionally, she will outline the results of the statistical analysis as it was conducted.

Description of the Survey Participants

Once the researcher obtained permission from the principals at the six participating secondary schools in the Orange Blossom School District, she sent the survey to each school's principal, as well as the academic department chairs at each school in the subjects of language arts, mathematics, social studies, and science. She asked each individual to forward the survey invitation to his or her faculty or department members through each school's email system. The researcher's motive for this plan was to ensure that as many faculty members as possible at each school site would receive the survey invitation at least once in his or her email. As a result, the invitation was sent to

approximately 134 middle school teachers and 484 high school teachers, for a total of 618 potential participants. The researcher sent a follow-up email one week later to each principal, and asked that he or she forward it along to his or her faculty members as a reminder. She also spoke at a faculty meeting at one school, in order to encourage teachers' participation as much as possible. A total of 132 teachers responded to the survey. The overall response rate for the survey was 21.4%. Although 132 teachers responded to the survey, the researcher could only include data for 104 of them. Two participants had to be excluded because they did not consent to take part in the study, and 13 participants did not meet the established delimitation requiring a minimum of three years of teaching experience. An additional 15 respondents started the survey, but did not complete enough of the items to comprise either of the predictor variables or the criterion variable. As a result, those incomplete responses were removed from the data so as to limit any bias. Therefore, the final response rate for the survey was 16.8%.

Teaching experience, grade level, gender, education, and subject area. Participants were asked to indicate the number of years of teaching experience they currently had, which served both as a means of delimitation and as a method for describing the study's participants. Of the 104 survey participants, 20 (19.2%) reported having 3-6 years of teaching experience, 17 (16.3%) respondents reported 7-10 years, 37 (35.6%) respondents reported 11-20 years, 23 (22.1%) respondents reported 21-30 years, and 7 (6.7%) respondents reported having more than 30 total years of teaching experience. When asked to indicate the grade level they taught, 44 (42.3%) respondents reported being middle school teachers, 59 (56.7%) respondents reported being high school teachers, and 1 (1.0%) respondent did not indicate his or her grade level.

Participants were also asked about their gender. Sixty-nine (65.1%) of the respondents reported their gender as female, 32 (31.1%) as male, and three (3.8%) preferred not to answer.

Participants were asked about the highest level of education they had completed: 32 (30.8%) of respondents reported having completed a bachelor's degree; 13 (12.5%) reported having completed some graduate school; 54 (51.9%) completed a master's degree; 1 (1.0%) a specialist's degree; 3 (2.9%) a doctoral degree; and 1 (1.0%) preferred not to answer. Finally, participants were asked about the subject area they currently taught. The four core subject areas of mathematics, language arts, social studies, and science represented the majority of survey participants. Table 5 provides a summary of the subject areas represented by the respondents. Many participants reported teaching more than one subject; therefore, they are included in more than one frequency count. One participant preferred not to answer.

Table 5

Descriptive Statistics for Secondary Teachers Subject Area Taught

Subject Area	Frequency
Mathematics	23
English/Language Arts	28
Social Studies	20
Science	24
Foreign Language	6
Arts (e.g. Art, Drama, Music, etc.)	3
Health and Physical Education	2
Vocational Education	6
Exceptional Student Education/ESOL	12
Reading	5
Counseling/AVID/JROTC	5

Quantitative Findings

The researcher performed a multiple regression analysis in order to address Research Question 1, "What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?" The purpose of this analysis was to determine to what degree teachers' use of mobile handheld devices as instructional tools can be predicted from their level of technology self-efficacy and their professional development activities. The researcher also performed a moderator analysis to determine whether the relationship between self-efficacy and the use of mobile handheld devices was changed as a result of professional development, as well as whether the relationship between teachers' professional development and the use of mobile handheld devices was changed as a result of their level of technology self-efficacy.

Variables in the Regression Analysis

The multiple regression analysis incorporated two predictor variables. The first predictor variable, technology self-efficacy, was determined for each participant through 16 technology self-efficacy-related items on the survey. These items, listed in Table 6, were adapted from the Computer Technology Integration Survey (L. Wang et al., 2004). Participants responded to each item by choosing from: "Strongly disagree"; "Disagree", "Neither agree nor disagree"; "Agree"; or "Strongly agree." To calculate a single score for each participant, the researcher calculated the mean of each participant's responses.

Table 6

Items Used to Measure the Predictor Variable of Technology Self-efficacy

Category	Item
Technology Integration	• I feel confident that I understand technology's capabilities well enough to maximize them in my classroom. • I feel confident that I have the skills necessary to use technology for instruction. • I feel confident in my ability to evaluate technological tools for teaching and learning. • I feel confident I can consistently use educational technology in effective ways.
Technology and Pedagogy	• I feel confident that I can successfully teach relevant subject content with appropriate use of technology. • I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning. • I feel confident about selecting appropriate technology for instruction based on curriculum standards. • I feel confident about using technology resources (such as spreadsheets, electronic portfolios, etc.) to collect and analyze data from student tests and products to improve instructional practices.
Technology at Work	• I feel confident I can effectively monitor students' technology use for project development in my classroom (for example, reviewing students' progress and providing feedback). • I feel confident that I can motivate my students to participate in technology-based projects (for example, showing enthusiasm for the use of technology). • I feel confident I can mentor students in appropriate uses of technology (for example, suggesting suitable technological tools for a particular task or goal, or advising students about responsible technology use). • I feel confident about assigning and grading technology-based projects.
Technology and Student Support	• I feel confident that I can use correct technological terminology when directing my students' technology use. • I feel confident I can help students when they have difficulty with technology. • I feel confident I can provide individual feedback to students during technology use. • I feel confident that I can be responsive to students' needs during technology use (for example, I can provide support when needed, or advise students about where to seek support if necessary).

Figure 4 illustrates the distribution of secondary teachers' technology self-efficacy scores, based on their responses to the survey. While the self-efficacy scores did range from the lowest possible score of 1 to the highest possible score of 5, the majority of the respondents demonstrated a relatively high level of technology self-efficacy. Overall, 75% of the survey respondents scored themselves as a 3.6 or higher, with 50% scoring at least 4.

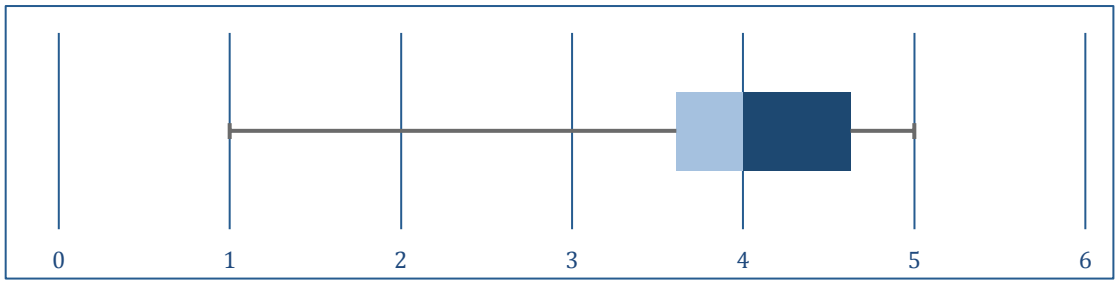


Figure 4. Secondary teachers' technology self-efficacy scores. This box-and-whisker plot illustrates the spread of technology self-efficacy scores across all survey participants.

The second predictor variable, level of professional development involving mobile handheld devices, was determined for each participant through a single item on the survey: "In the past 3 years, what type(s) of professional development activities involving the educational use of mobile handheld devices have you participated in? (Select all that apply.)" Participants selected from: "District-provided workshop or training;" "District-provided online course;" "District technology conference;" "Course offered by a university/college;" "Professional conference;" "Massive Online Open Course (MOOC);" "Reading professional literature about technology;" "Collaboration with colleagues/peers;" "Self-study;" "I have not participated in any professional development activities involving mobile handheld devices;" "I prefer not to answer;" and "Other." Figure 5 illustrates the types of professional development activities that

secondary teachers reported having taken part in. Of the nine types of professional development activities that were included as choices, three activities were especially prevalent, as each was selected by more than half of the study's participants. The most common type of professional development activity that was reported by teachers was collaboration with peers; it was reported by 62 (59.6%) of participants. The second most common choice was district-provided workshops or trainings; 58 (55.8%) of participants reported it as a method of professional development in which they had taken part. Third most common was self-study, as 55 (52.9%) of teachers reported it as a method of professional development involving mobile handheld devices that they had utilized. 23 participants reported that they had not participated in any professional development activities involving mobile handheld devices in the past three years. However, five of those individuals also selected other professional development options, so the researcher opted to remove them from this classification. In all, a total of 18 (17.3%) of respondents reported not having participated in any professional development activities that involved mobile handheld devices.

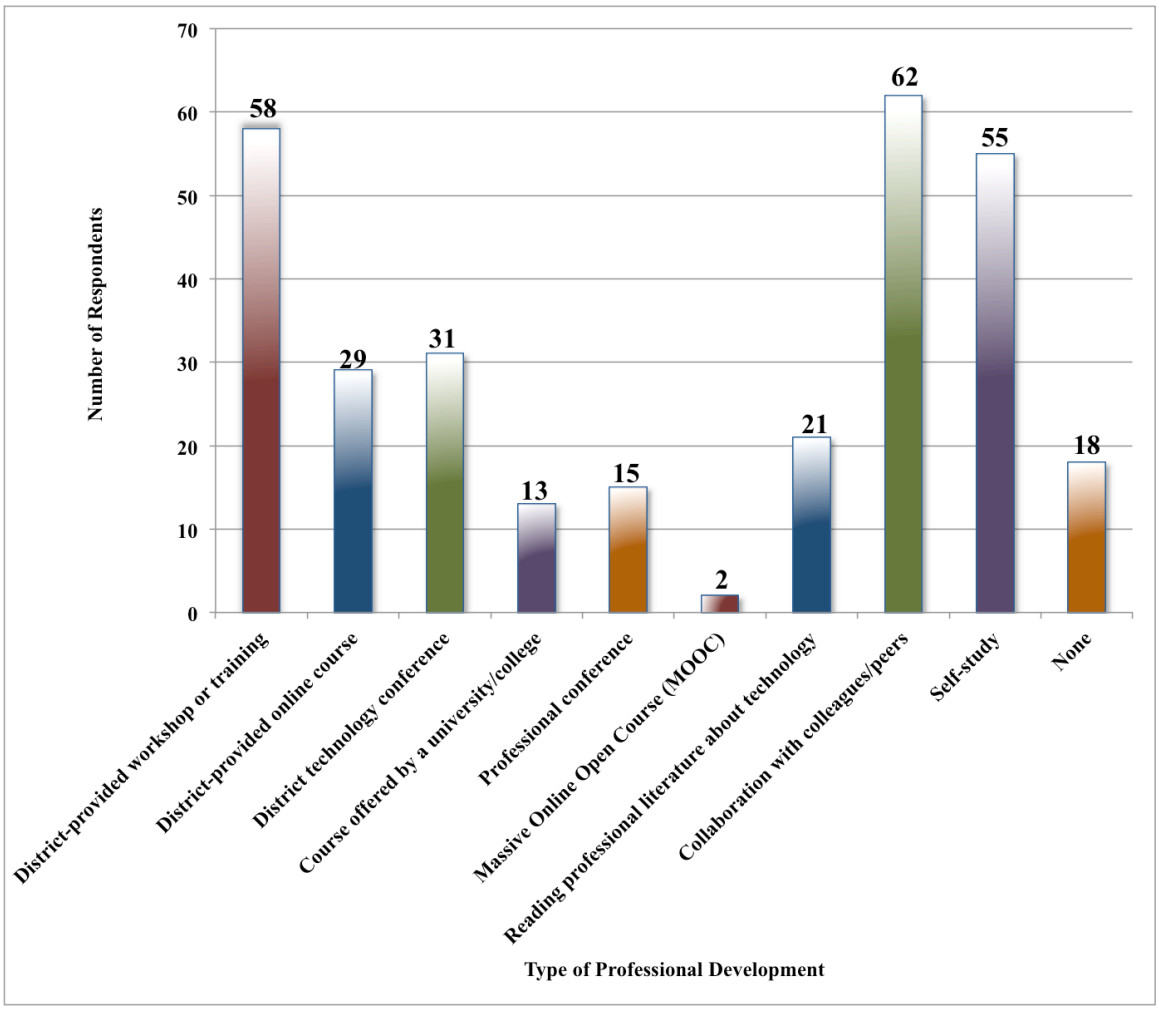


Figure 5. Secondary teachers' reported professional development activities. This bar graph illustrates the number of participants who reported having taken part in each of nine possible professional development activities, as well as those who did not participate in any such activities.

In order to calculate a single professional development score for each participant, the researcher tallied the number of affirmative responses he or she indicated, and then calculated a ratio by taking the number of professional development activities they had chosen out of nine possible professional development options. One participant opted not to provide a response for this item by choosing "I prefer not to answer." To account for this missing piece of data, the researcher imputed the mean of the rest of the respondents' scores, so as not to skew the data. Table 7 includes descriptive statistics for both predictor

variables, as well as Cronbach's alpha as a measure of internal validity for the 16 separate items used to measure technology self-efficacy.

Table 7

Descriptive Statistics for Secondary Teachers' Technology Self-efficacy and Level of Professional Development Involving Mobile Handheld Devices

Variable	*N*	Min	Max	*Mean*	*Standard Deviation*	Cronbach's Alpha
Technology Self-efficacy	104	1.00	5.00	3.99	0.76	0.945
Professional Development Involving Mobile Handheld Devices	104	0.00	1.00	0.31	0.21	n/a*

Note. *not applicable because only one question was used to calculate this variable.

The multiple regression analysis incorporated a single criterion variable, secondary teachers' use of mobile handheld devices as instructional tools. This variable was determined for each participant through six items on the survey instrument. In these items, participants reported the frequency with which they utilized mobile handheld devices in their classroom in the following ways: "Communication (e.g. texting, group texting, photo messaging, video messaging, Twitter, email, phone calls, blogging, phonecasting)"; "Organization (e.g. calendar, reminders, alerts, alarms, notetaking, speech to text)"; "Research (e.g. web searches, video streaming)"; "Archiving/display of student work (e.g. audio recording, video recording, photography, uploading to the Internet, online bulletin board)"; "Educational tool (e.g. calculator, graphing calculator, dictionary, thesaurus, stopwatch)"; and "Assessment (e.g. text polling, Kahoot, Socrative)". Participants responded to each item by choosing from: "Never"; "Rarely", "Every once in a while"; "Weekly"; or "Daily." Table 8 illustrates the number of

respondents who answered within each category, which demonstrates how often and in what ways secondary teachers reported that they use mobile devices in their teaching. According to the results, the most common way in which secondary teachers incorporate the use of mobile handheld devices within their pedagogy is as an educational tool, such as a calculator, dictionary, or stopwatch. Secondary teachers also reported more frequently incorporating mobile handheld devices into their instruction for organizational purposes and as a tool for in-class research. The least common uses for mobile devices as reported by secondary teachers were for assessment and for archiving and display of student work.

Table 8

Secondary Teachers' Reported Classroom Uses for Mobile Handheld Devices

Use	Never	Rarely	Every once in a while	Weekly	Daily	*Mean**
Communication	22	12	20	24	26	3.192
Organization	12	15	13	31	33	3.558
Research	7	13	30	28	26	3.510
Archiving/display student work	23	25	27	21	8	2.673
Educational tool	10	10	22	30	32	3.615
Assessment	31	16	31	17	9	2.587

Note: *mean ranges from 1 to 5.

To calculate a single score for each participant for the criterion variable, the researcher again calculated the mean of each participant's responses. Table 9 includes descriptive statistics for the criterion variable of secondary teachers' use of mobile

handheld devices as instructional tools. The table also includes Cronbach's alpha as an internal consistency measure of reliability for the six separate items used to measure mobile handheld device use.

Table 9

Descriptive Statistics for Secondary Teachers' Use of Mobile Handheld Devices as Instructional Tools

Variable	*N*	Min	Max	*Mean*	*Standard Deviation*	Cronbach's Alpha
Mobile Handheld Device Usage	104	1.00	5.00	3.19	0.96	0.827

Bonferroni Adjustment

The researcher opted to use a Bonferroni adjustment when determining the value for alpha. Instead of using the generally accepted alpha value of 0.05, the researcher divided this value by two, as that was the number of predictor variables included in the multiple regression analysis. Therefore, she set the value for alpha at 0.025. The purpose of this adjustment was to reduce the possibility of falsely rejecting the null hypothesis.

Multiple Regression Analysis

First, the researcher determined the correlations between the two predictor variables of teachers' level of technology self-efficacy (SE) and their level of professional development involving mobile handheld devices (PD) and the criterion variable of teachers' use of mobile handheld devices as instructional tools (MHD). These correlations are depicted in Table 10. The results of the correlation analysis demonstrated that SE showed a moderate positive correlation (.522) with MHD, which accounted for

27.2% of the variance between the variables. PD showed a weak moderate positive correlation (.341) with MHD, which explained 11.6% of the variance between the variables. Additionally, SE and PD demonstrated a weak moderate positive correlation (.355) with each other, which accounted for 12.6% of the variance between the two predictor variables. All of these correlations were significant ($p < 0.001$).

Table 10

Correlation Matrix for Variables Included in the Regression Analysis

Variable	MHD	SE	PD
MHD	1.000	.522	.341
SE	.522	1.000	.355
PD	.341	.355	1.000

Note. MHD = teachers' use of mobile handheld devices as instructional tools, SE = technology self-efficacy, PD = professional development involving mobile handheld devices.

To address research question 1, "What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?", the researcher performed a regression analysis. The predictor variables for the analysis were teachers' level of technology self-efficacy (SE) and their level of professional development involving mobile handheld devices (PD); the criterion variable was teachers' use of mobile handheld devices as instructional tools (MHD). According to the model summary for the analysis as shown in Table 11, the model explained 30% of the variation in the criterion variable, adjusted $R^2 = 0.286$, $F(2,104) = 21.669$, which was significant ($p < 0.001$).

Table 11

Model Summary for Regression Analysis

R	R Squared	Adjusted R Squared	Cohen's f Squared	Std. Error of the Estimate
.548	.300	0.286	.429	.8129532

The results of the regression analysis are listed in Table 12. Multicollinearity is not shown to be a problem, as the VIF for each variable is less than 2 (1.144 for each). While SE was shown to be a significant contributor to the model ($p < .001$), PD did not make a significant contribution ($p = .048$). This may be due to the fact that the two predictor variables were shown to be significantly correlated with one another, as demonstrated by the aforementioned results ($p < .001$) in the correlation matrix.

Table 12

Regression Analysis for Predictor Variables Level of Technology Self-efficacy and Level of Professional Development Involving Mobile Handheld Devices and Criterion Variable Teachers' Use of Mobile Handheld Devices as Instructional Tools

Predictor Variable	B	Std. Error	Beta	t	*p*	VIF
SE	.580	.113	.459	5.155	<.001	1.144
PD	.799	.399	.178	2.000	.048	1.144

Note. $p < 0.25$, Note: MHD = teachers' use of mobile handheld devices as instructional tools, SE = technology self-efficacy, PD = professional development involving mobile handheld devices.

Moderator Analysis

Next, the researcher conducted a moderator analysis involving the variables of teachers' technology self-efficacy (SE), their level of professional development involving

mobile handheld devices (PD), and their use of mobile handheld devices as instructional tools (MHD). The purpose of this analysis was to examine whether the relationship between SE and MHD was influenced by PD. Conversely, the researcher also sought to assess whether the relationship between PD and MHD was influenced by SE. To avoid any potential issues with multicollinearity, the researcher centered the two predictor variables before analysis.

A fourth variable (SECPDC) was created for the moderator analysis by finding the product of the two centered predictor variables of self-efficacy (SEC) and professional development (PDC). Table 13 illustrates the results of the regression analysis that included the moderator variable SECPDC. Multicollinearity was indeed controlled, as all VIFs were less than 2. The Beta for SECPDC (-0.160) was found to be nonsignificant (p = .710), which suggested that PD does not moderate the relationship between SE and MHD. Conversely, the results also suggested that SE does not moderate the relationship between PD and MHD.

Table 13

*Regression Analysis for Moderator Variable Level of Technology Self-efficacy * Level of Professional Development Involving Mobile Handheld Devices and Criterion Variable Teachers' Use of Mobile Handheld Devices as Instructional Tools*

Variable	B	Std. Error	Beta	t	*p*	VIF
SEC	.586	.114	.463	5.138	<.001	1.164
PDC	.781	.404	.174	1.934	.056	1.160
SECPDC	-0.160	.430	-.031	-.372	.710	1.023

Note. $p < 0.25$, SEC = Self-efficacy (centered), PDC = Professional Development (centered), SECPDC = Self-efficacy (centered) * Professional Development (centered).

Qualitative Phase

The researcher conducted a qualitative analysis to address Research Question 2, "How do secondary teachers perceive their self-efficacy and professional development experiences regarding mobile handheld devices as they implement them as instructional tools?", as well as Research Question 3, "What other factors do secondary teachers perceive as barriers and enablers to their implementation of mobile handheld devices as instructional tools?" The following section will describe the results of the qualitative phase of the study. The researcher will define the research procedures and describe the interview participants. Additionally, she will outline the results of the qualitative analysis as it was conducted.

Description of the Interview Participants

Because the researcher's ultimate goal was to synthesize the findings from the quantitative and qualitative phases of the study, it was appropriate to include some of the same participants in both phases. Therefore, the researcher determined that the interview participants should be a subset of those who had taken part in the survey. In order to obtain maximum variation in the qualitative data, the researcher aimed to include participants who implemented the use of mobile handheld devices in their pedagogy at varying degrees. To achieve this variation, the researcher extracted all of the survey responses one week after sending the initial invitation email, and isolated those who stated that they were willing to take part in the interview. She then removed all of the responses that were disqualified because the participant did not consent, did not meet the predetermined delimitations, or did not complete enough of the survey to be included. A total of 43 possible interview participants remained. The researcher calculated the mobile

handheld device score for each of these participants using a spreadsheet, and then sorted the group according to the score. The researcher then chose three individuals at the top, three individuals at the bottom, and three individuals in the middle of the list. She then either sent an interview invitation email to each potential participant, or she contacted him or her personally. After several days, the researcher had received affirmative responses from six of the nine individuals. She then contacted two additional individuals from the middle and high groups according to the aforementioned spreadsheet. Ultimately, a total of eight teachers agreed to take part in the interview, as described in Table 14. All participants' names are pseudonyms, so as to maintain their confidentiality.

Table 14

Description of Participants for the Interview Phase of the Study

Pseudonym	Level of Mobile Device Use	Gender	Grade Level	Department	Years of Experience	Mobile Devices Owned
Julie	Medium	Female	9-12	Foreign Language	6	Smartphone, tablet
Robert	Medium	Male	6-8	Science	12	Smartphone, tablet
Michael	Low	Male	6	Mathematics	13	Smartphone, tablet
Penny	High	Female	9-12	Elective	20	Smartphone, tablet
Lynn	Medium	Female	6	Language Arts	19	Smartphone, tablet
Monica	Low	Female	8	Elective	23	Smartphone, tablet, e-reader
Kevin	High	Male	8	Science	20+	Smartphone, tablet
Laura	High	Female	9-12	Mathematics	14	Smartphone, tablet

Each interview was conducted at a time outside of the school day, and at a location off school grounds that was convenient for the participant. The researcher utilized a semi-structured protocol for each interview. The interviews were originally anticipated to take between 30 and 45 minutes to complete. The shortest interview lasted just under 19 minutes and the longest interview lasted just over 38 minutes, with an average of 28.7 minutes per interview.

Qualitative Data Analysis

Once all of the interviews were conducted and transcribed, the researcher sent a copy to each participant for respondent validation. None of the participants responded with any concerns or requested that any changes be made to his or her transcript. The researcher then proceeded with data analysis. She utilized in vivo coding, using the participants' words to create a comprehensive list of 59 codes. She kept an Excel spreadsheet of all of the codes, organized by participant. She also went through the transcripts a second time, ensuring that she did not miss any codes. Once the first round of coding was completed for all of the transcripts, the researcher utilized pattern coding in another phase of analysis, with the goal of grouping the codes into separate categories. The categories were: support, managing a 21st-century classroom, student-centered classroom, technological capital, intellectual capital, and emotional capital, which the researcher further divided into positive emotional capital and negative emotional capital. Figure 6 depicts the frequency with which each category occurred for each interview participant. As previously discussed in Chapter 3 regarding credibility, the categories were found within the transcripts of most or all participants, which demonstrated triangulation of the data by source.

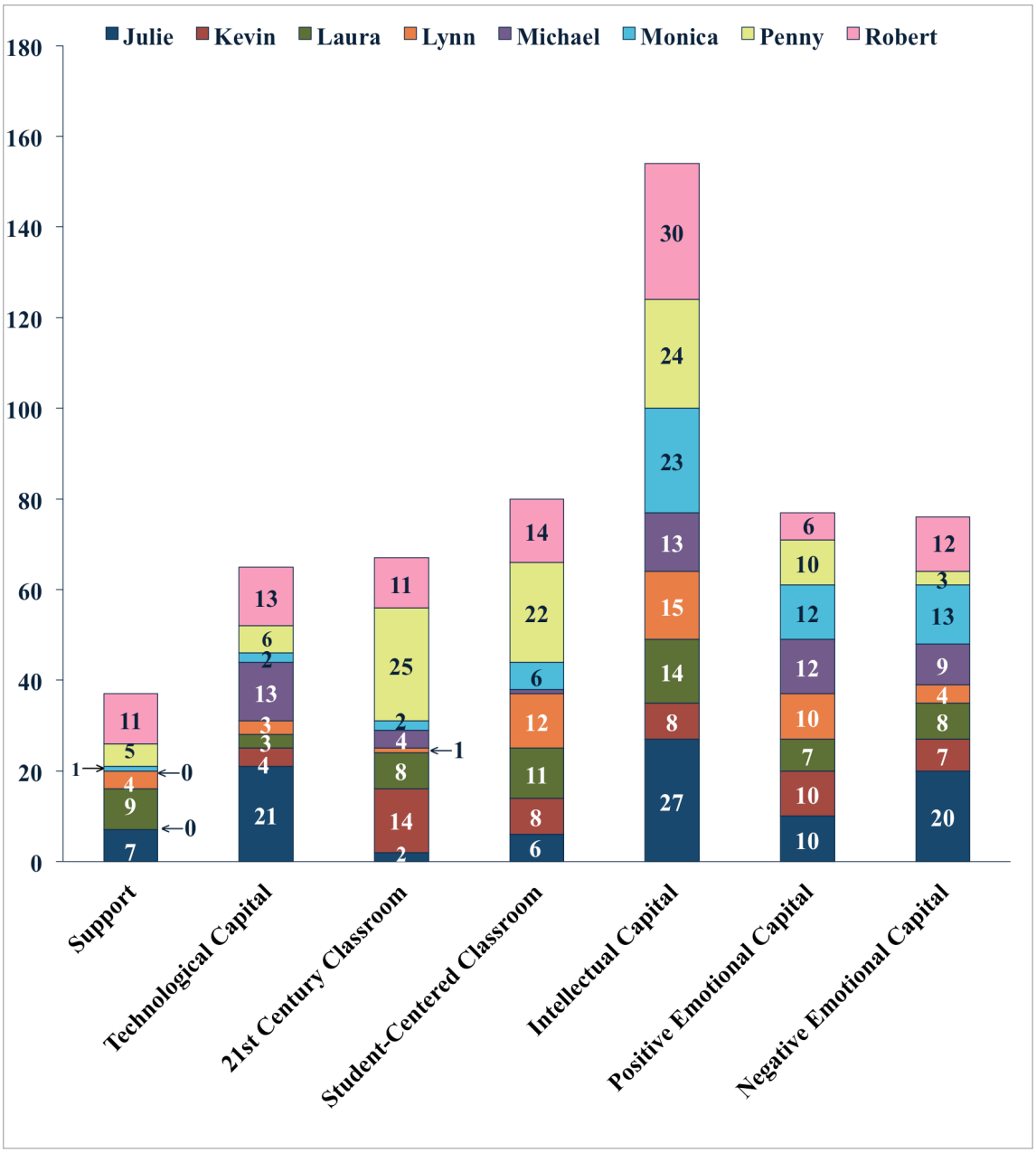


Figure 6. Category frequency. This bar graph illustrates the frequency of each category within each participant's interview transcript.

Qualitative Findings

As a result of her examination of the aforementioned categories, the researcher identified the emerging themes of the qualitative analysis. These themes were: secondary teachers' diverse and fluid technology-related self-efficacy, essential capital for mobile

handheld device use, and evolving classrooms. Together, these themes worked to describe secondary teachers' perceptions of their technology-related self-efficacy and their experiences with professional development as they implemented mobile handheld devices as instructional tools. Additionally, these themes provided the researcher with an overall picture of the barriers and enablers to the use of mobile devices that secondary teachers perceived.

Secondary teachers' diverse and fluid technology-related self-efficacy. All participants reported owning a smartphone and a tablet, with one participant owning an e-reader as well. When asked how they used those devices in their everyday life, answers included everything from texting and email to watching videos and reading books. While teachers reported being comfortable with a variety of non-instructional uses for mobile devices, their reported levels of self-efficacy for utilizing those devices in a pedagogical context was mixed. As previously described, the researcher chose interview participants based on their varying levels of mobile device use in their classrooms. The participants also reported varying levels of technology self-efficacy in the study's survey. Accordingly, participants' interview responses regarding their perceptions of self-efficacy involving the use of mobile devices were varied. For example, when asked about her level of confidence regarding the use of mobile devices as instructional tools, Monica reported, "I think I have a low level of confidence…because I have not been successful at it", though she also reported daily use of her personal smartphone for everything from online banking to shopping and reading. Michael also reported having a low level of confidence for incorporating new types of technology into his teaching, but also stated that he frequently used his smartphone for messaging, research, and shopping. Michael

and Monica were both located on the low end of the mobile handheld device-using spectrum. On the other end of that range, Penny, whose level of self-efficacy regarding technology was very high, discussed that sometimes new types of technology "were all challenges to me, but as I got used to them and I started to use them more in the classroom, I became more comfortable with them and confident with them." It was clear from the participants' discussion of their experiences regarding instructional technology that secondary teachers had a deep understanding of their technology self-efficacy, which not only varied among participants, but was also recognized as fluid. Moreover, teachers' responses demonstrated that they possessed a keen awareness of what they required in order to increase their level of self-efficacy for incorporating innovative technologies in the classroom, specifically the use of mobile handheld devices.

Practice. When asked about factors that would increase their level of self-efficacy regarding instructional technology, all of the interview participants mentioned practice at least once. Six of the eight participants specifically referenced hands-on practice as being especially crucial in the development of their self-efficacy. According to Monica, discussing what she would need in order for her to feel confident in trying a new method for incorporating mobile devices in her classroom:

> I would have gone home, had my children and their friends be a practice group, and I would have practiced the whole thing, until I mastered it. And then I would have done it in the classroom. Yeah, so if I was able to find it and get that out of it, I wouldn't have jumped right to the classroom, because I wouldn't want to stand there and be so embarrassed that I didn't know it. Um, but I would definitely practice with them, and you know, use them as like a little test study.

For Monica, the hands-on practice that she described was crucial to the improvement of her self-efficacy. Similarly, Robert described, "Well, every time you use them, you get a little more confidence in one more way to use them. If something works, then you learn what works and what doesn't work." Participants' acknowledgment of the importance of meaningful practice synchronizes with previous literature that asserts that active mastery experiences are the most powerful source of self-efficacy, in that they allow an individual to directly experience success in a particular situation (Bandura, 1997; Tschannen-Moran & Hoy, 2007).

Professional development. Participants also frequently cited professional development in the form of training when describing the advancement of their technology-related self-efficacy. Some of those comments were positive; for example, when describing her perceptions of the technology-focused professional development of which she had taken part, Julie commented, "I think I've taken something from - I wouldn't say every workshop, but most workshops. You know, I've taken something from it and have…used it in my teaching somehow." Similarly, Penny's experiences with technology-related professional development were largely positive as well. She stated, "…now you have professional development, you have all these new technologies, where they offer you the help. And they're giving so much to teachers." Both Penny and Julie recognized the benefits of the professional development activities in which they had taken part.

On the contrary, not all participants described their professional development experiences regarding mobile handheld devices as being productive. When asked about the types of professional development in which she had participated and how those

experiences had influenced her classroom practices, Lynn remarked, "I'm going to say that since I don't remember them much, they probably didn't affect me much." While Lynn was certain that she had attended at least one training session about mobile devices, she was unable to recall any of those experiences specifically. Comparably, Michael also found his prior professional development experiences to be lacking. Of an iPad training that he had previously attended, Michael described, "it just wasn't relevant to my instruction at all, so I hate to say it, but I just sat there for the two or three hours and went through the steps, and didn't really learn anything out of it." Michael's prior professional development experiences had left him with a negative impression.

Participants also expressed their need for follow-up and support after professional development activities in order to successfully implement new types of technology within their pedagogy. Robert was positive about the professional development sessions that he had attended about the use of mobile handheld devices in the classroom. He described them as "…good, because they gave ideas." However, Robert also felt disappointed about the lack of follow-up that he had experienced after the completion of training. He expressed:

> The one and done thing doesn't work as well, because you get it there, you think this is a good idea. You get some papers. But then you're back to your school, and they're not there, and there are questions when you implement that you didn't think of, you didn't actually know to think about the system. So they're limited because of the fact that the follow up is limited. To truly introduce something new to a teaching program, to get teachers to do it, you have to have continued support. You can't just show them how to do it, and then push them out. And

> that's how most seminars and most professional developments work. The expert flies in, one and done, and you never see them again.

For Robert, the lack of follow-up and support he had experienced reduced the positive effects of the professional development in which he had taken part.

Collaboration. Some teachers found the help they needed to increase their level of technology self-efficacy through working with colleagues. For some, this meant leaning on their peers as a system of support as they attempted to implement new types of technology, such as mobile handheld devices. Robert described feeling a need for, "someone to come the first time, explain, and walk through. Not a tech support from the company. Maybe another teacher who's done it. Who…can come in your room, and with you walk it through, [which] would greatly increase your confidence." For other teachers, this collaboration meant more of a partnership. For example, Julie recounted a past experience in which she had worked with a team of teachers who all had the same technology-related goals for their pedagogy:

> Because the thing is, when you're in a training session, you're just kind of learning. But then when you have the time, like the same planning period to be with each other, and kind of make a lesson together, using the technology, using what you learned, [that] helps a lot.

For teachers who felt the most efficacious in utilizing innovative technologies in their classrooms, collaboration meant their acting as the support for other teachers who needed it. Laura, Kevin, and Penny, who were the most frequent users of mobile devices within their instructional practices among the interview participants, all mentioned taking part in initiatives through which they trained and supported others in the use of innovative

technologies. Laura also mentioned that she was frequently asked by her colleagues to help them with day-to-day technology-related issues.

Regardless of the type of collaboration that teachers experienced, it was clear that the act of working with others had served to strengthen each individual's sense of self-efficacy. In fact, Lynn, a self-reported medium user of mobile handheld devices, experienced an evolution from being a person who sought help into one who helped others, which represented a huge leap in her technology self-efficacy. She described:

> I've been very proud of myself, because other people have asked me for my help with their iPhones, which, to me, because I never was technologically 'ept.' I was always inept; I was never experienced with technology. And the fact that [her husband], who has always been an expert with computers, kind of relies on me with help with his iPhone, and my father has asked me, and other people have asked me for help with their iPhones, and maybe iPads a little bit. So that's made me feel very confident.

It is clear that the experience of helping others had made a powerful and positive impact on Lynn's technology self-efficacy.

Though the interview participants in the current study reported varying levels of self-efficacy regarding the use of instructional technology, a common theme among all of the participants was an understanding of that self-efficacy. Additionally, participants displayed an awareness of what had contributed, or would be likely to contribute, to improving their technology self- efficacy. Improving secondary teachers' self-efficacy is one step toward increasing their use of mobile devices in the classroom; in the current

study, the researcher also sought to identify other factors that would aid teachers in achieving that goal.

Essential capital for mobile handheld device use in the classroom. When participants described their experiences implementing the use of mobile devices in their classrooms, they identified a number of elements that either encouraged their use of such devices, or that hindered it. From these factors emerged the common theme that in order to successfully use mobile devices in their classrooms, there are certain types of capital that teachers must have. These factors fell into the categories of intellectual capital, emotional capital, social-cultural capital, and technological capital. Figure 7 illustrates the four types of capital, and how they can overlap to create a situation in which a teacher is best equipped to implement mobile devices in his or her classroom. Figure 7 will be discussed in further detail in the next chapter.

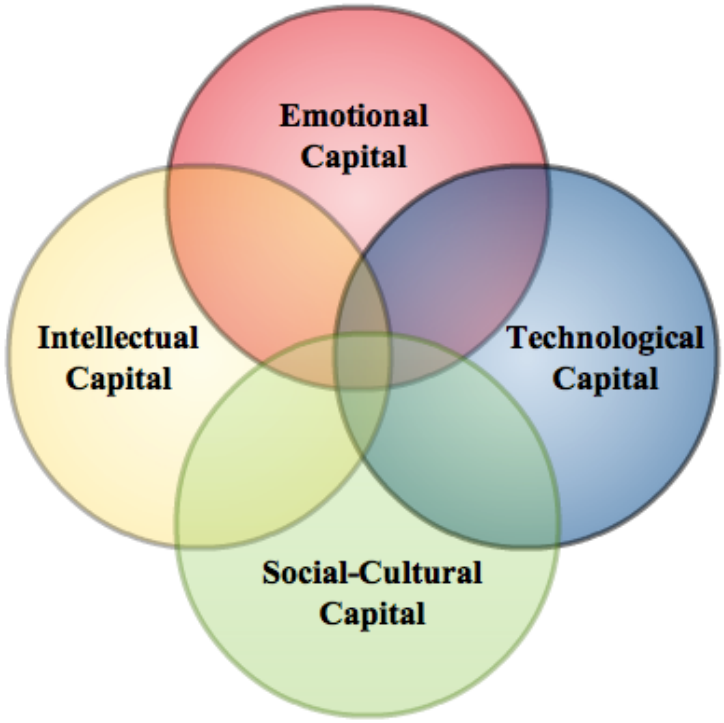


Figure 7. Essential capital for mobile device use. This Venn diagram illustrates the four types of required capital, and their relationship to each other.

Intellectual capital. Intellectual capital refers to the knowledge and skills that teachers must have in order to effectively implement mobile handheld devices within their instruction. As previously noted, participants frequently mentioned training and professional development as a means to increase their understanding and skills when discussing the development of their technology self-efficacy. Participants also referred to such comprehension and abilities, or their perceived lack thereof, when discussing how and why they used or did not use mobile devices in their teaching. Respondents mentioned factors such as experience, planning, and knowledge, as well as simply needing more time to develop those factors, when describing their version of the successful implementation of mobile devices in their classrooms. For example, Lynn felt generally positive about her confidence with using mobile devices in the classroom, remarking:

> I am very, very eager and open to doing it. I've used whatever I've been able to, but I am absolutely open to learning more. I think I feel confident, yet I don't feel like I'm quite as experienced or knowledgeable with all that's open to me with my teaching.

For Lynn, her desire to use mobile devices in her teaching, and her confidence in her ability to do so, was diminished by her feeling as though she did not have the necessary knowledge to use them to their fullest potential. She went on to say how she hoped for "knowing ways to be able to use them [mobile devices], to enhance my students' learning, um, knowing different sites to be able to use, to review, to teach, to just, I guess, to enhance their learning." It was clear that, for Lynn, her lack of knowledge regarding

how to use mobile handheld devices in her classroom acted as a significant barrier to her use of them.

Experience was also discussed as a crucial factor in secondary teachers' implementation of mobile devices in their classrooms. Merely possessing the knowledge about how to incorporate them is not enough; participants need experience as well. Robert described, "Being taught is one thing, but people that know it, that show you a bunch of stuff, you can't remember it all. You need to practice with it, work it again." Moreover, sometimes that experience is the only way to truly gain an understanding of how to use the device. Robert also explained, "it's just, there are just certain things that until you do it, you don't know." This finding echoes that of existing research regarding instructional technology implementation that emphasized the importance of authentic experiences for teachers (Honey & Moeller, 1990; Mueller et al., 2008; Voogt et al., 2013; Wozney et al., 2006),

Participants also discussed that, in order to be able to develop the skills they required to incorporate mobile devices into their instruction, teachers must have sufficient time. Julie expressed why she found time to be so crucial to the successful implementation of any innovative technology:

> I'm the type of person who likes to be very – I like to plan, and I like to make sure things go as planned, so if I don't have the time to do that, I'm less likely to incorporate something new that they want us to incorporate. So…the planning time is definitely important.

Similarly, Laura discussed how much time she spent helping her students to organize their work via the mutual use of mobile devices. She described, "They send me a picture

of it, I complete it, color coded, I take a picture and I either send it to them through whatever app they sent it, if it's Facebook, Google+, or through Hangouts, or text message." Though she reported feeling as though this type of mobile device use had been successful, Laura was also realistic about the additional time it required of her, referring to this strategy as "time consuming, but awesome." Regardless of whether the time was needed before the implementation of mobile devices in the form of training, practice, or planning, or during the implementation, as Laura described, participants commonly identified time as a vital need. The researcher discovered intellectual capital, the knowledge and skills that teachers must have in order to successfully implement mobile handheld devices, to be a common theme within the current study; furthermore, the importance of this type of capital was a theme that appeared in previous research as well (Banas, 2010; Ertmer & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007).

Emotional capital. Participants discussed both positive and negative versions of emotional capital, or the feelings and beliefs teachers have about the use of mobile devices in the classroom. For example, Michael, who considered himself an infrequent user of mobile devices for instructional purposes, described how incorporating new types of technology such as mobile devices might prompt a teacher to feel fearful. He explained:

> I mean it's, you know, a lot of times when you try something new in teaching, and you haven't done it before, there's that little fear factor just getting there. You don't know how the kids are going to react, you don't know if there's going to be a malfunction or a breakdown of what you're trying to do at that time.

Michael equated the use of innovative technologies such as mobile handheld devices with the negative emotion of fear, which is consistent with Honey and Moeller's (1990) findings.

Some participants described feeling as though they had been "forced to use" new types of technology, which led to negative feelings about the process of change. Some participants perceived change as difficult, and experienced feeling a loss of control over their own pedagogy. Kevin described, "I'm discouraged when people say I have to. I don't do well with 'you have to do this', without having a justification why." Some experienced feeling a lack of control in a different way: as concern for the safety of their students as a result of the use of mobile devices. As Robert asserted, "But that's the drawback of technology, is you can't control it. And I like to have more control, and so I'm a little less comfortable using cell phones. But computers, they're much easier to monitor." For Kevin and Robert, the lack of control over the devices and over their autonomy represented negative emotional capital that had hindered their efforts.

Conversely, participants also described positive emotional capital that had encouraged their use of mobile devices in their classrooms. For example, respondents cited the desire to learn or to use mobile devices as a crucial ingredient to their implementation in the classroom. Some talked about having a natural curiosity or ability regarding the use of technology. Kevin, a frequent user of mobile devices in his classroom, described himself as, "I'm just a naturally curious guy. I've always been. I always, I'm that guy who wants all the bells and whistles." Accordingly, Laura stated that she had always considered herself to be an inherently inquisitive person, "I'm the type that if I don't know how to do something, I'll play with the cell phone until I figure it

out." For Kevin and Laura, their innate curiosity had bolstered their efforts in trying out new types of technology such as mobile devices.

Participants also discussed the importance of the feeling of motivation, especially in the event that they experienced technical difficulties. When asked about her perception of an unsuccessful experience with mobile devices in her classroom, Lynn explained:

> If it didn't work, I would probably try my best to have someone teach me how to use it so I would be able to continue using it. I wouldn't just give up, or because I just think that there is a lot more that you can do, and a lot of new things available.

Perseverance, as Lynn described, was also cited as a type of positive emotional capital that teachers require in order to effectively incorporate the use of mobile devices in their classrooms. According to Michael, "When you're trying to figure that out and do it yourself, there's a certain amount of fortitude that has to come with it, and some people have it, and some people don't." This is consistent with Bandura's (1977, 1997) assertion that individuals who have higher levels of self-efficacy are more likely to persevere in situations where they encounter challenges.

Social-cultural capital. Social-cultural capital refers to the interpersonal connections, as well as the shared goals that are common among teachers. For participants in the current study, interactions with others represented experiences that affected their attitudes or feelings toward the use of mobile handheld devices in their pedagogy. For example, Penny, a frequent user of innovative types of technology, described how the social component of professional development had affected her

knowledge of how to utilize mobile devices within her teaching, as well as her motivation for doing so:

> I think when we teachers get together for professional development, [we] share ideas together. They say, 'this is what I do in my classroom,' 'this is what I do,' you know. So it's basically when you network with a lot of teachers, you know, you want to use it. Because it, you know, um, the word just goes around.

For Penny, collaborating and sharing ideas with others caused her to feel that she was part of a network of teachers with the common goal of effective mobile device use. This perception resulted in a culture of collaboration among her and her colleagues.

Conversely, Laura reported feeling a lack of social-cultural capital. She explained, "the majority of the…people who I plan with do not use any kind of mobile technology, so I'm an outcast within that group." As a result, Laura, who was a frequent user of mobile devices within her classroom, had sought out a different group of teachers in a separate subject area with which to collaborate. Laura's example shows how crucial social capital is for those teachers who want to utilize mobile devices more.

For individuals who did not report feeling as though they had a natural affinity for technology, seeing others' successes drove them to want to improve. For example, Monica, who considered herself as having a low level of self-efficacy as well as being an irregular user of mobile devices in the classroom, described how her peers' example had inspired her:

> Seeing other people utilize [mobile devices] in a way that I want to, drives me to have more confidence, because I don't currently have it (laugh). So it's a giant motivator, I think, in terms of seeing the other people. Um, so I think it reminds

> me that I don't have any skill there, which can kind of bring me down at the moment, but it can also really motivate you to want to be that person.

The type of experience that Monica described corresponds with vicarious experiences, a source of self-efficacy. Vicarious experiences can be a powerful source of self-efficacy for individuals, especially in situations where a person has less experience (Bandura, 1977, 1997; Tschannen-Moran & Hoy, 2007).

Technological capital. Technological capital refers to the devices and infrastructure that must be present in order for teachers to effectively utilize mobile devices in their teaching. In order to use mobile devices, students and teachers must have access to the devices themselves. For some teachers, that type of access meant having the devices on hand in the classroom to provide to students. According to Julie, that type of practice had been successful for her. She described, "in the past I've also been able to check out an iPad cart or an iPod cart, so that the students who don't have one, they can grab one." However, in her current school, she found those types of resources to be less common. She explained that if she had those resources available to her students, she would be likely to use them more often. Julie stated, "I don't have the access to it, like I did in my previous school. So, um, if we get a cart soon, that's what I would like to do." Similarly, Michael expressed his frustration with the lack of available mobile resources that he experienced, saying:

> If the resources aren't there to use it, the training is useless. So it's kind of, we don't have the resources to even use them. So whether I had more training or not, unless the training was somehow to, how to use the phones that the kids already

have. Now if we had a training that showed some way that could incorporate what the kids already have, to what I'm doing…

As Michael described, allowing students to bring and use their own devices can be a solution to the lack of resources that might be present in a school. Kevin described how that practice had been successful in his classroom for a long time, "I love the fact that every kid now has a cell phone, ok? Because before it was kind of on the down low." In fact, all of the interview participants mentioned that most of their students had smartphones and/or tablets with them in school. However, many of the participants expressed their concerns with relying on this type of "Bring Your Own Device" policy.

Robert explained:

For whatever reason, not every kid has one, and I don't want them to feel left out if they can't afford it. Or if their parent doesn't want them having it, or if they just forgot it at home. All of those things put them 'on the out.'

Robert's concern about the potential for inequity within his student population is consistent with literature that suggests that such a first-level digital divide exists, and that it also applies to mobile handheld devices (Hohlfeld et al., 2008; Zhang et al., 2015).

Julie expressed a concern with the differences among the operating systems of different devices, and the issues those disparities may cause during implementation. She described an experience during which her students completed a learning activity with their own smartphones: "Some have iPhones, some have Droids, so it was not…we didn't have everything uniform, so it was – not only was I trying to troubleshoot that, but then I was trying to troubleshoot the differences between the different operating systems, and it was a disaster."

Similarly, Robert portrayed another type of concern that he had felt when his students used their own smartphones in the past:

> If I use a tablet, which is monitored here at school, I can look at the browsing history and they can't say anything. But the phone I can't touch it because it's their personal property. And they're smart enough to know how to cover their tracks.

For Robert, the most pressing concern was his lack of control over what his students could do on their own smartphones, because they did not have to access the Internet through the school's firewall-protected Wi-Fi.

The school's Internet access was another example of technological capital that was frequently mentioned by participants in the current study. Several participants mentioned how their difficulty with the school-provided Wi-Fi presented a barrier to their use of mobile devices in the classroom. When Julie was asked about factors that hindered her use of mobile devices in her classroom, she stated, "The Wi-Fi at work. It's also such a disappointment when you really want to use something and [the] Internet's down, and so, that's a big thing that's discouraging, because you never know how the day's going to go." Michael shared this view, describing the school's Wi-Fi as "a joke." According to Monica, when she described her perceptions of the barriers to her use of mobile devices:

> My biggest one would have to be accessibility to Wi-Fi. It's wonderful when it works, but when you can't get access to something, or servers are down, or networks are down, then it can really just kind of set everything back. So in a school setting, I think it's important just to have that infrastructure that can support it.

Julie, Michael, and Robert described feeling the same type of frustration after they had trouble with infrastructure issues that they could not control, which made their use of mobile handheld devices difficult or even impossible.

The four types of necessary capital that were mentioned by teachers, intellectual capital, emotional capital, social-cultural capital, and technological capital, represent both barriers and enablers to their use of mobile devices as instructional tools. They act as enablers in that teachers who possess capital in each of the four areas in turn have all of the necessary components for the successful implementation of mobile devices. But they also can act as barriers, in that the lack of any one of these factors might represent a hindrance that teachers are unable to overcome, thus reducing or even preventing their use of mobile devices as instructional tools.

Evolving classrooms. The third theme the researcher identified as a result of the qualitative analysis was that today's classrooms were recognized by secondary teachers as constantly evolving. The inclusion of instructional technology into education as well as the resultant technological advances that are continuously being made have created an environment in which students, teachers, schools, and school districts must constantly find a way to adapt to changing norms. Within the context of the implementation of mobile handheld devices, that evolution takes the form of newly formed student-teacher partnerships, a redefined concept of classroom management, and a focus on digital literacy.

Student-teacher partnerships. A commonly expressed opinion among participants was that they felt that their students were more knowledgeable about and skilled with mobile devices than they (the teachers) were. As Kevin explained, "The kids,

ok? They're ahead of us. And my feeling is that, whenever you're talking about technology, I have to understand that wherever I think I am, the kids are already one or two years ahead of me." For Kevin, this discrepancy in technology ability between himself and his students represented an opportunity for him to learn from them. He described an app that he had just become familiar with, "I never knew about it, and the kids taught me about it. I'm a teacher, but I'm also a student. From my students – they teach me, and they keep me current." Similarly, Monica discussed how, rather than attending professional development sessions on her own, she had considered calling upon former students to help her learn more about mobile devices and their implementation:

> It is kind of what I'm looking at for some plans, I've talked to some kids I've seen come back, who are very good with that stuff. And I think that, because they're more current, and some of them are at schools that are so technologically advanced, maybe they could assist. So rather than going to the workshops, I may use some of the kids to help.

Monica's and Kevin's decisions to celebrate their students' technological strengths and to allow the students to take on leadership roles either assisting or instructing their teachers is an example of a shift in thinking from teacher-centered to student-centered, which better allows them to meet the needs and interests of their students.

Another example of that type of transformation is teachers' recognition that the incorporation of innovative technologies such as mobile devices in the classroom can result in students who are more interested and engaged. As Penny described, "You can build kind of much more to relate to them compared to…you know, they may find math boring, but you know, I think I can find ways to influence them to use technology."

Penny's experiences had shown her that her students found normally dull material to be more engaging with the inclusion of technology. Monica also portrayed her experience of a similar phenomenon. She described some of the positive effects she had seen as a result of using mobile devices in her classroom:

> I think just the overall benefit of the engagement of the students. I think that they…because they've known nothing else, really, but the technology…I think they buy into it a little bit more. Into what they're doing, when they can pull out the phone and just do what they're doing. And so I think from there, [they] buy in to really anything. It's great to kind of get on their level. So I think that's definitely an influence also.

Penny's and Monica's conclusions that the use of mobile devices led to an increase in their students' engagement and motivation mirrors the results of previous studies that examined the positive effects of mobile device use (Ciampa, 2014; Furió et al., 2015; Pollara & Broussard, 2011; M. Wang et al., 2009).

Classroom management. As the nature of modern-day classrooms changes, so must the methods that teachers use to manage their classroom and their students' learning. With the incorporation of mobile devices come unique challenges that teachers must be aware of and plan for. One such example is the management of the devices themselves. Michael said, "Because the problem is, too, that a lot of times, with some students, or populations of students, when you supply them with technology, they turn around and damage it. Or they mistreat it, or they break it." It is clear that Michael was concerned with the safety of the mobile handheld devices, and how his students would treat them.

Another common apprehension that was discussed by many of the participants is their students' behavior. They expressed their concern about their students' potential to be off-task when they were given mobile handheld devices to work with. As Robert described:

> There are a lot of sites that kids can get into that you don't want them to go to. They'll text their friends, they'll take pictures, they'll Instagram, and they'll Snapchat. You know, they'll do all that stuff here. So it's hard to watch – it's hard to watch 20 kids as it is, but when they have their cell phones out, you're not looking over, which takes away from teaching, because they will go to sites they shouldn't go to, they'll go text their friends, or whatever it is.

For Robert the difficulty in knowing what his students were doing at all times caused him to be fearful for his students' safety. He explained, "When they get the phone, the whole world is exposed to them. When you have a 10-year-old kid, you're giving every horrible person in the world unfiltered access to your 10-year-old child…and that is troubling." While Robert's experiences were as a result of working with middle school-aged students, Laura described having similar experiences with her high school students:

> You know, you give them an inch, they take a yard. They want, you know, they'll put their headphones in. You'll find them on YouTube. You tell them to look up Algebra Nation, and instead of watching an Algebra Nation video, they're watching skateboarding. It has its pros and its cons. And it all comes down to monitoring.

According to Laura, monitoring was the key difference between students who are off-task and potentially unsafe and students who are on-task. Similarly, Penny asserted, "You've

got to really teach the students, uh, when to use it. And how to use it." Accordingly, Lynn described how she had experienced firsthand that her establishment of classroom rules and norms regarding mobile devices had paid off:

> Because in the very beginning, I was a little hesitant, and I also was worried that they were going to do things that they weren't supposed to, like texting. But now I feel like, I'm more confident, and I'm more trusting of them. And for the most part, nobody has ever proven me, given me any other reason, or any reason not to trust them.

For Lynn, what had been at first an uncomfortable experience had become a positive one, after she and her students had developed a culture of trust.

Digital literacy. Despite the changes that teachers reported they must make in both their thinking and their classroom practices, participants recognized that these changes are inevitable. Because today's students live in an increasingly digital world, they must develop skills and knowledge that will enable them to remain current in the face of constantly advancing technology (Boechler, Dragon, & Wasniewski, 2014). As Penny described:

> I think that in the future, it's – you know – as you call it, it's ubiquitous. It's everywhere. And we are just going to get more dependent on it, from the oldest generation [to] the newer generation coming in. It's – there's no way you can say don't bring the cell phone to the classroom.

Participants also recognized the benefits to their students of incorporating the types of mobile technologies that they are accustomed to using every day. As Laura stated:

> I'm encouraged because I think this is where the country's going. And I think it's the best way to teach kids organization. To tell them to write it on a calendar – our students can barely keep a piece of paper for five minutes. So it's teaching them a life skill.

Comparably, Lynn described feeling the same way as Laura. She felt that the use of mobile devices aided in her students' learning. Lynn expressed, "Why not let them use them in a way that's going to also help their learning, and benefit me in the long run, because, you know, they're going to be learning more? And that'll be a good thing." Kevin talked about how the world had changed with the advent of mobile technologies. He shared, " I remember what it was like before we had these. Ok, so it's not like I grew up with this stuff, you know? It's a big difference when you know what it was like before." Kevin, a veteran teacher of more than 20 years, discussed how he recognized the need to grow and to adapt to the times. Penny, a veteran teacher as well, described her agreement with this view: "When it comes down to today's generation, today's students …I know many teachers who have retired because they can't keep up, you know? It's a different generation, you know? So you can't beat them down, you've got to learn to keep up with it."

For Penny, Laura, Lynn, and Kevin, their experiences with incorporating mobile handheld devices into their pedagogy had encouraged them to continually utilize them, due to their positive views of the technological nature of the world, as well as the benefits of using mobile devices that they had seen.

As the landscape of education continually transforms with the constant introduction of innovative types of technologies, such as mobile handheld devices, so

must teachers grow and adapt to those changes. Thus, teachers' perceptions of their constantly evolving classrooms represent a significant component of their perceptions of their implementation of mobile devices. Factors such as a growth in student-teacher partnerships, a redefining of classroom management, and a focus on digital literacy comprise key elements of secondary teachers' experiences with the incorporation of mobile handheld devices as instructional tools.

Comparison of Quantitative and Qualitative Results

The primary goal of the quantitative phase of analysis was to answer Research Question 1, "What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?" The qualitative phase was centered on responding to Research Question 2, " How do secondary teachers perceive their self-efficacy and professional development experiences regarding mobile handheld devices as they implement them as instructional tools?" and Research Question 3, "What other factors do secondary teachers perceive as barriers and enablers to their implementation of mobile handheld devices as instructional tools?" However, the researcher was able to draw parallels between some of the findings of the two phases. In the following section, the researcher will describe these similarities and discuss how the two phases of data analysis relate to one another.

Self-efficacy and Mobile Handheld Devices

In the quantitative phase of the current study, the correlation analysis showed a significant positive correlation (0.522, $p < .001$) between secondary teachers' technology-related self-efficacy and their use of mobile handheld devices. This finding suggests that as teachers' self-efficacy increases, so does their level of mobile device use for

instructional purposes. Additionally, the regression analysis revealed that self-efficacy (SE) made a significant contribution to the multiple regression model, which predicted 30.0% of the variation, adjusted $R^2 = 0.286$, $F(2,104) = 21.669$, $p < .001$, in the criterion variable of secondary teachers' use of mobile handheld devices as instructional tools (MHD). Accordingly, in the qualitative phase of analysis, emotional capital was found to be an essential component for mobile device use. Emotional capital refers to teachers' feelings and beliefs regarding the use of mobile devices. Self-efficacy, or one's beliefs in their own abilities, is an example of the type of emotional capital that is so crucial to secondary teachers' success in the implementation of such devices in their pedagogy.

Professional Development and Mobile Handheld Devices

Another finding that resulted from the quantitative phase of data analysis was that a positive correlation exists between secondary teachers' professional development activities and their use of mobile devices. However, while this correlation was found to be significant (0.341, $p < .001$), it was not as strong as the correlation that was found between self-efficacy and the use of mobile devices. Additionally, in the regression analysis, the researcher found that the predictor variable of professional development (PD) did not make a significant contribution to the overall regression model. Furthermore, in the moderator analysis, the researcher examined whether PD changed the relationship between SE and MHD. The results of that moderator analysis were nonsignificant, indicating that PD does not moderate that relationship. In the qualitative analysis, while the researcher did find professional development to be a common theme within secondary teachers' experiences, participants' perceptions of professional development activities were not consistently positive. These varied opinions about the

results of professional development may in some part explain why those types of activities were not found to have more of a significant effect on secondary teachers' use of mobile handheld devices.

Chapter Summary

The current study aimed to examine the relationship between secondary teachers' technology self-efficacy, their professional development activities involving mobile handheld devices, and their use of the devices as instructional tools. The researcher utilized multiple regression and moderator analyses in order to determine this relationship. She also utilized qualitative methods to explore teachers' perceptions of their experiences implementing mobile handheld devices within their pedagogy. Furthermore, qualitative methods served to identify additional barriers and enablers to secondary teachers' instructional use of mobile devices.

While quantitative results revealed self-efficacy to be a useful predictor of teachers' mobile handheld device use, professional development was found to be nonsignificant. Qualitative findings revealed the varied and dynamic state of secondary teachers' technology-related self-efficacy, as well as the factors that secondary teachers recognized as modifiers to that self-efficacy. Finally, qualitative findings also revealed certain types of capital that secondary teachers recognize as essential to their implementation of mobile handheld devices as instructional tools.

CHAPTER 5. DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

In the following chapter, the researcher will discuss the results of the quantitative and qualitative analyses of the current study, and how they address each research question. She will then explore the implications of those findings and discuss how they relate to the problem of secondary teachers' reluctance to incorporate mobile handheld devices in their teaching. Finally, drawing from the conclusions of the study, the researcher will make recommendations for future research.

Discussion

The purpose of the current study was twofold: the researcher's first goal was to examine secondary teachers' technology self-efficacy, their professional development activities regarding mobile handheld devices, and how those factors affect their use of such devices as instructional tools. The researcher's second objective was to examine teachers' perceptions of other factors that act as barriers or enablers to their use of mobile handheld devices. To achieve these goals, quantitative and qualitative phases were conducted concurrently. 104 secondary teachers in a large urban public school district in the Southeast region of the United States participated in a 28-item survey regarding their technology self-efficacy, their professional development activities, and their use of mobile handheld devices in the classroom. Eight teachers, a subset of the survey participants, also took part in semi-structured interviews. The results of the quantitative and qualitative analyses provided the researcher with an overall picture of secondary teachers' experiences, allowing her to respond to each of the three research

questions.

Research Question 1: What is the relationship between secondary teachers' technology self-efficacy, professional development, and their reported use of mobile handheld devices as instructional tools?

To examine this question, the researcher first conducted a multiple regression analysis. For this analysis, secondary teachers' technology self-efficacy and their level of professional development regarding mobile handheld devices served as the predictor variables, with secondary teachers' level of use of mobile devices as instructional tools as the criterion variable. According to the summary for the multiple regression analysis, the model explained 30% of the variation in the criterion variable, adjusted $R^2 = 0.286$, $F(2,104) = 21.669$, which was significant ($p < 0.001$). The variable of secondary teachers' technology self-efficacy was found to be a significant contributor to this model, while teachers' level of professional development did not make a significant contribution. From these results, it appears that secondary teachers' technology self-efficacy is a useful predictor of the frequency with which those teachers will incorporate mobile handheld devices into their instruction. However, secondary teachers' level of participation in professional development regarding mobile devices does not serve as a useful predictor.

To further examine any existing relationship between the variables, the researcher conducted a moderator analysis to determine whether secondary teachers' level of professional development regarding mobile devices changed the relationship between their technology self-efficacy and their incorporation of mobile devices into their instruction. To achieve this analysis, the researcher added a moderator variable into the multiple regression which was calculated by taking the product of the two predictor

variables. The results of the analysis showed this moderator variable's contribution to be nonsignificant, which demonstrated that secondary teachers' level of professional development does not change the relationship between their technology self-efficacy and their use of mobile handheld devices as instructional tools.

The results of the multiple regression analysis demonstrated a clear relationship between secondary teachers' technology self-efficacy and their use of mobile handheld devices as instructional tools. This conclusion supports the research of Ertmer and Ottenbreit-Leftwich (2010), who asserted that, "evidence suggests that self-efficacy may be more important than skills and knowledge among teachers who implement technology in their classrooms" (p. 261). Similarly, Albion (1999) asserted that, "self-efficacy beliefs are an important, and measurable, component of the beliefs that influence technology integration" (p. 2). While previous literature supports the notion that self-efficacy plays an integral role in teachers' implementation of technology in general, the findings of the current study demonstrate the importance of self-efficacy beliefs in secondary teachers' incorporation of mobile devices as a specific type of innovative technology.

Conversely, the results of the multiple regression and moderator analyses demonstrated that teachers' level of professional development neither significantly predicted their use of mobile devices in their instruction, nor changed the relationship between their self-efficacy and their mobile device use. This finding was surprising when compared with previous research that highlighted the importance of professional development to teachers' technology integration. For example, in their study of exemplary technology-using teachers, Ertmer et al. (2006) found that teachers considered professional development to be the most influential extrinsic factor to technology use.

However, not all professional development activities are deemed effective, according to Kanaya et al. (2005). They argued that there are certain elements of professional development programs that make them more effective than others, such as intensity of delivery and an emphasis on teachers' individual knowledge, needs, and interests. The quantitative phase of the current study did not incorporate the quality of the professional development.

Therefore, some of the findings from the qualitative phase of the current study may serve to explain why professional development was not found to have a more significant effect. For example, Monica and Michael discussed being dissatisfied with technology training sessions they had attended that were not relevant to their needs, which is consistent with Knowles et al.'s (2005) assertion that adults must recognize the importance of relevance of new knowledge in order for them to successfully engage with it. Robert also discussed feeling a lack of fulfillment from his professional development activities, describing his subsequent success as "limited because of the fact that the follow up is limited", which echoes the findings of Overbaugh and Lu (2008). It is clear that mere participation in professional development activities, as was measured in the current study, does not necessarily translate into a change in teachers' practice. Instead, the value and effectiveness of the professional development program must also be considered.

Research Question 2: How do secondary teachers perceive their self-efficacy and professional development experiences regarding mobile handheld devices as they implement them as instructional tools?

To examine this question, the researcher conducted interviews with participants who were located at the low, middle, and high ends of the mobile handheld device-using spectrum. This scale was determined by participants' responses to six questions on the survey. The researcher's goal for this qualitative phase of the study was to gain an overall understanding of the phenomenon of secondary teachers' mobile handheld device implementation within the context of their perceptions of their technology self-efficacy as well as their professional development experiences.

The results of the qualitative analysis demonstrated that secondary teachers are keenly aware of their technology-related self-efficacy, which was found to be greatly varied among interview participants. Some teachers reported themselves to be very confident and willing to take chances, while others reported a low level of confidence and a tendency toward fear of the devices. These findings mirrored that of Wozney et al. (2006), who stated that teachers who report low levels of technology-related self-efficacy are less likely to take any risk in trying to implement new types of technology. Furthermore, Honey and Moeller (1990) reported that for some teachers, a deep-seated fear of technology prevents their attempting to implement innovative technologies into their pedagogy whatsoever. These findings also related to the results of the multiple regression analysis, which demonstrated that secondary teachers' self-efficacy is a useful predictor of their instructional use of mobile handheld devices. Consequently, the

qualitative findings expanded the significance of secondary teachers' self-efficacy by providing a complete picture of factors that impacted that self-efficacy.

The results also demonstrated that secondary teachers recognize their needs with regard to increasing their level of technology self-efficacy. Participants reported those needs to be practice, professional development, and collaboration. These requirements echoed many of the elements of Bandura's (1977, 1997) four sources of self-efficacy, which are active mastery experiences, vicarious experiences, verbal persuasion, and physiological or affective states. Participants regarded practice as crucial to the development of their self-efficacy. Similarly, active mastery experiences are described as those in which a person experiences success firsthand; such experiences are the most powerful sources of self-efficacy (Bandura, 1977, 1997; Tschannen-Moran & Hoy, 2007). Participants' recognition that they require hands-on practice and relevant professional development to increase their technology self-efficacy reaffirms the importance of active mastery experiences.

The results of the qualitative analysis also demonstrated that secondary teachers possess a growing awareness of how their classrooms are evolving as a result of the increase in innovative instructional technologies such as mobile handheld devices. These changes in day-to-day practices represent a crucial part of teachers' perceptions of their experience with the implementation of mobile handheld devices as instructional tools. Participants reported recognizing an increase in student-teacher partnerships, an updated definition of classroom management, and an understanding of the importance of digital literacy.

Teachers reported feeling that their students were much more technologically skilled than they were, and many of them accepted this as a positive circumstance, allowing their students to take on the role of the teacher. For example, both Kevin and Monica mentioned times where they had willingly learned about mobile devices from their students. Fairman (2004) reported a similar theme as a result of the Maine Learning Technology Initiative (MLTI). During the MLTI, teachers reported a shift from traditional teacher-centered classrooms to a more reciprocal relationship, in which students assumed the responsibility of educating their teachers about laptops. As a result of that give-and-take format, teachers reported improvements in their technology ability and classroom integration due to their learning from students' knowledge and expertise, while students reported benefits such as higher levels of self-esteem, more frequent interaction with their teachers and peers, and increased respect from teachers.

Another common theme among participants' responses was a concern for the day-to-day rules and procedures involved with the classroom use of mobile handheld devices. Those concerns regarded both school-provided equipment, as was the case with Michael, who worried about the students' treatment of expensive technological devices; or with students' behavior, such as with Robert, whose concern centered on his students' safety should they use their mobile handheld devices in ways not condoned by him. Regardless, the incorporation of mobile devices in a classroom was found to present teachers with challenges about how to set boundaries for their appropriate use. This finding is consistent with previous research by Charles (2012), who found that, more often than not, students found ways to break established rules for cell phone use. The author argued for a shift in thinking from "authoritative teaching roles to a more democratic negotiation of

classroom interaction based on relationships of trust and respect" (p. 13). Lynn's revelation that her pedagogical use of mobile devices and establishment of classroom norms had led to an enhanced level of trust in her students further supports Charles's assertion.

Teachers also recognized that today's students live in an increasingly technological world; thus, the importance of digital literacy is undeniable. Students must develop the skills and knowledge regarding technology that will allow them to "be competitive in increasingly digital global markets" (Boechler et al., 2014, p. 2). This finding relates to Hohlfeld et al.'s (2008) concept of a third-level digital divide, which refers to "schools' responsibility for preparing students with both the technological skills and the abilities to independently make decisions so that they are capable of selecting and using the appropriate ICT for accomplishing personally valuable objectives in efficient ways" (p. 1650).

Many participants noted the benefits to their students that they had experienced firsthand. Participants reported observing higher levels of student engagement, learning gains, and improved organization as a result of their use of mobile handheld devices in the classroom, which was consistent with benefits noted in previous literature (Liu et al., 2014). While these benefits were not the focus of the current study, participants did report that experiencing those positive outcomes served to improve their perceptions of the incorporation of mobile devices in their classrooms.

Research Question 3: What other factors do secondary teachers perceive as barriers and enablers to their implementation of mobile handheld devices as instructional tools?

To address this question, the researcher included interview questions regarding the encouraging and/or hindering factors that participants perceived while implementing mobile handheld devices. Additionally, the researcher found that participants mentioned some of these factors throughout the natural progression of the interview discussion as well. As a result of the qualitative analysis that followed, the researcher identified four types of capital that secondary teachers recognized to be essential to their implementation of mobile handheld devices in their classrooms. These essential characteristics are: intellectual capital, emotional capital, social-cultural capital, and technological capital.

Intellectual capital is defined as the necessary knowledge and skills that teachers must possess. This knowledge refers not only to teachers' comprehension of the devices themselves, but also of how to incorporate them within their pedagogy. Both Julie and Robert described how they felt familiar with their personal smartphones, but had experienced difficulty with their students' devices because many of them were different. Additionally, Lynn and Monica mentioned feeling that they did not know much about new and different ways to utilize the devices in their instruction. Intellectual capital also relates to the previously mentioned theme of redefined classroom management. Teachers must have the skills to manage the devices, classroom procedures, and their students' behavior. This finding correlates with Koehler and Mishra's concept of Technological Pedagogical Knowledge (TPK), a component of Technological Pedagogical Content Knowledge (TPACK). The authors asserted that TPACK represents the intersection of all

of the types of knowledge teachers must have in order to most effectively incorporate innovative types of technology such as mobile handheld devices within their specific discipline. When secondary teachers possess these types of knowledge, intellectual capital functions as an enabler to their use of mobile devices in their instruction, while a lack of capital instead becomes a barrier.

Emotional capital refers to teachers' feelings and beliefs regarding mobile handheld devices. Positive forms of emotional capital, such as motivation, perseverance, comfort, and buy-in, boost teachers' utilization of mobile devices. On the other hand, negative forms of emotional capital, such as fear, difficulty with change, and a lack of control, hinder such efforts. This finding mirrors that of Honey and Moeller (1990), Ertmer et al. (2006), and Ertmer et al. (2012), who found that teachers reported a variety of intrinsic factors such as attitudes and beliefs when asked about contributors that affected their use of instructional technology. While teachers also reported a variety of extrinsic factors, according to Ertmer et al. (2006) and Ertmer et al. (2012), they reported feeling that the intrinsic factors exerted a far more powerful influence than the extrinsic ones. Ertmer et al.'s (2006) and Ertmer et al.'s (2012), findings, when paired with the current findings about emotional capital in the qualitative phase of the study, may help to explain why, in the quantitative phase, self-efficacy (an intrinsic factor) was found to be a significant predictor of teachers' use of mobile handheld devices, while professional development (an extrinsic factor) was not.

Social-cultural capital refers to the shared experiences and common goals among teachers that contribute to a culture of collaboration. As was found in previous studies that examined enabling factors to teachers' use of innovative types of technology, the

development of the school environment as a culture that allows and encourages this type of cooperation among teachers is crucial (Ertmer & Ottenbreit-Leftwich, 2010; Hew & Brush, 2007; Pan & Franklin, 2011). Vicarious experiences, or those in which a person witnesses another's success, as well as verbal persuasion, in which an individual is encouraged by peers, can be powerful sources of self-efficacy (Bandura, 1977, 1997; Tschannen-Moran & Hoy, 2007). These two types of experiences relate to participants' reported need for collaboration as a means to increase their self-efficacy, and in turn, their use of mobile devices as instructional tools. Teachers such as Monica and Lynn recognized how seeing others successfully implement mobile handheld devices in their classrooms reinforced their aspiration to attempt it themselves. Additionally, collaborative experiences can lead to situations where colleagues encourage each other. Bandura (1977) referred to the importance of "the interactive, as well as the independent, effects of social persuasion on self-efficacy" (p. 198). For example, Julie spoke of the importance of her team members' support when she had tried to utilize new types of technology in the past.

Technological capital, or the necessary devices and infrastructure needed to support the use of mobile handheld devices in the classroom, was the fourth type of capital that was found to be required in order for teachers to effectively incorporate such devices. Secondary teachers mentioned that schools do not commonly have mobile devices for students to borrow and use while in class, which represents a significant barrier. Conversely, participants discussed allowing their students to use their own devices while in school, which can instead be an enabling factor, although some teachers, such as Julie and Robert, encountered difficulty as a result of managing and using a

variety of different devices at the same time. Additionally, participants mentioned their concern for students who do not have their own mobile devices, which was a clear example of the digital divide regarding mobile devices that was found by Zhang et al. (2015), as well as the first-level digital divide noted by Hohlfeld et al. (2008). This first-level digital divide also refers to a lack of infrastructure within schools, which prevents students from utilizing technology. Participants also noted that insufficient Wi-Fi often acts as a barrier to their incorporation of mobile handheld devices in their classrooms.

Figure 8 expands upon Figure 7, and represents the relationship and interaction between the four types of essential capital for mobile device use. In order for a teacher to be fully equipped to best incorporate mobile devices into his or her pedagogy, he or she must fall in the center brown section of the Venn diagram, as one who has intellectual, emotional, social-cultural, and technological capital. In that case, the four types of capital function as enablers for the teachers' pedagogical use of the mobile devices. An individual who fits into the section of the figure directly to the right of the center has technological, emotional, and social-cultural capital, but not intellectual; therefore, the lack of intellectual capital becomes a barrier, and such a person might benefit from effective professional development in the form of training, collaboration with peers, or a partnership with students with the goal of increasing his or her knowledge and skills. A teacher who identifies with the section of the figure directly below the center has intellectual, technological, and social-cultural capital, but not emotional. Consequently, because the lack of emotional capital presents a barrier to such a person, they might benefit from professional development in the form of training or collaboration with colleagues in an effort to increase his or her technology self-efficacy and/or buy-in for the

benefits of mobile device use. A teacher who fits into the section directly above the center section has intellectual, emotional, and technological capital, but lacks social-cultural capital. As a result, the lack of social-cultural capital represents a barrier to the teachers' incorporation of mobile devices within his or her pedagogy. Such an individual requires a network of colleagues with which to collaborate, as well as an environment that promotes a culture of mobile device implementation. Finally, a teacher who fits into the section that is left of the center of the diagram has intellectual, emotional, and social-cultural capital, but not technological. As a result, the lack of technology becomes a barrier; therefore, that category of individual might benefit from a "Bring Your Own Device" policy, an improvement in school resources, or an upgrade in the school's technology infrastructure. For an individual who fits into only one or two of the red, blue, green, or yellow sections, or for those who do not identify with any of these types of capital at all, several interventions may be necessary in order to reduce or eliminate the multiple barriers he or she faces.

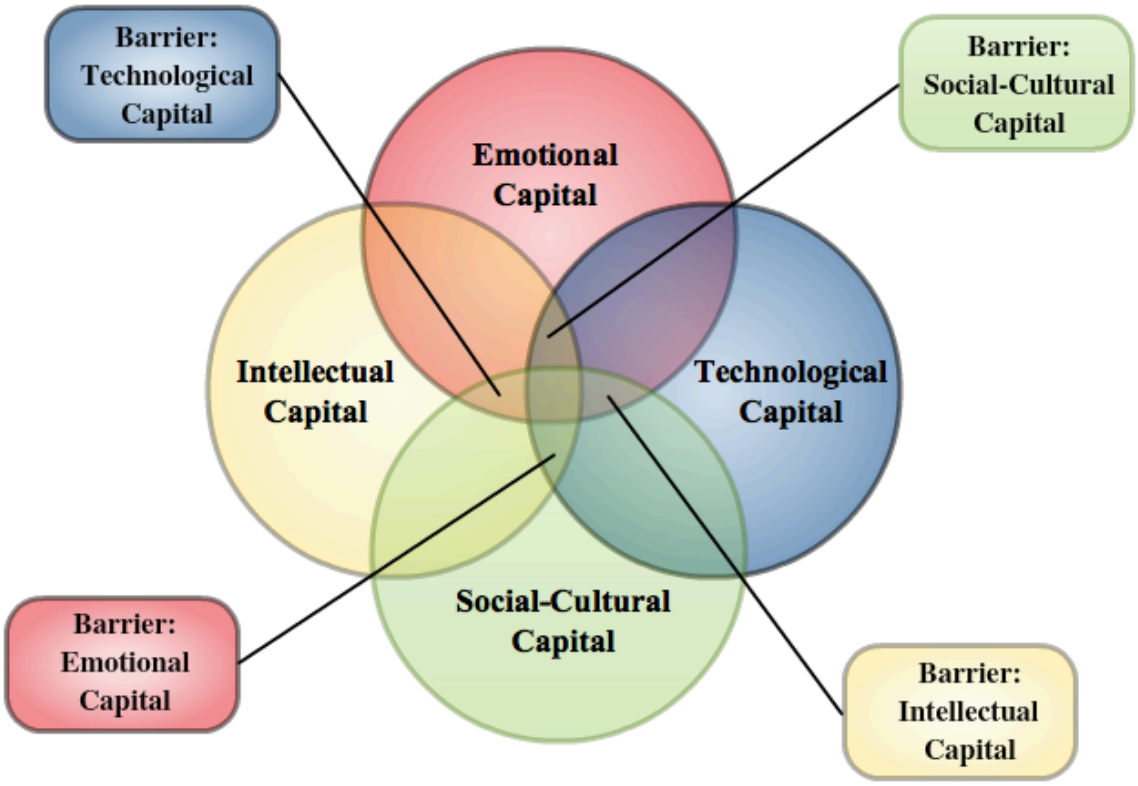


Figure 8. Essential capital and barriers for mobile device use. This Venn diagram illustrates the four types of required capital, and barriers created by missing capital.

Implications of the Study

The findings of the current study present implications for a number of stakeholders involved within secondary schools. In the following section, the researcher will discuss how the results of the study affect individuals at multiple levels. These levels include designers of professional development programs, school and district leaders, and individual secondary teachers.

Implications for Designers of Professional Development

The results of the current study demonstrated that sole participation in professional development activities does not necessarily lead to an increase in secondary teachers' use of mobile handheld devices as instructional tools. The results of the

multiple regression and moderator analyses showed professional development to be neither a significant predictor of teachers' use of mobile devices, nor a factor that changes the relationship between teachers' self-efficacy and their use of mobile devices. However, in the qualitative analysis, secondary teachers named practice and training as crucial needs to improving their self-efficacy, as well as to increasing their use of mobile devices for instructional purposes. Participants' critical comments about the quality and relevance of the professional development activities in which they had taken part, as well as the support that followed those activities, suggested that professional development programs involving mobile handheld devices could be improved. Therefore, this finding has clear implications for designers of those programs.

Brinkerhoff (2006) found that professional development programs that focused on minimizing identified barriers to teachers' technology use had the greatest amount of success in effecting change within teachers' technology-related practices. Therefore, designers of professional development must be aware of the factors that teachers identified as barriers to their use of mobile handheld devices, so that they can be lessened. Designers and providers of professional development must also be aware that some teachers lack intellectual capital, while others lack emotional capital; therefore, a "one size fits all" plan for professional development is not always the most appropriate or effective. When examining the most common types of professional development activities reported by participants, "self-study" was one of the top responses by participants. This further supports the implication that many secondary teachers seek their own professional development opportunities in order to find ones that fit their individual needs. Consequently, according to Knowles et al.'s (2005) andragogical model, fostering

the adult learner's self-concept as an independent and self-directed learner is crucial to their success.

Providers of professional development must also be sure to provide adequate follow-up and support after the conclusion of any activities. Participants frequently cited a lack of support following training as a concern. Participants also expressed their desire for the opportunity to collaborate with peers. This collaboration provides the social-cultural capital that teachers need in order to most effectively implement mobile handheld devices within their pedagogy. Accordingly, when comparing participants' responses about the types of professional development activities in which they had participated, "collaboration with colleagues/peers" was the most common answer.

Implications for School and District Leaders

School and district leaders also play an important role in creating a culture that fosters successful mobile device implementation. Because collaboration was reported as an important factor for secondary teachers who are working to utilize mobile handheld devices in their classrooms, leaders at both the district and school levels must provide opportunities for that type of collaboration and support. It is crucial that each school adopt a culture of collaboration, as well to establish a goal of the improved use of mobile devices for instructional purposes. It is also of the utmost importance that school and district funds be utilized to minimize the barrier of the existing digital divide whenever possible. If more mobile devices were available, they could be provided to students who do not have their own. Additionally, school Wi-Fi systems should be improved so that those devices can be utilized as efficiently as possible.

Implications for Teachers

The results of the study demonstrated that secondary teachers possess a strong awareness of their self-efficacy, as well as of the barriers and enablers that they have experienced. Once professional development programs and infrastructure are to be improved, it falls upon each individual educator to take advantage of all of the opportunities extended to him or her, and to subsequently utilize the available resources in the classroom. Effective professional development programs have been found to improve teachers' technology-related self-efficacy, which in turn increases their utilization of instructional technologies such as mobile handheld devices (Banas, 2010; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2006; Hew & Brush, 2007; Wozney et al., 2006).

Teachers must also be open to collaboration with colleagues, as well as with students. The positive effects of student-teacher partnerships as was found in the current study, as well as was discussed in previous research by Fairman (2004), support the many possible benefits of that practice. These benefits include improved teacher utilization of innovative technologies, higher levels of interaction between students and teachers, increased respect for students, and enhanced student self-esteem.

Figure 9, the cycle of improved mobile device implementation, depicts the synthesis of the aforementioned discussion, based on the findings of the current study. The first step in this process must be to identify those factors that influence teachers' mobile device use or lack of use. Once those barriers and enablers have been established, professional development programs that target those factors can be best designed. When secondary teachers then participate in those optimized professional development

activities, their self-efficacy will in turn increase. The improvement in secondary teachers' technology self-efficacy can serve to increase their collaboration with both peers and students, creating ideal conditions for their effective utilization of mobile devices as instructional tools.

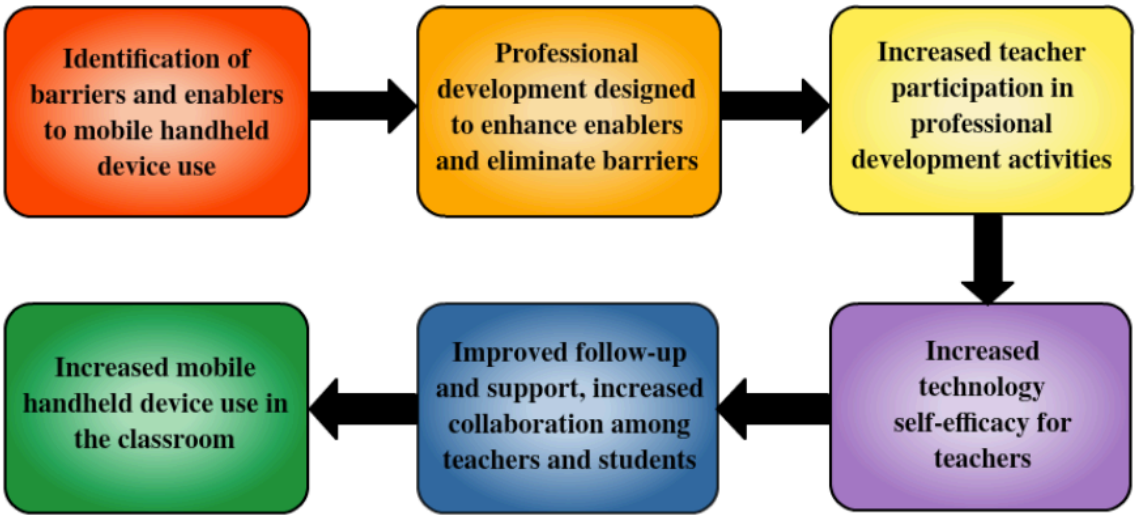


Figure 9. Process of increasing mobile device implementation. This flowchart depicts the proposed steps in improving secondary teachers' incorporation of mobile handheld devices within their pedagogy.

Recommendations for Future Research

A goal of the current study was to examine the relationship between secondary teachers' technology self-efficacy, their professional development activities, and their use of mobile handheld devices as instructional tools. While the quantitative findings revealed self-efficacy to be a significant predictor of secondary teachers' instructional use of mobile handheld devices, the researcher found the results regarding professional development to be nonsignificant. Findings from the qualitative phase suggested that teachers' perceptions of the professional development activities themselves may have contributed to the mixed results of those endeavors. Therefore, a future study is

recommended that focuses on the qualities of professional development activities involving mobile handheld device use that teachers perceive to be most effective. Such future research might also examine the effects of those professional development activities on secondary teachers' technology self-efficacy, as well as on the other types of essential capital (emotional, intellectual, and technological) as were identified in the current study.

While the focus of the current study was the perceptions of teachers, the qualitative findings revealed that many teachers recognized positive effects on their students as a result of the incorporation of mobile handheld devices in their classrooms. These effects included increased engagement, increased student-teacher partnerships, and learning gains. Though an examination of the benefits to students was not a goal of the current study, future research that explores these potential benefits would shed light on that subject. Additionally, some participants also recognized negative effects on their students as a result of mobile handheld device use, such as off-task and potentially unsafe behaviors. Future research should therefore incorporate the possibility of both positive and negative implications of the classroom implementation of these devices.

While the current study focused on all types of mobile handheld devices, many participants spoke primarily of smartphones when discussing how they utilized such devices in their classrooms, especially with respect to "Bring Your Own Device" policies. Therefore, future research that focuses on the use of just one type of device, such as smartphones or tablets, is warranted. Additionally, a cross comparison of teachers' perceptions of the use of different devices may have additional implications for designers of professional development so that they may incorporate those unique

challenges into their programs. A comparison of different devices and the potential challenges and benefits for each may also have implications for school and district leaders who make determinations about what types of devices on which to devote technology funds.

Finally, the population involved in the current study included only middle and high school teachers. A future study that examines mobile device use among elementary school teachers may reveal their perceptions of barriers and enablers to be very different, or they might be very much the same as reported by secondary teachers. In either case, designers of professional development who aim to provide the most effective training possible must have a strong understanding of those challenges for teachers at every level.

Conclusion

The current study was conducted in an effort to address the problem that secondary teachers are reluctant to incorporate mobile handheld devices in their instruction. To examine this problem, the researcher aimed to examine the relationship between secondary teachers' technology self-efficacy, their professional development activities involving mobile handheld devices, and their use of such devices as instructional tools. Quantitative and qualitative analyses were conducted in a convergent parallel design, which allowed the researcher to examine any existing relationship between the variables, to deepen her understanding of that relationship by examining teachers' perceptions, and to identify any additional barriers and enablers to teachers' implementation of mobile handheld devices.

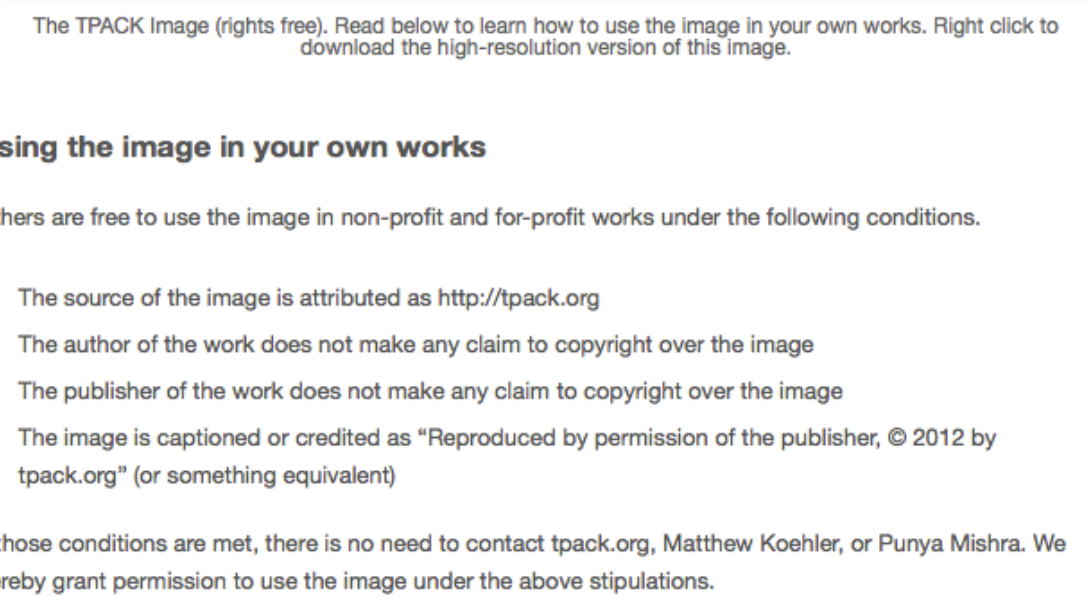
The findings of the study revealed that, while self-efficacy was found to be a significant predictor of secondary teachers' instructional use of mobile device use,

professional development was not. Qualitative data regarding teachers' perceptions about the quality and follow-up support of those activities suggested that those factors might play a part in their effectiveness. Additionally, the findings of the qualitative phase of the study revealed that secondary teachers possess a keen understanding of their technology-related self-efficacy, as well as factors that modify it. Qualitative data also revealed four categories of crucial elements that teachers must have in order to most effectively implement mobile handheld devices within their pedagogy: intellectual capital, emotional capital, social-cultural capital, and technological capital.

These findings have implications for designers of professional development programs, in that they must be aware of teachers' perceived barriers and enablers to mobile device implementation, so that they may minimize hindering factors as much as possible. The findings also have implications for school and district leaders, in that they must allow for collaboration among colleagues, as well as provide the proper technological resources and infrastructure in an effort to lessen any existing digital divide. Finally, the findings have implications for secondary teachers, in that they must take part in professional development once it has been optimized. Teachers must also be open to partnerships with peers and students in order to contribute to a system of support for all stakeholders involved. The goal of effecting these changes at all levels of secondary education will be an overall increased and improved use of mobile handheld devices as instructional tools among teachers and students in secondary schools.

APPENDICES

Appendix A. Permission To Reproduce TPACK Image



The TPACK Image (rights free). Read below to learn how to use the image in your own works. Right click to download the high-resolution version of this image.

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Others are free to use the image in non-profit and for-profit works under the following conditions.

- The source of the image is attributed as http://tpack.org
- The author of the work does not make any claim to copyright over the image
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If those conditions are met, there is no need to contact tpack.org, Matthew Koehler, or Punya Mishra. We hereby grant permission to use the image under the above stipulations.

Image obtained from http://www.tpack.org on April 30th, 2016.

Appendix B. Permission to Reproduce Bandura's (1977) Sources of Self-efficacy

APA Copyright and Permissions Information

APA Permissions Policy

APA supports the dissemination of information to aid in the development of science and scholarly research. APA also values and respects its own intellectual property as well as the intellectual property of others. As a result, APA believes it is essential for publishers of scholarly and other proprietary material to develop an efficient and consistent system, based on mutual trust, for granting permissions for both electronic and print publication of proprietary works. Therefore, APA adopts the following guidelines for the use of APA copyrighted content.

3. Permission is Not Required for the Following:

- A maximum of three figures or tables from a journal article or book chapter
- Single text extracts of less than 400 words
- Series of text extracts that total less than 800 words

No formal requests to APA or the author are required for the items in this clause.

Return to Top

4. Requirement for Attribution and Credit

APA requires that full credit be given to the author(s) and APA of the material(s) reused. That credit should include the following:

- For material republished from books: author, title, edition, publisher, city, copyright year, and "reprinted [or adapted] with permission."
- For material republished from journal articles: author, title of article, title of journal, volume number, issue number (if relevant), page range (or first page if this is the only information available), date, APA as publisher, and "reprinted [or adapted] with permission."
- The following language should be added to the credit line for versions translated from the English: "APA is not responsible for the accuracy of this translation".

Image obtained from http://www.apa.org/about/contact/copyright/index.aspx on April 30th, 2016.

Appendix C. School District Approval Letter

[redacted]

December 18, 2015

Ms. Allison Berger
[redacted]

Dear Allison Berger:

The Superintendent's Research Review Committee has approved your request to conduct research entitled, "Going on the Grid: Secondary Teachers' Implementation of Mobile Handheld Devices as Instructional Tools", in the [redacted] (the District). According to documentation submitted, the purpose of this study is to explore secondary (middle and high school) teachers' technology self-efficacy, their professional development involving mobile handheld devices, and how these impact their use of the devices as instructional tools. This research is approved and limited to the study, scope, and methods outlined in the proposal. The study will utilize a survey that will be forwarded to teachers.

As this study is conducted, please be governed by the following guidelines and policies as outlined in District's Policy [redacted]

- Section 4 – General Provisions, Item C – *No Right to Access*: There is no right to access district students, staff or data related thereto for research purposes. Researcher may only access schools, students, staff, and data relevant to the research as approved by the Department of Research and Evaluation.
    - Research Request is for the following schools:
        - [redacted]
- Section 6 – Approval of Research, Item B – *Limited Approval*. The Department of Research and Evaluation's approval/acknowledgement of an external research study is conditional and subject to further approval by the school principal(s) and research subject(s) that form the basis for the proposed study. A principal may place restrictions on an External Researcher's access to students and staff to maintain a safe and secure school and to minimize disruption to instructional and other school activities.
    - Provide letter documenting approval from each school's principal

---

[redacted]

- Teacher participation is strictly voluntary. Obtain written Informed consent from teacher participants.
    - Provide proof of informed consent from each teacher
- Contact **NO** school or department other than schools where principals have approved access. District policy provides that no one has the right to access students, staff or data, and prohibits researchers from requesting data directly from schools or departments.
- When contacting school administrators, either by email or in person, please provide a copy of your approval letter.
- Research activities at schools must not occur during the testing window of the Florida Standards Assessments and End-of-Course Assessments – February 16 – May 6, 2016 and May 13, 2016 for secondary schools.
- Summarize findings for reports prepared from this study and do not associate responses with a specific school or individual. Information that identifies the District, schools, or individual responses will not be provided to anyone except as required by law.
- This research study must be concluded by October 7, 2016, when the IRB expires.
- If the study requires the use of additional resources or change in participants in the future, a written request must be submitted to this office. Please wait for an approval before proceeding.

Please submit one copy of the study results to the Department of Research and Evaluation no later than one month after completion of the research.

Thank you for your interest in our District.

[redacted]

Director

[redacted]

Cc: [redacted]

[redacted]

Appendix D. School Participation Recruitment Narrative/Email

School Participation Recruitment Narrative/Email

Hi, my name is Allison Berger, and I am a middle school teacher in [redacted]. I am also a doctoral student at Florida Atlantic University who is about to begin my dissertation research. My study's purpose is to examine secondary teachers' experiences with and perceptions of the use of mobile handheld devices as instructional tools.

Participants in this study will respond to a 28-item electronic survey that should take 5-8 minutes to complete. They will also have the opportunity to participate in a face-to-face interview that will take place outside of the school day.

I could really use your help and support in completing my dissertation. Would you be willing to forward my survey link to your faculty/department members?

Thank you so much for your time and help!

Sincerely,

Allison Berger

Appendix E. FAU IRB Approval Letter

Institutional Review Board
Division of Research
777 Glades Rd.
Boca Raton, FL 33431
Tel: 561.297.0777
fau.edu/research/researchint

Michael Whitehurst, Ed.D., Chair

DATE:	October 7, 2015
TO:	Roberta Weber
FROM:	Florida Atlantic University Social, Behavioral and Educational Research IRB
IRBNET ID #:	797146-2
PROTOCOL TITLE:	[797146-2] Going on the Grid: Secondary Teachers' Implementation of Mobile Handheld Devices as Instructional Tools
PROJECT TYPE:	*New Project*
ACTION:	APPROVED
APPROVAL DATE:	October 7, 2015
EXPIRATION DATE:	October 7, 2016
REVIEW TYPE:	Expedited
REVIEW CATEGORY:	Expedited review category #B7

Thank you for your submission of Response/Follow-Up materials for this research study. The Florida Atlantic University Social, Behavioral and Educational Research IRB has APPROVED your New Project. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

- This study is approved for a maximum of ***250* subjects**.
- It is important that you use the approved, stamped consent documents or procedures included with this letter.
- ****Please note that any revision to previously approved materials or procedures, including modifications to numbers of subjects, must be approved by the IRB before it is initiated.** Please use the amendment form to request IRB approval of a proposed revision.
- All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All regulatory and sponsor reporting requirements should also be followed, if applicable.
- Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.
- Please note that all research records must be retained for a minimum of three years.
- **This approval is valid for one year.** A Continuing Review form will be required prior to the expiration date if this project will continue beyond one year.

If you have any questions or comments about this correspondence, please contact Tina Horton at:

Institutional Review Board
Research Integrity/Division of Research

Florida Atlantic University
Boca Raton, FL 33431
Phone: 561-297-0777
researchintegrity@fau.edu

* Please include your protocol number and title in all correspondence with this office.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within our records.

Appendix F. Pilot Survey Instrument

Informed Consent Page

Going on the Grid: Secondary Teachers' Implementation of Mobile Handheld Devices as Instructional Tools

The purpose of this research study is to explore your experiences and perceptions with your level of confidence, professional development, and the implementation of mobile handheld devices in the classroom. The secondary purpose of this study is to identify any barriers and enablers you have perceived that may have have affected your use of such devices in the classroom.

To participate in this study, you will complete a 28-item electronic survey on technology self-efficacy, professional development, and the use of mobile handheld devices as instructional tools. The survey is estimated to take 10 minutes to complete. Then you may be selected to participate in a face-to-face interview about your experiences and perceptions. The interview is estimated to take between 45 and 60 minutes.

There are no foreseeable risks associated with participating in this research study.

The benefits to taking part in this study are that participants will help to inform designers of technology integration programs about barriers and enablers that affect the skilled use of mobile handheld devices as innovative educational tools.

Your data will be submitted to the researcher via a secure and encrypted website. Only those who are working with the study will have access to your data, and all data will be kept strictly confidential, except in a case where it is required by law. Data will be stored on the researcher's password-protected personal laptop, and will be destroyed 3 years after the completion of the study. The results of this study will be published, but your name will not be included anywhere in the publication.

Contact Information: For related problems or questions regarding your rights as a research subject, contact the Florida Atlantic University Division of Research at (561) 297-0777. For other questions about the study, you should call the principal investigators, Dr. Roberta Weber at [redacted] or Allison Berger at [redacted]

Consent Statement

I have read the information describing this study. All my questions have been answered to my satisfaction. I am 18 years of age or older and freely consent to participate. I understand that I am free to withdraw from this study at any time without penalty. I have printed a copy of this consent form for my records.

* 1. By clicking the "I consent" button below, I am giving my consent to participate in this research study.

- ◯ I consent to participate in this research study.
- ◯ I do not consent to participate in this research study.

* 2. Would you be willing to participate in a 45-60 minute interview at a later time about your experiences with integrating mobile handheld devices in your classroom?

- ◯ Yes I will participate in a face to face interview.
- ◯ No I will not participate in a face to face interview.

Contact information

3. Please enter your name and email address (so that the researcher can contact you for the interview).

Name

Email address

Years of Experience

* 4. Not including the current school year, how many years of teaching experience do you have?

- ◯ fewer than 3 years
- ◯ 3 - 6 years
- ◯ 7 - 10 years
- ◯ 11 - 20 years
- ◯ 21 - 30 years
- ◯ more than 30 years
- ◯ I prefer not to answer.

Demographic Information

* 5. What is your gender?

- ◯ Female
- ◯ Male
- ◯ I prefer not to answer.

* 6. What is the highest level of education you have completed?

* 7. Which of the following subjects do you teach? (Select all that apply.)

- ☐ Mathematics
- ☐ English/Language Arts
- ☐ Social Studies
- ☐ Science
- ☐ Foreign Language
- ☐ Arts (e.g. Art, Drama, Music, etc.)
- ☐ Health and Physical Education
- ☐ Vocational Education
- ☐ Exceptional Student Education
- ☐ I prefer not to answer.
- ☐ Other (please specify)

* 8. What grade level(s) do you currently teach?

- [ ] 6
- [ ] 7
- [ ] 8
- [ ] 9
- [ ] 10
- [ ] 11
- [ ] 12
- [ ] I prefer not to answer.

Technology Integration

Below is a definition of technology integration with accompanying examples:

Technology integration: Using technology to support students as they construct their own knowledge through the completion of authentic, meaningful tasks.

Examples:

Students working on research projects, obtaining information from the Internet.

Students constructing Web pages to show their projects to others.

Students using application software to create student products.

* 9. Using the above as a baseline, please check one response for each of the statements in the table:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident that I understand technology's capabilities well enough to maximize them in my classroom.	○	○	○	○	○	○
I feel confident that I have the skills necessary to use technology for instruction.	○	○	○	○	○	○
I feel confident that I can successfully teach relevant subject content with appropriate use of technology.	○	○	○	○	○	○
I feel confident in my ability to evaluate technological tools for teaching and learning.	○	○	○	○	○	○
I feel confident that I can use correct technological terminology when directing my students' technology use.	○	○	○	○	○	○
I feel confident I can help students when they have difficulty with technology.	○	○	○	○	○	○

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident I can effectively monitor students' technology use for project development in my classroom.	○	○	○	○	○	○
I feel confident that I can motivate my students to participate in technology-based projects.	○	○	○	○	○	○
I feel confident I can mentor students in appropriate uses of technology.	○	○	○	○	○	○
I feel confident I can consistently use educational technology in effective ways.	○	○	○	○	○	○
I feel confident I can provide individual feedback to students during technology use.	○	○	○	○	○	○
I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning.	○	○	○	○	○	○
I feel confident about selecting appropriate technology for instruction based on curriculum standards.	○	○	○	○	○	○
I feel confident about assigning and grading technology-based projects.	○	○	○	○	○	○
I feel confident about using technology resources (such as spreadsheets, electronic portfolios, etc.) to collect and analyze data from student tests and products to improve instructional practices.	○	○	○	○	○	○

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident that I can be responsive to students' needs during technology use.	◯	◯	◯	◯	◯	◯

Professional Development

* 10. In the past 3 years, what type(s) of professional development activities involving the educational use of mobile handheld devices have you participated in? (Select all that apply.)

- [ ] District-provided workshop or training
- [ ] District-provided technology conference
- [ ] District-provided online course
- [ ] Course offered by a university/college
- [ ] Professional conference
- [ ] Massive Online Open Course (MOOC)
- [ ] Reading professional literature about technology
- [ ] Collaboration with colleagues/peers
- [ ] Self-study
- [ ] I prefer not to answer.
- [ ] Other (please specify)

Mobile Handheld Devices

* 11. Please indicate how frequently you incorporate the use of mobile handheld devices in your classroom for each purpose.

	Never	Rarely	Every once in a while	Weekly	Daily	I prefer not to answer.
Communication (e.g. texting, group texting, photo messaging, video messaging, Twitter, email, phone calls, blogging, phonecasting)	○	○	○	○	○	○
Organization (e.g. calendar, reminders, alerts, alarms, notetaking, speech to text)	○	○	○	○	○	○
Research (e.g. web searches, video streaming)	○	○	○	○	○	○
Archiving/display of student work (e.g. audio recording, video recording, photography, uploading to the Internet, online bulletin board)	○	○	○	○	○	○
Educational tool (e.g. calculator, graphing calculator, dictionary, thesaurus, stopwatch)	○	○	○	○	○	○
Assessment (e.g. text polling, Kahoot, Socrative)	○	○	○	○	○	○

Thank you!

Thank you so much for your time and participation!

Appendix G. Final Survey Instrument

Informed Consent Page

Going on the Grid: Secondary Teachers' Implementation of Mobile Handheld Devices as Instructional Tools

The purpose of this research study is to explore your experiences and perceptions with your level of confidence, professional development, and the implementation of mobile handheld devices in the classroom. The secondary purpose of this study is to identify any barriers and enablers you have perceived that may have have affected your use of such devices in the classroom.

To participate in this study, you will complete an electronic survey on technology self-efficacy, professional development, and the use of mobile handheld devices as instructional tools. The survey is estimated to take 10 minutes to complete. Then, if you are willing to participate in a face-to-face interview about your experiences and perceptions, you may be selected to take part in an interview. The interview is estimated to take between 45 and 60 minutes.

There are no foreseeable risks associated with participating in this research study.

The benefits to taking part in this study are that participants will help to inform designers of technology integration programs about barriers and enablers that affect the skilled use of mobile handheld devices as innovative educational tools.

Your data will be submitted to the researcher via a secure and encrypted website. Only those who are working with the study will have access to your data, and all data will be kept strictly confidential, except in a case where it is required by law. Data will be stored on the researcher's password-protected personal laptop, and will be destroyed 3 years after the completion of the study. The results of this study will be published, but your name will not be included anywhere in the publication.

Contact Information: For related problems or questions regarding your rights as a research subject, contact the Florida Atlantic University Division of Research at (561) 297-0777. For other questions about the study, you should call the principal investigators, Dr. Roberta Weber at [redacted] or Allison Berger at [redacted]

Consent Statement

I have read the information describing this study. All my questions have been answered to my satisfaction. I am 18 years of age or older and freely consent to participate. I understand that I am free to withdraw from this study at any time without penalty. I have printed a copy of this consent form for my records.

* 1. By clicking the "I consent" button below, I am giving my consent to participate in this research study.

- ◯ I consent to participate in this research study.
- ◯ I do not consent to participate in this research study.

* 2. Would you be willing to participate in a 45-60 minute interview at a later time about your experiences with integrating mobile handheld devices in your classroom?

- ◯ Yes I will participate in a face to face interview.
- ◯ No I will not participate in a face to face interview.

Contact information

3. Please enter your name and email address (so that the researcher can contact you for the interview).

Name

Email address

Years of Experience

* 4. Not including the current school year, how many years of teaching experience do you have?

- ◯ fewer than 3 years
- ◯ 3 - 6 years
- ◯ 7 - 10 years
- ◯ 11 - 20 years
- ◯ 21 - 30 years
- ◯ more than 30 years
- ◯ I prefer not to answer.

Technology Integration

Below is a definition of technology integration with accompanying examples:

Technology integration: Using technology to support students as they construct their own knowledge through the completion of authentic, meaningful tasks.

Examples:

Students working on research projects, obtaining information from the Internet.

Students constructing Web pages to show their projects to others.

Students using application software (e.g. Microsoft Word, Powerpoint, iMovie, or web apps such as Google Docs) to create student products.

Teachers using technological resources within their teaching and in the daily practices of their classroom.

* 5. Using the above definition of technology integration as a baseline, please check one response for each of the statements in the table:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident that I understand technology's capabilities well enough to maximize them in my classroom.	○	○	○	○	○	○
I feel confident that I have the skills necessary to use technology for instruction.	○	○	○	○	○	○
I feel confident in my ability to evaluate technological tools for teaching and learning.	○	○	○	○	○	○
I feel confident I can consistently use educational technology in effective ways.	○	○	○	○	○	○

Technology and Pedagogy

* 6. Using the above definition of technology integration as a baseline, please check one response for each of the statements in the table:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident that I can successfully teach relevant subject content with appropriate use of technology.	○	○	○	○	○	○
I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning.	○	○	○	○	○	○
I feel confident about selecting appropriate technology for instruction based on curriculum standards.	○	○	○	○	○	○
I feel confident about using technology resources (such as spreadsheets, electronic portfolios, etc.) to collect and analyze data from student tests and products to improve instructional practices.	○	○	○	○	○	○

Technology at Work

* 7. Using the above definition of technology integration as a baseline, please check one response for each of the statements in the table:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident I can effectively monitor students' technology use for project development in my classroom (for example, reviewing students' progress and providing feedback).	○	○	○	○	○	○
I feel confident that I can motivate my students to participate in technology-based projects (for example, showing enthusiasm for the use of technology).	○	○	○	○	○	○
I feel confident I can mentor students in appropriate uses of technology (for example, suggesting suitable technological tools for a particular task or goal, or advising students about responsible technology use).	○	○	○	○	○	○
I feel confident about assigning and grading technology-based projects.	○	○	○	○	○	○

Technology and Student Support

* 8. Using the above definition of technology integration as a baseline, please check one response for each of the statements in the table:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I prefer not to answer.
I feel confident that I can use correct technological terminology when directing my students' technology use.	○	○	○	○	○	○
I feel confident I can help students when they have difficulty with technology.	○	○	○	○	○	○
I feel confident I can provide individual feedback to students during technology use.	○	○	○	○	○	○
I feel confident that I can be responsive to students' needs during technology use (for example, I can provide support when needed, or advise students about where to seek support if necessary).	○	○	○	○	○	○

Professional Development

* 9. In the past 3 years, what type(s) of professional development activities involving the educational use of mobile handheld devices have you participated in? (Select all that apply.)

- [ ] District-provided workshop or training
- [ ] District-provided online course
- [ ] District technology conference
- [ ] Course offered by a university/college
- [ ] Professional conference
- [ ] Massive Online Open Course (MOOC)
- [ ] Reading professional literature about technology
- [ ] Collaboration with colleagues/peers
- [ ] Self-study
- [ ] I have not participated in any professional development activities involving mobile handheld devices.
- [ ] I prefer not to answer.
- [ ] Other (please specify)

Mobile Handheld Devices

* 10. Please indicate how frequently you incorporate the use of mobile handheld devices (such as cell phones, smartphones, tablets, e-readers, etc.) in your classroom for each purpose.

	Never	Rarely	Every once in a while	Weekly	Daily	I prefer not to answer.
Communication (e.g. texting, group texting, photo messaging, video messaging, Twitter, email, phone calls, blogging, phonecasting)	○	○	○	○	○	○
Organization (e.g. calendar, reminders, alerts, alarms, notetaking, speech to text)	○	○	○	○	○	○
Research (e.g. web searches, video streaming)	○	○	○	○	○	○
Archiving/display of student work (e.g. audio recording, video recording, photography, uploading to the Internet, online bulletin board)	○	○	○	○	○	○
Educational tool (e.g. calculator, graphing calculator, dictionary, thesaurus, stopwatch)	○	○	○	○	○	○
Assessment (e.g. text polling, Kahoot, Socrative)	○	○	○	○	○	○

Demographic Information

* 11. What is your gender?

- ○ Female
- ○ Male
- ○ I prefer not to answer.

* 12. What is the highest level of education you have completed?

* 13. Which of the following subjects do you teach? (Select all that apply.)

- ☐ Mathematics
- ☐ English/Language Arts
- ☐ Social Studies
- ☐ Science
- ☐ Foreign Language
- ☐ Arts (e.g. Art, Drama, Music, etc.)
- ☐ Health and Physical Education
- ☐ Vocational Education
- ☐ Exceptional Student Education
- ☐ I prefer not to answer.
- ☐ Other (please specify)

* 14. What grade level(s) do you currently teach?

- [ ] 6
- [ ] 7
- [ ] 8
- [ ] 9
- [ ] 10
- [ ] 11
- [ ] 12
- [ ] I prefer not to answer.

Thank you!

Thank you so much for your time and participation!

Appendix H. Computer Technology Integration Survey Adaptation Permission

From: Allison Berger [aberge12@fau.edu]
Sent: Monday, June 08, 2015 2:43 PM
To: Ling Wang
Subject: survey permission

Hello Dr. Wang,

My name is Allison Berger, and I am a doctoral candidate at Florida Atlantic University, as well as a Nova Southeastern alumna. I am in the proposal stage for my dissertation, in which I plan to research the relationship between secondary teachers' technology self-efficacy, professional development, and their implementation of mobile handheld devices as instructional tools. I'm writing to inquire about whether I may use your Computer Technology Integration Survey as part of my survey instrument, as a means to measure teachers' technology self-efficacy. I would slightly modify some of the items so that they refer to general technology rather than specifically computers, as that is more appropriate for my study. I would be sure to include the complete citation for your work so as to attribute the authorship of the original instrument to you. Please email me back at your earliest convenience and let me know if I have your permission.

Warmest regards,

Ali

Allison Berger, M.A.T.L.
Doctoral Candidate
Department of Curriculum, Culture, and Educational Inquiry
aberge12@fau.edu

From: Ling Wang <lingwang@nova.edu>
Date: June 9, 2015 at 11:25:17 AM EDT
To: Allison Berger <aberge12@fau.edu>
Subject: **RE: survey permission**

Dear Allison,

Yes, please feel free to use the instrument in your research.

Best of luck,

Ling

Ling Wang, Ph.D.
Professor of Graduate School of Computer and Information Sciences
Nova Southeastern University
[redacted]

Appendix I. Professional Development and Technology Integration Survey

Adaptation Permission

From: Ali Berger [mailto:allison.berger.1@gmail.com]
Sent: Monday, February 16, 2015 10:28 PM
To: jwhite@brookstone.edu
Subject: survey permission

Hi Dr. White,

My name is Allison Berger, and I'm a doctoral student at Florida Atlantic University in Boca Raton, FL. I'm preparing to begin my dissertation within the next year. I plan to research the relationship between teachers' technology-related self-efficacy, professional development, and their implementation of mobile handheld devices as instructional tools. In my literature review, I came across your dissertation from Keiser University, and I really appreciate the level of detail in your PD-related questions. I'm hoping to obtain permission from you to utilize some of your survey questions in my own research. I would modify them slightly so that they are specific to mobile handheld devices and my study. I would be sure to include the complete citation for your dissertation. Please email me back at your earliest convenience and let me know if I have your permission.

Thank you so much!

Sincerely,

Allison Berger
allison.berger.1@gmail.com

On Mar 5, 2015, at 8:12 AM, Jessica White <jwhite@brookstone.edu> wrote:

Hi, Allison...
I apologize for the late response. I typically respond to emails as soon as I receive them. I would be glad to allow you to use some of my survey questions in your own research. Just a heads up, though, be sure your dissertation chair guides you through the process the right way. If you have to develop your own questions (even by tailoring them), you're going to probably need a pilot test...depending on the type of research you're doing. I tailored questions from another individual's survey and had to conduct a pilot test to ensure the way I changed wording made sense and everything. Just keep that in mind as you move forward. I wish you the best as you complete your doctorate degree!

Jessica L. White, Ph.D.
Instructor
Brookstone College
424 Gallimore Dairy Road
Greensboro, NC 27409
[redacted]

Appendix J. Teacher Survey Invitation Email

Participant Recruitment Email

Hello! My name is Allison Berger, and I am a fellow [redacted] teacher, as well as a doctoral student at FAU. I am conducting a research study that involves secondary teachers' experiences with mobile handheld devices in the classroom. I could really use your help in completing my study. I'm looking for participants to take part in a short survey, and possibly an interview. This research will be part of my dissertation, "Going on the Grid: Secondary Teachers' Implementation of Mobile Handheld Devices as Instructional Tools".

Teachers who agree to participate in the study will complete an electronic survey using Survey Monkey. It is estimated to take 5-8 minutes to complete, and it is completely voluntary.
If you have any questions, please feel free to contact me at [redacted] or aberge12@fau.edu.

I really appreciate your time and help!

To access the survey, please click the link below.

https://www.surveymonkey.com/r/goingonthegrid

Thank you!

Sincerely,

Allison Berger

FAU Institutional Review Board

Approved on:	11/06/2015
Expires on:	10/07/2016

Appendix K. Teacher Interview Invitation Email

Good morning Teacher,

My name is Ali Berger and you recently participated in my research study for my dissertation regarding secondary teachers' experiences with mobile handheld devices in the classroom. First, thank you so much for participating in my study by completing my survey!

Second, I appreciate you volunteering to take part in an interview about your experiences and perceptions with mobile handheld devices in the classroom. I am hoping you are still available for an interview and I am reaching out to determine a date and time that works within your schedule. Currently, I am finished with school at 4:00 pm and I am happy to meet you at any time and location that is most convenient for you. The estimated time for the interview is 45-60 minutes, so hopefully you will have some time in your schedule in the next week or two to meet with me.

Again, I really appreciate your help with my research study. If you have any questions or concerns, or if it is more convenient to call and schedule a time to meet, please contact me at [redacted]. I look forward to meeting you!

Thanks so much,

Ali Berger

Appendix L. Interview Protocol

Interviewer Name:

Interviewee Name:

Interviewee Position:

Date:

Place:

Starting Time:

Ending Time:

Introduction

Thank you for participating in this interview. The purpose of this research is to understand your experiences as a secondary school teacher who is implementing mobile handheld devices in your classroom. Your responses and your identity will be kept confidential in this study. May I have your permission to record our discussion?

I would like to speak with you about your experiences with mobile handheld devices in your classroom. I have some questions to ask you that will help to guide our discussion.

Demographic Questions

1. How many years of teaching experience do you have?

2. What grade(s) do you teach?

3. What subject(s) do you teach?

Questions

1. Which mobile handheld devices (such as a smartphone, tablet, e-reader) do you own?

2. Describe how you use your _____ in your everyday life.

Probe: Can you tell me other ways in which you use your _____?

3. What has affected your level of confidence for using your mobile device in your everyday life?

Probe: Which of those factors have you found to be more influential than others? Why?

4. How do you feel about your level of confidence for incorporating new types of technology into your teaching?

Probe: What has contributed to that feeling of confidence (or lack of confidence)?

5. Tell me about some ways in which you feel you have successfully incorporated technology into your teaching.

Probe: Give me an example of a time where you successfully used a technological tool that was new for you. How did you feel about that experience?

6. Tell me about some uses for technology in which you feel less confident.

Probe: Give me an example of a time where you tried a technological tool that you felt wasn't as successful. How did you feel about that experience?

7. Tell me about how you have incorporated the use of mobile handheld devices into your teaching.

Probe: Can you tell me other ways in which you incorporate them into your teaching?

Probe: Give me an example of something you would like to try (using mobile handheld devices in your teaching)

8. How did you feel about the experience of using mobile handheld devices in your teaching?

Probe: What would you do the same, or differently, next time?

9. What has affected your level of confidence for using your mobile device in your classroom?

Probe: Which of those factors have you found to be more influential than others? Why?

10. Tell me about how your previous experiences with mobile handheld devices (in and out of the classroom) have influenced how you felt about your own level of confidence with using them.

11. Tell me about any professional development that you have participated in that involved mobile handheld devices. (Note: if they have not participated, skip to question 12)

Probe: Can you tell me about any others?

Probe: How did you feel about that experience?

11a (If yes, they participated) How did your participation in those activities affect your use of mobile handheld devices in your classroom?

11b. (If no, they have not participated) Suppose you had participated in professional development about the use of mobile handheld devices. How would that have affected your use of them in your classroom?

12. What other factors have you experienced that encouraged your use of mobile handheld devices in your classroom?

Probe: Tell me about a time when you experienced that.

Probe: Are any of those encouraging factors more influential than others?

13. What other factors have you experienced that have discouraged your use of mobile handheld devices in your classroom?

    Probe: Tell me about a time when you experienced that.

    Probe: Are any of those discouraging factors more influential than others?

Closing

Is there anything else that you would like to add? Do you have any other questions? Thank you so much for participating and contributing to this research study.

Appendix M. Preliminary List of In Vivo Codes

- practice
- desire
- natural ability/curiosity
- forced to use
- need time
- confident
- lack of school resources
- planning
- BYOD
- digital divide
- money
- on-task behavior
- feelings of success
- training
- lack of confidence
- issues with devices
- feelings of no success
- student engagement
- classroom management
- collaboration
- overwhelmed
- hands-on
- school culture
- technological world
- infrastructure
- comfort level
- difficulty with change
- loss of control
- off-task behavior
- tech support
- continued support
- observing peers
- ease of use
- fear
- successful experiences
- perseverance
- responsibility for technology/students mistreat
- experience
- kids teach me
- helping others
- lack of experience
- lack of knowledge
- trust
- benefits to students
- demonstration
- get used to it
- trial and error
- sad
- empowered
- determined
- embarrassed
- need for the devices
- motivation
- kids ahead of us
- use inside the classroom and out
- useful PD
- discouraging
- enabler
- barrier

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* Pseudonym assigned to ensure confidentiality.